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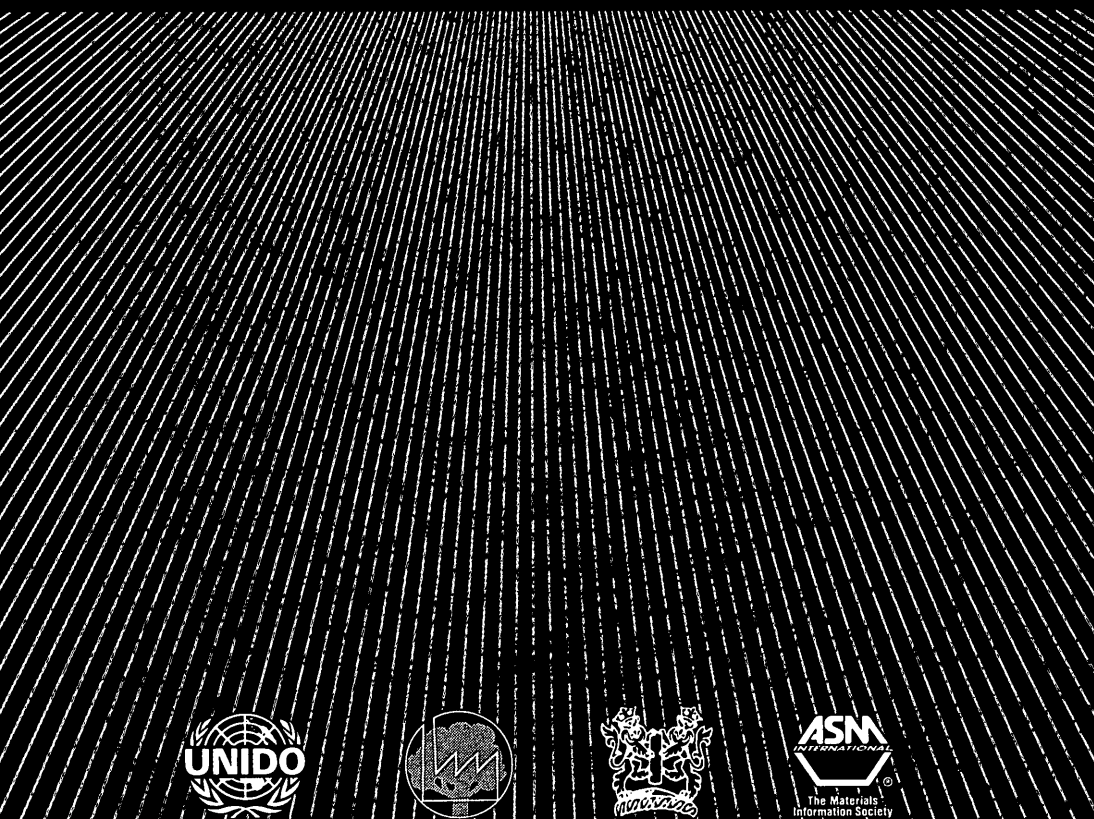
INIB

ENERGY AND ENVIRONMENT
SERIES

Energy Conservation in Industry



INTIB

Energy and Environment Series, No. 5

ENERGY CONSERVATION IN INDUSTRY

Compiled by
Peter Pembleton
Industrial and Technological Information Bank

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Note

The *Energy and Environment Series* of the Industrial and Technological Information Bank (INTIB) is produced by UNIDO. INTIB is the information clearing-house of UNIDO, providing industry in developing countries with the necessary background for sound technological and business decisions.

INTIB
Energy and Environment Series, No. 5: Energy Conservation in Industry

PREFACE

The *Energy and Environment Series* of the Industrial and Technological Information Bank (INTIB) is starting its second year of production with this number.

During internal discussions when beginning the *Series*, it was thought that some of the subject areas covered should be repeated at intervals, to encourage continuity of interest and (hopefully) subscription, as well as to monitor developments within that particular sector of energy or environmental concern. Therefore, this number is at the same time the second volume on the subject of energy conservation/energy efficiency.

Despite, or perhaps because of, the world's concern with environmental issues, energy efficiency and/or substitution has come again to the fore as being of major concern at the global as well as at the micro-economic (industrial and municipal) levels. Within Agenda 21 (the main result of the United Nations Conference on Environment and Development, held at Rio de Janeiro, in June 1992), protection of the atmosphere is one of the 40 areas of concern, as current and past patterns of energy consumption and utilization have, demonstrably, led to major global problems, starting with global warming and continuing through to various side-effects on the ecosystem's different media.

Energy generation and utilization are major sources of emissions and, depending upon the way the wind blows, not just of concern to the immediate vicinity of the plant, but also of concern to whole regional ecosystems, which may be shared between several countries. Therefore, this number of the *Series*, includes material on current energy utilization practices, including process changes to save, to replace or to better use energy resources within several industrial sectors, as well as one country's attempts to measure and monitor air and other environmental pollution.

The lead article examines ways in which the glass industry can save energy, going through the process of production, describing energy consumption characteristics, and presenting specific technology options for the various stages.

A number of reference centres in or for eastern European countries have been provided, all of which are working on national/regional aspects of energy conservation at municipal and/or industrial levels. Material from the United Nations Economic Commission for Europe (ECE) has again been included, courtesy of that organization's Energy Efficiency 2000 project activities. These abstracts and summaries present a wide range (both geographical and sectoral) of energy efficiency issues in that region, as well as in other countries involved in the project.

Abstracts of technical papers taken from sources world-wide present sector- and subsector-specific practices in metallurgy, plastics and composites, ceramics, adhesives, as usual courtesy of the major contributor to the *Series*, Materials Information. A special licence agreement with UNIDO, on the utilization of the internationally available databases, has enabled information to be presented on energy conservation in these sectors and the business aspects of the materials. Such entries constitute approximately one half of the information presented in this volume.

For the first time, the *Series* contains abstracts of nationally collected and generated data. The Austrian Federal Environmental Agency has provided its reports on the state of the environment in general, in relation to the different environmental media and in particular locations and specific industrial sectors. One such report has already been translated into English, while all others abstracted remain in the German language. It is important to note that although most of the Austrian material was produced in monograph form, it has been abstracted on a chapter by chapter (or section by section) basis, as an abstract of the whole monograph would have been much less informative.

INDUSTRIAL AND TECHNOLOGICAL INFORMATION BANK

Previously published titles

INECA Journal Vol. 1, Nos. 1 and 2, 1990
Abstracts of industrial energy conservation technologies and technical papers

INECA Journal Vol. 2, No. 1, 1991
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Industry and Environment: A Guide to Sources of Information, 1991[**]

Energy and Environment Series

No. 1: *Energy Conservation in Industry*, 1992[*]
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Environmental Technology Monitor[***]
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* Available from Materials Information. Separate order form supplied.
** Available from Verlag Dr. Grüb. Separate order form supplied
*** Available from UNIDO. Separate order form supplied
**** Available from United Nations Publications. Separate order form supplied

CONTENTS

HOW TO USE THIS PUBLICATION

The *Energy and Environment Series* consists of a recent technical report on a current topic (in this case, energy conservation), followed by two sections containing abstracts of technical material.

The first section is entitled "Energy Conservation" and contains just over 400 abstracts of papers taken from three leading international databases on materials technology. The abstracts are arranged under three topics: metals, advanced materials and business aspects of materials technology.

The second section is entitled "CLEANTEC DATA" and contains around 300 abstracts or author summaries of technical reports (mostly unpublished) obtained and processed by UNIDO in the course of its energy and environment information activities. CLEANTEC DATA is the former name of the system of databases established by INTIB.

This section is subdivided according to the source of the information as follows: UN/ECE (material obtained from the Economic Commission for Europe's Energy Efficiency 2000 project Secretariat) and the Federal Environmental Agency of Austria (reports of environmental monitoring and other environmental issues of national importance).

All the abstracts include:

- A sequential record number;
- The title of the document in upper-case letters;
- An alphanumeric code in brackets;
- An abstract;
- Author(s) and/or corporate author(s);
- Other bibliographic details.

Three indexes are available, covering both data sections, using subject descriptors from the *Thesaurus of Metallurgical Terms* and *Thesaurus of Engineered Materials*, published by Materials Information, and the *Thesaurus of Industrial Development Terms*, published by UNIDO. Therefore, there may be variations in the application of terminology from the three thesaurii: in some cases the use of singular or plural varies, in others American English spelling is used.

NB: Please note that the following terms will not be found in the subject index, as they are the main subject of this issue: energy management, energy conservation, energy efficiency, or variations thereof.

The subject index includes the sequential record number of the abstract and the title of the document.

Please note that materials presented in the data sections may have more than one author with multiple corporate affiliations. Therefore, to avoid ambiguity, the corporate affiliations have not been included in the abstract. Corporate affiliation is, however, included in the corporate author index.

The author and corporate author (which includes author affiliation) index entries include the name in alphabetical order followed by the sequential record number.

General points to note:

- In some cases, the titles of documents have been edited or translated;
- In the second section, the technical reports are mainly unedited, unpublished papers;
- Also in the second section, the ECE material which is marked as 'Summary' in the bibliographic reference, is the original text as submitted by the author, which is (mostly) unedited—your understanding is requested for the occasional errors of English usage!

SAMPLE EXERCISES:

To find abstracts on the subject "air pollution":

a) turn to the "combined subject index";
b) look up the term "air pollution" — there are 26 references which contain an abstract number and the document title;
c) taking the first reference, number "0012", turn to the data sections, which are in ascending numerical sequence, and look up the item — i.e. the full abstract with bibliographic references.

To find abstracts of documents written by the author "Bishop, M.T.":

a) turn to the "combined author index";
b) look up the name "Bishop, M.T." — there are two references with an abstract number;
c) taking the first reference, number "0187", turn to the data sections, which are in ascending numerical sequence, and look up the item — i.e. the full abstract with bibliographic references.

To find abstracts of documents associated with the organization "Austrian Energy Agency":

a) turn to the "corporate author/affiliation index";
b) look up the term "Austrian Energy Agency" — there are two references with an abstract number;
c) taking the first reference, number "0479", turn to the data sections, which are in ascending numerical sequence, and look up the item — i.e. the full abstract with bibliographic references.

To order the document with the item number "0012":

a) note the page heading — "Energy Conservation - Metals";
b) turn to page viii and follow the instructions under "ENERGY CONSERVATION".

To order the document with the item number "0439":

a) note the page heading — "CLEANTEC DATA - UN/ECE";
b) turn to page viii and follow the instructions under "CLEANTEC DATA - UN/ECE".

DOCUMENT DELIVERY / PHOTOCOPYING SERVICE

All items presented in this volume have been prepared from documents available at the source of the abstract. Should you be interested in a full text copy of the articles/reports, please send requests to the following addresses where they are stored:

Energy Conservation Section (pages 21-65)

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Energy Conservation in the Glass Industry

Erratum from EES No. 3: The lead article, entitled: *Control of Industrial Pollution and the Final Disposal of Hazardous Wastes*, was prepared for UNIDO by John H. Meyer. Due to an oversight, we omitted to mention his name along with the article.

EXPLANATORY NOTES

- 1 ton equals 2240 pounds, unless otherwise specified.
- Besides the common abbreviations, symbols and terms, the following have been used in the present article:

$kcal/m^2h$	Kilocalories per square meter hour. This unit of measurment is used to express the amount of heat that passes through one square meter of a material in one hour.
kW	Kilowatt
LNG	Liquified natural gas
LPG	Liquified petrolium gas

This document was prepared for UNIDO by The Energy Conservation Center (ECC), Japan

INTRODUCTION

The conservation of energy in an essential step we can all take towards overcoming the mounting problems of the worldwide energy crisis and environmental degradation. In particular, developing countries are interested in increasing their awareness of inefficient power generation and energy usage in their countries. However, usually only limited information sources on the rational use of energy are available.

Know-how on modern energy saving and conservation technologies should, therefore, be disseminated to governments and industrial managers, as well as to engineers and operators at the plant level in developing countries. It is particularly important that they acquire practical knowledge of the currently available energy conservation technologies and techniques.

In December 1983, UNIDO organized a Regional Meeting on Energy Consumption as well as an Expert Group Meeting on Energy Conservation in small- and medium-scale industries for Asian countries. During these meetings, it was brought out that, for some energy-intensive industries, savings up to 10 percent could be achieved through basic housekeeping improvements, such as auditing and energy management.

All these experiences brought UNIDO to prepare a regional programme on the promotion and application of energy saving technologies in selected subsectors, since the rational use of energy calls for a broad application of energy conservation technologies in the various industrial sectors where energy is wasted. One of these energy intensive industrial sectors to be considered to improve efficiency through the introduction of modern energy conservation technologies is the glass industry, which has a high level of energy consumption and therefore CO_2 production. In recent years, CO_2 generated in huge amounts is said to cause global warming, and the impact on the earth's environment is becoming serious. To cope with this situation, efforts have been made throughout the world to reduce the amount of CO_2 generated, with the target placed on the year 2000.

In the glass industry, significant improvements in the level of energy efficiency could be achieved by combustion control, furnace wall insulation, exhaust heat recovery, heat balancing, use of electric boosters and bubbling, electric heating of forehearth, using a great amount of cullet and applying a low-melting-temperature batch technique.

Currently, UNIDO is implementing thes Programme, with the financial support of the Government of Japan, in selected Asian developing countries. The programme aims at adopting these innovative energy conservation technologies, developed in Japan, to the conditions of developing countries. In the programme, the transfer of such technologies by the following means is being considered:

- Conducting surveys of energy usage and efficiency at the plant level;
- Preparing handy manuals on energy management and energy conservation/saving technologies, based on the findings of the above-mentioned survey;
- Presenting and discussing the handy manuals at seminars held for government officials, representatives of industries, plant managers and engineers;
- Disseminating the handy manuals to other developing countries for their proper utilization and application by the industrial sector.

The experience obtained through the programme will be applied to other programmes/projects which involve other industrial sectors as well as other developing countries and regions.

UNIDO started the programme with the project US/RAS/90/075 - Rational Use of Energy Resources in Steel and Textile Industry in Malaysia and Indonesia. This was followed by project US/RAS/92/035 - Rational Use of Energy Saving Technologies in Pulp/Paper and Glass Industry in Philippines and Thailand. The present handy manual on glass industry was prepared by UNIDO, with the cooperation of experts from the Energy Conservation Center (ECC) of Japan, on energy saving technologies in the framework of the above mentioned UNIDO project. It is based on the results of the surveys carried out, the plant observations and the recommendations and suggestions emanating from the Seminars on Energy Conservation in the Glass Industry, held under the same project in January and February 1993 in Bangkok and Manila. The handy manual will not only be interesting for governments and representatives from industry, but it is, in particular, designed to plant-level engineers and operators in developing countries in improving energy efficiency in the production process.

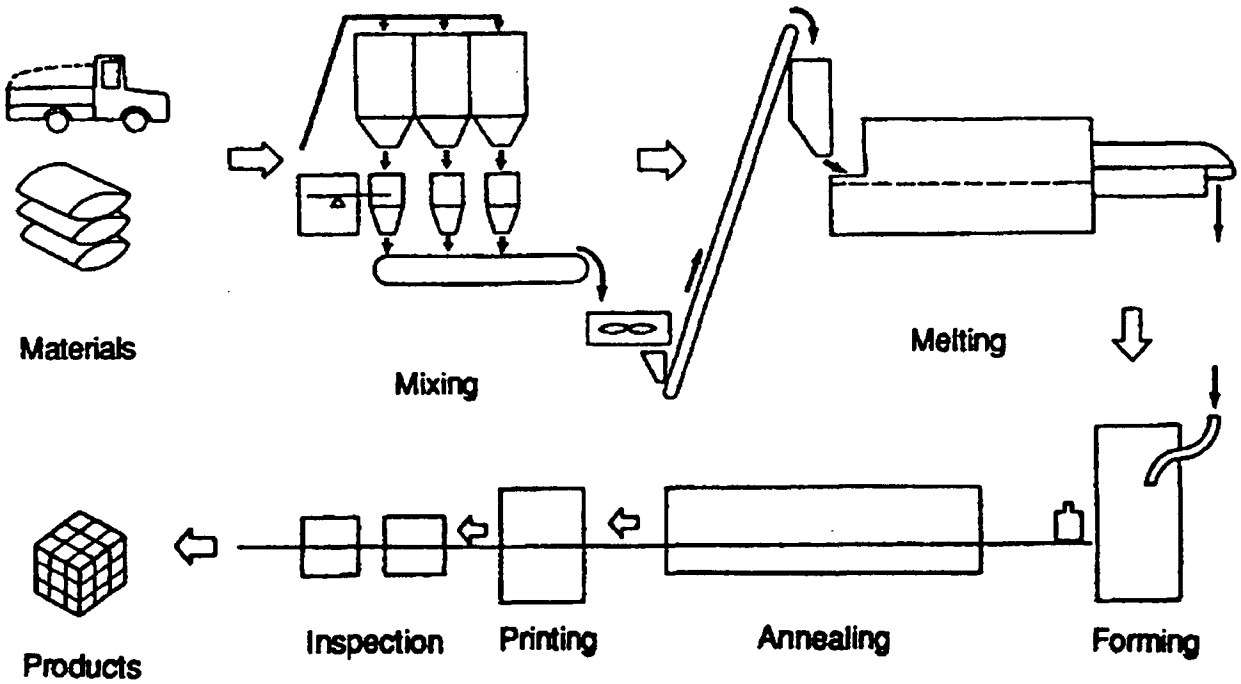
I. Production process of the glass industry

The glass industry consumes much energy. Fuels are burnt to create a high temperature inside the furnace, where the batch is reacted, vitrified, degassed, homogenized, and taken out as products (e.g. glass bottles, tableware). The products are put into the lehr for annealing, and the surfaces are printed as required. Then they are placed into the baking furnace. Thus, each of these processes uses a furnace which consumes much energy. The typical manufacturing process of a bottle is shown in figure 1.

The fossil fuels (coal, petroleum, natural gas) as energy resources are limited resources which must be left for the people of next generations as much as possible. SO_x and NO_x are discharged into the atmosphere by the combustion of fuels, thereby affecting human health. This has raised serious problems. In recent years, CO_2 generated in huge amounts is said to cause global warming, and the impact on the earth's environment is becoming serious. To cope with this situation, efforts have been made throughout the world to reduce the amount of CO_2 generated, with the target placed on the year 2000.

Energy-saving or energy conservation efforts in industrial activities are directly connected to the effect of controlling the cost increase due to the reduction of unit energy consumption in industry, leading to intensified competition. At the same time, such efforts provide an essential means for the improvement of the global environment, so that human health will be maintained for a long time to come. It is imperative for the

Figure 1. Manufacturing process (bottle)



industrialist to understand that energy conversation is one of the most important policies for industry, the nation and the world.

II. Characteristics of energy consumption in the glass production process

Figure 2 illustrates the ratio of the energy cost to the total manufacturing cost at glass bottle manufacturing plants in 1973 immediately before the first oil shock, in 1981 after the second oil shock and in 1989. Despite the energy conservation efforts, the ratio rose from 9 percent in 1973 to 16.7 percent in 1981 mainly due to spiralling oil costs. The ratio fell to 8.6 percent in 1989 due to energy conservation efforts and lower oil prices. The energy cost in 1981 can be broken down as follows:

- Heavy oil 11 percent
- Electric power 4 percent
- LPG 2 percent

Energy conservation for each energy source is a major task to be solved for cost reduction.

Figure 3 shows the percentage of total energy consumed by each process.

The situation differs according to the product types and scales. Figure 3 gives examples of the glass bottle manufacturing plant equipped with a tank furnace and the small-scale plant provided with a pot furnace.

The melting process is the greatest energy consumer in both the plant provided with the tank furnace for continuous production and the plant provided with the pot furnace for small-quantity production of multiple product types.

The figure records 75 percent on the tank furnace; it even reaches close to 82 percent when 7 percent for the forehearth is added. More energy, nearly 85 percent, is consumed in the case of the pot furnace.

Thus, when energy conservation efforts are made, top priority must be placed on the furnace, then on the lehr.

The unit energy consumption means the energy required to make the product of unit amount (1 kg or 1 ton). It is expressed either by unit energy consumption if energy is used as the unit or by unit fuel consumption if the amount of fuel is used as the unit.

Basically, energy conservation in the glass factory is to reduce the unit energy consumption.

To reduce unit energy consumption, it is necessary to reduce the amount of fuels used, while it is important as well to increase production without increasing the amount of fuels, and to reduce the failure rate of production, thereby ensuring production increase in the final stage.

Specific energy consumption includes all the energy used to manufacture the product — oils such as heavy oil, LPG and kerosine oil, electric power used for transportation, etc.

Table 1 shows an example of energy consumption for each process and fuel in the glass-bottle-making-plant. The management is required to get a total picture of this situation. Each process of the plant must be evaluated in terms of the unit fuel consumption or unit electricity consumption at each section.

Regarding the furnace, it is necessary to obtain correct data on the unit energy consumption (or unit fuel consumption). It corresponds to the energy consumption for the amount of glass taken out of the furnace. It may be expressed in calories or in the value converted into the amount of heavy oil. When the electric booster is used, the amount should include the electric energy used for that booster. This applies also to the annealing

furnace. In this case, the value is expressed in the amount of energy consumption for the amount of annealed glass.

Unit energy consumption varies greatly depending on the production scale. It also depends on the kinds of glass because it is related to the quality level. Figure 4 illustrates the differences in the tableware plant and the glass bottle plant. The smaller scale and the higher product quality level of the tableware manufacturing plant than those of the glass-bottle-making plant explain the reasons for considerably higher unit energy consumption in the tableware manufacturing plant.

For the pot furnace factory for small-quantity production of multiple product types, only the unit energy consumption in the furnace is clear; it is 4,000 to 8,000 kcal/kg. The difference depends on the kinds of glass, such as bolosilicate glass, soda lime glass and crystal glass, and furnace size.

Table 2 represents the situation of the unit consumption for the lehr. Big differences are observed according to heating method, operation time, heat of the glass to be loaded, and amount of the glass loaded into the lehr.

When the unit energy consumption is compared with that of other companies, it is necessary to note how the reference or standard has been determined as well as to clarify whether the energy means the total energy in the plant or only the energy used in the furnace, whether the forehearth is also included in the furnace or not, and whether electric power is included or not. Figure 5 shows the flow sheet of energy conservation. The flow

Figure 2 Energy cost distribution for total manufacturing cost in glass bottle

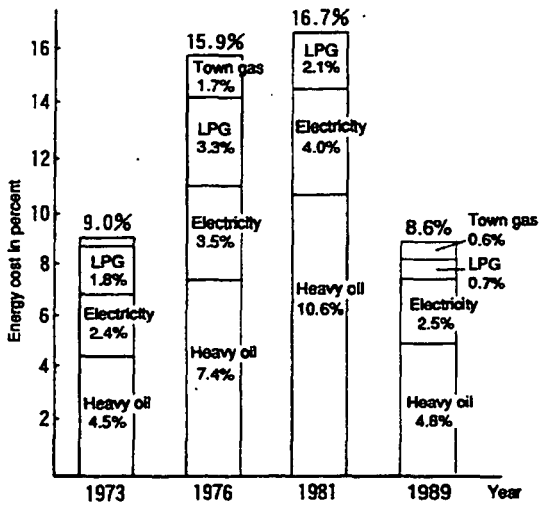


Figure 4. Unit energy consumption for factories

Figure 3. Share of total energy consumption

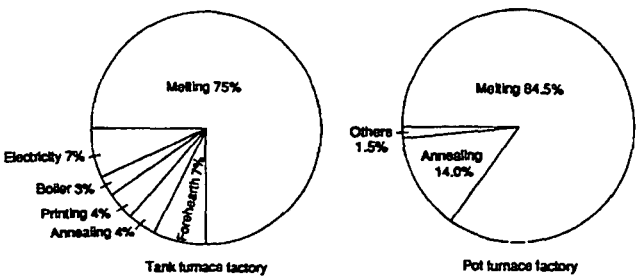
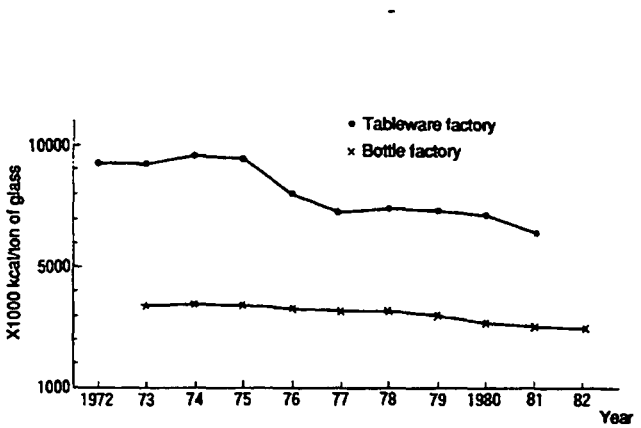


Figure 5. Flow sheet for energy conservation



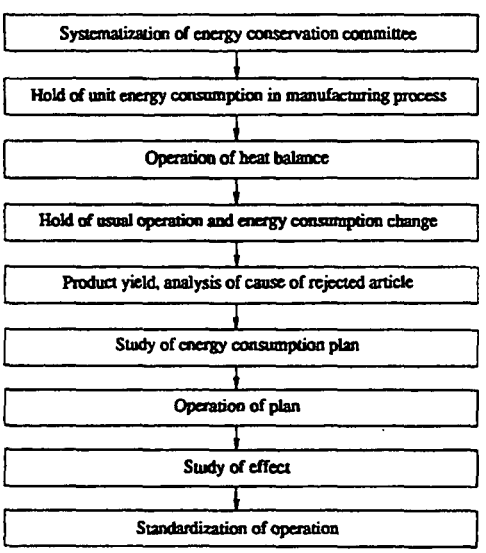


Table 1. Distribution of energy consumption for glass bottle manufacture

						x 10^{-4}kca/ton glass	
	Heavy oil	Kerosene	LPG	City Gas	Electricity	Total	%
Batch					1.47	1.47	0.58
Melter	161.80				16.96	178.76	71.03
Forehearth	1.77		14.76		0.8	19.33	6.89
Forming				0.08	26.85	26.93	10.70
Lehr			9.59		2.86	12.45	4.95
Printing, working			6.32	0.09	1.54	7.95	3.16
Package					0.47	0.47	0.19
Others	0.05	0.02	0.32	0.14	3.58	4.11	1.63
Total	163.61	0.02	30.99	0.31	56.74	251.68	
(%)	65.05	0.01	12.31	0.12	22.54		100

Table 2 Unit energy consumption of lehrs

- Style	Fuel	Operating Time	Rising Time, Holding Time	Production	Condtion of input	Capacity	Unit Energy Consumption (monthly average)
Muffle	Gas	8h	4h	Cup	After forming	219 kg/h	448 kcal/kg
Direct	Electricity	8	4	Cup	After forming	219	385
Muffle	Gas	8	4	Cup	After grinding	156	1572
Muffle	Oil	8	16	Head lens	After forming	250	1861
Direct	Gas	8	2	Head lens	After forming	250	596
Muffle	Gas	24		Bottle	After forming	360	462
Direct Radiation	Gas	8	1	Grove lens	After forming	180	778
Muffle	Oil	24		Bottle	After forming	168	827
Radiant tube	Gas	8	1	Bottle	After forming	238	506

sheet should be modified according to the particular requirements of each plant.

III. Promotion of energy conservation technology

A. Melting furnace

Melting furnaces used in the glass production are available in a great number of types. They can be broadly classified into the types shown in figures 6 to 10.

Figure 6 shows the side port type. This is a large furnace with a daily capacity of 100 to 150 tons or more. Two or more ports are installed at a right angle to the direction of the glass flow, and temperature distribution within the furnace can be changed to a desired value by controlling the amount of combustion of each port; this permits the production of high-quality glass. This type of furnace is often used as a furnace for production of plate glass or a bottle making large furnace.

Figure 7 shows the end port type furnace. It is a small and medium type furnace with a daily capacity of 100 tons or less. Compared with the side-port-type furnace, the end-port-type furnace features a simple structure and less expensive installation cost, but has difficulties in increasing its size. The flame returns along the longitudinal direction of the furnace and is sucked into the port on the side opposite to the rear wall. The temperature distribution inside the furnace varies according to the length of the flame and it is comparatively difficult to change the temperature distribution.

These two types of furnaces in many cases use regenerators. Some of the small type furnaces use the recuperator.

Figures 8 to 10 illustrate the pot furnaces for the small quantity production of multiple product types. Figure 8 illustrates the conventional multiple pot furnace used since early times, where six to ten pots are installed in the circular furnace, and glasses of different kinds are molten in these pots. The batch is loaded into the pot and molten during the night, and forming is performed during the daytime. The efficiency is not so good, and high-quality glass cannot be obtained. Most of the small- and medium-size companies use this type of furnace.

Figure 9 represents the pot furnace where only one pot is installed. It allows the use not only of the close pot but also the open pot. In spite of its small size, it is designed for high

Figure 6. Tank furnace (side-port-type)

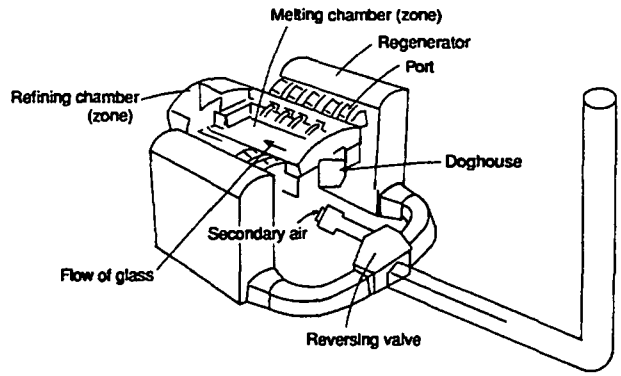


Figure 7. Tank furnace (end-port-type)

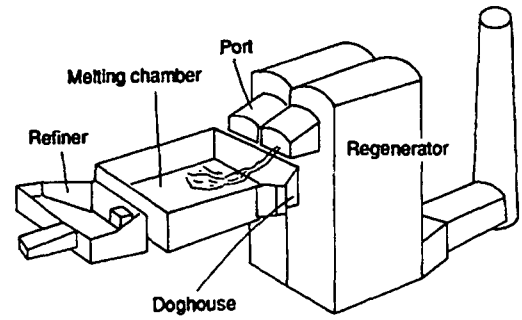


Figure 8. Pot furnace

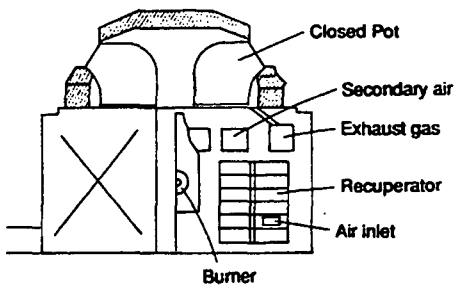
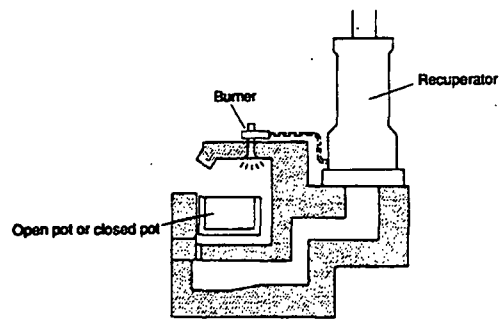


Figure 9. Single pot furnace (new type)



efficiency. Some furnaces of this type have a unit energy consumption of 4,000 to 5,000 kcal/kg-glass.

Figure 10 shows a multiple pot furnace where the pots are installed in parallel, not in a circular form. The small- and medium-size companies also tend to use robots and conveyers for transportation. Since the use of the circular form will make the layout within the plant rather difficult, this type of furnace has been developed to solve the problem.

In the pot furnace the recuperator is used exclusively as a heat exchanger.

Since the melting furnace consumes much energy, this design provides a great energy conservation effect, which is represented in the reduced unit energy consumption. The unit consumption varies according to the scale. Figure 11 shows the yearly average value for the bottle making plant in Japan.

For twelve years from 1975 to 1986, unit energy consumption has declined by about 26 percent from 3,470,000 kcal/ton to 2,560,000 kcal/ton. According to the recent report, some of the furnaces have reduced the unit energy consumption below 2,000,000 kcal/ton. This is not only largely due to the reduced amount of oil used.

The first step toward energy conservation in the melting furnace is to improve the combustion efficiency, to intensify heat insulation and to make effective use of the exhaust gas.

1. Combustion control

The fuel used in the melting furnace is liquid fuel (heavy oil) or gas fuel (LNG, LPG). Appropriate combustion can be checked by measuring the CO_2, O_2 and CO contained in the exhaust gas.

Glass materials used in the tank furnace are carbonates such as soda ash (Na_2CO_3) and limestone ($CaCO_3$). They are decomposed during the reaction for vitrification to discharge CO_2. Thus, as a result of the gas analysis, the sum of CO_2 generated by combustion and CO_2 generated from the material is produced in the tank furnace, so that the amount of CO_2 is greater than that in the case of combustion alone. It is to be noted that, when the combustion control is considered, the value will be inappropriate. It is desirable to check combustion control with oxygen volume in the exhaust gas from the tank furnace.

Figure 10. Parallel multi-pot furnace

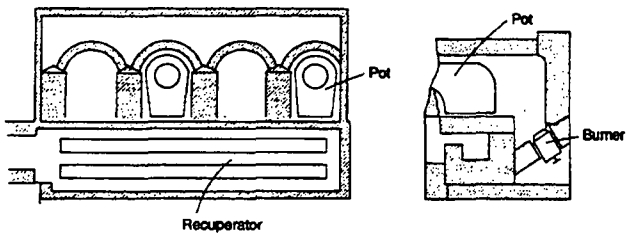
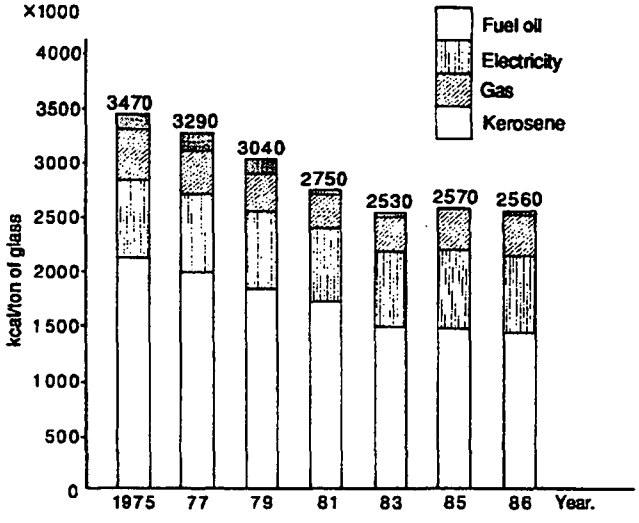


Figure 11. Unit energy consumption for glass bottle manufacturing



(a) Influence of cooled air other than preheated secondary air

The secondary air used for combustion is preheated by the heat exchanger. The primary air for spraying and air intruding from the clearance of the burner tiles enters the furnace cold. Reduction in the volume of such cold air will lead to energy conservation. Figure 12 shows the result of calculating the amount of possible energy conservation by reducing the volume of this cool air and replacing it with the preheated air. It gives a graphic representation based on m=1.25 and the volume of cold air accounting for 10 percent of the entire air. If the cold air is reduced by 1 percent and the preheated air is increased by 1 percent, it corresponds to a reduction of air ratio by 1 percent; the fuel saved is about 0.5 percent.

(b) Temperature distribution inside the furnace

To ensure stable production of high-quality glass, temperature distribution must be maintained at the optimum level inside the furnace.

As shown in figure 13, temperature distribution inside the tank furnace is so designed that the hot spot is located at the central position slightly displaced in the direction of the throat. The position of this hot spot moves a little depending on the load conditions.

If the combustion is such that this spot is greatly displaced, the flow of the glass will be disturbed inside the furnace, and striae, blister, seed and similar defects will appear, deteriorating the product quality.

If the temperature distribution inside the furnace is maintained at the optimum value, the leading edge of the loaded batch will move in such a way that it is pushed backward. If the temperature distribution inside the furnace is not satisfactory, and the back current of the glass is poor, the batch will go forward.

In the side port furnace, temperature distribution should be optimized with comparative ease by controlling the combustion at each port, but it is actually accompanied by difficulties. That is, adjustment of the fuel for each port can be done by the burner, but the volume of the preheated secondary air cannot be controlled for each port. Figure 14 shows the volume of air supplied to each port. As shown in the figure, more gas flow occurs at the position closer to the flue through which the exhaust gas is discharged, and the checker bricks are also heated to high temperature. On the other hand, more air flows at the position farther from the flue. So great volume of air flows at the port farthest from the flue with large m combustion, whereas combustion with small "m" results at the port closest to the flue. The average value is recorded as a value for "m" in the analysis of gas inside the furnace. This can be said to be satisfactory neither from the viewpoint of obtaining the optimum temperature distribution nor from the viewpoint of energy conservation for combustion.

To improve this situation, a separate regenerator chamber has been developed, which enables the volume of air to be controlled for each port. However, this is not much used because of the clogging caused by carry-over and other problems.

The optimum temperature distribution in the end-port-type furnace is more difficult to create than that of the side-port-type. As shown in figure 15, the burner of the end-port-type furnace is installed on one end of the glass flow, and there is no way of creating the temperature distribution except by controlling the flame length.

If the short flame is selected, the hot spot will be positioned closer to the burner; if the longer one is selected, it will move toward the throat side.

The flame length can be adjusted by:

- Changing the burner capacity (by replacing the nozzle);
- Changing the burner type (by changing the volume of primary air and the flame rotary angle);

Figure 12. Relationship between preheated air and fuel savings

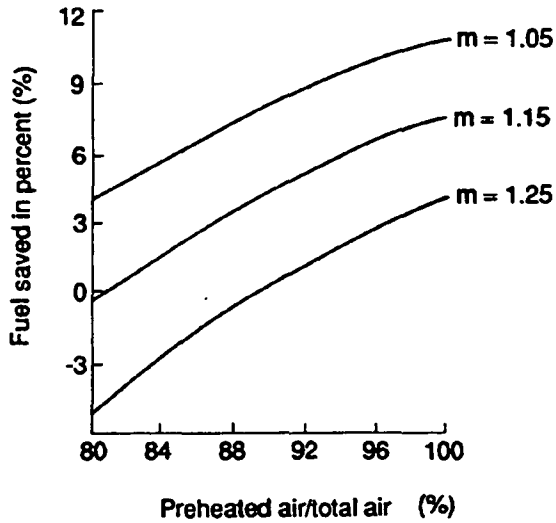


Figure 13 Relationship between temperature distribution and flow of molten glass

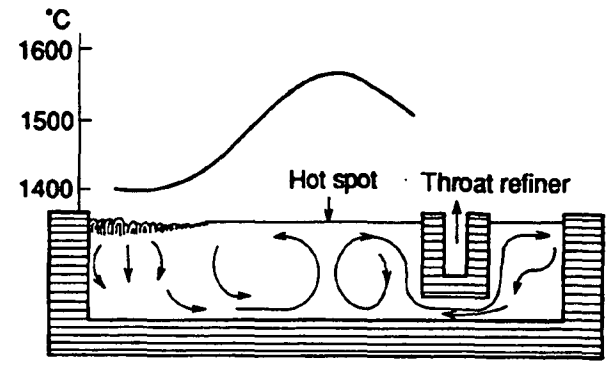


Figure 14. Distribution flow of exhaust gas and air in regenerator

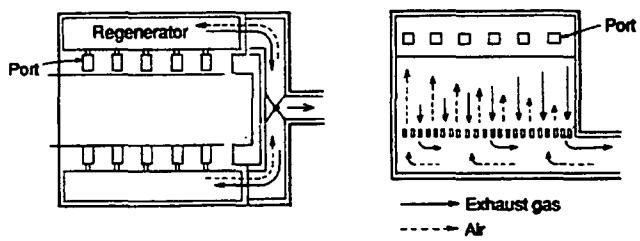
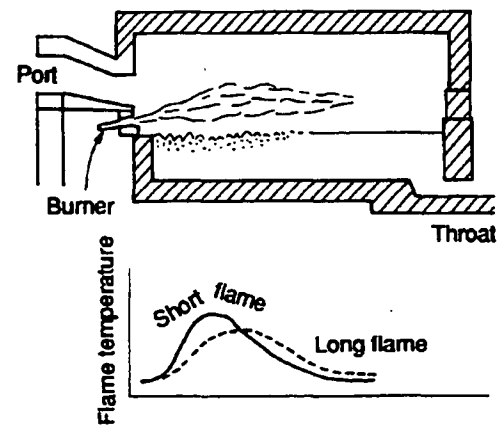


Figure 15. Temperature distribution of combustion flame for end-port-type furnace



- Changing the burner atomizing pressure (longer flame is obtained by lowering the primary pressure);
- Adjusting the secondary air.

However, as these methods are also limited in effects, the end-port-type is not often used for the large furnace with daily capacity of 100 to 150 tons or more.

(c) Combustion in forehearth

The forehearth has a function of controlling the glass temperature before its formation, and has a direct influence on the quality of the glass product. Its outline is shown in figure 16:

The basics for temperature control are:

- Optimization of the temperature of the gob to be fed to the forming machine;
- Temperature distribution from the forehearth inlet to the feeder to be adjusted so that the temperature will be lowered gradually along the glass flow, without any high temperature occurring on the way.

For the purpose of temperature control, a great number of small burners are installed in the flow direction. For this control, the cooling zone is divided into 3 or 4 zones.

LPG or a similar gas is used as fuel because gas features fast combustion, easiness to create short flames, and little or no generation of carbon. When carbon falls on the glass, it will cause foams to be produced, resulting in coloration.

When the coloured glass is molten, the colour may be changed by the influence of the atmosphere. To ensure the stable colouring, sufficient care should be taken of the atmosphere for oxidation or reduction in the forehearth.

When gas is to be burnt, air is often premixed into the gas. This method is available in three types as shown in figure 17.

Figure 17 (a) represents a premixing system using the venturi mixer for gas and air. This permits the total air ratio to be optimized, and, if the air ratio is changed in any zone, air ratios in other zones are also affected. Thus it is not applicable to the combustion control system where many burners are used.

Figure 17 (b) shows the method where gas and air are mixed by the burner tip. This method is designed to ensure safety by preventing back firing, but it fails to eliminate interference between gas and air zones.

Figure 17 (c) illustrates the method where the gas-air premixing valve is installed in front of the blower. With this method, the gas-air ratio is constant in front of the blower, so that the air ratio is constant in all zones, even if the volume to be combusted by the burner is changed for each zone. Therefore, it ensures reliable control of the air ratio, and permits substantial energy conservation, according to a report.

Comparison of oxygen (O_2) in the exhaust gas on the basis of the three methods has revealed that 8 percent of oxygen was contained in the exhaust gas using method (a), 6 percent using method (b), and 1 percent using method (c). Substantial reduction of the air ratio has succeeded in reducing the volume of the fuel gas.

2. Insulation

Since the melting furnace has a large surface area, the minimization of loss of heat from the furnace wall is a major concern for energy conservation.

However, the heat insulation of the melting furnace must be carefully studied. Otherwise, it will cause the erosion of the used bricks, reduce the service life of the furnace and cause quality of the glass to deteriorate, thereby bringing about many adverse effects.

(a) Insulation for melting chamber bottom

Improved insulation at the bottom will raise ground temperature of the furnace bottom. This will improve the melting capacity of the furnace, resulting in better yield. The subsidiary advantage of productivity improvement is secured in addition to the direct advantage of reduction of the heat loss from the bottom. Figure 18 (a) illustrates an example of insulation.

Compared with the conventional case without using the insulation brick, the amount of heat loss has been reduced by about 43 percent from 3240 to 1382 kcal/m^2h.

The refining chamber is also heat-insulated like the melting chamber. The insulation may be intensified in order to prevent the glass from being cooled.

(b) Crown insulation

As silica brick used for the crown, super-duty silica bricks have been developed; they are high-purity products containing the minimum alkali and alumina, providing improved insulation.

Some furnaces use AZS-type electrofused refractory (fused AZS) for the crown. Figure 18 (c) shows the example of insulation. AZS means alumia-zirconia-silica.

When the temperature inside the furnace is 1500° C, the temperature on the outermost insulation wall is reduced to 95° C, and the amount of heat loss reaches 810 kcal/m^2h. When insulation is not provided, the crown external wall temperature reaches 300 to 400° C.

(c) Side wall insulation

It has been an established trend that the fused AZS is used for the tank block, and the insulation is provided, except for the metal line. The brick joints are also insulated but sufficient care is required. Figure 18 (c) shows an example of insulation, where the outermost wall uses the ceramic fiberboard. When the average temperature on the inner wall is 1350° C, the outer wall temperature is 141° C, and the amount of heat loss is 2017 kcal/m^2h. The temperature of the outer wall is 232° C, and the amount of heat loss is 6102 kcal/m^2h if insulation is not provided.

The upper side wall not in contact with the molten glass has come to use the fused AZS in place of the silica brick. At the same time, insulation is also improved. Figure 18 (d) shows an example of insulation.

When the average temperature on the inner wall is 1500° C, the outer wall has the temperature of 171° C, and the amount of heat loss of 2088 kcal/m^2h. When insulation is not provided, the temperature on the outer wall reaches 304° C and the amount of heat loss reaches 6152 kcal/m^2h.

3. Exhaust heat recovery

As the melting of glass requires a temperature of 1450 to 1550° C, the exhaust gas contains a great deal of heat. The temperature of the exhaust gas entering the regenerator from the melting chamber reaches as high as 1450° C. In this way, exhaust gas having a high temperature is recovered by the regenerator or recuperator, and is used to preheat the secondary air for combustion.

(a) Exhaust gas recovery by regenerator

The regenerator is designed in such a way that high temperature exhaust gas is passed through the checker bricks, and the heat is absorbed by these bricks. After the combustion, gas is fed in for some time (15 to 30 minutes), air is fed in by switching, and the brick heat is absorbed, raising the air temperature. The air is used for combustion. This procedure is repeated at intervals of 15 to 30 minutes. Thus, two regenerators are required for each furnace.

The exhaust gas temperature is 1350 to 1450° C at the regenerator inlet, and drops 400 to 500° C at the regenerator outlet. Air enters the regenerator at the room temperature, and is heated to reach 1200 to 1300° C at the outlet. Then, it is used as secondary air for combustion.

(b) Exhaust gas recovery by recuperator

Exhaust gas and air flow through the wall of the recuperator, and the heat is exchanged by the wall. This method

Figure 16. Outline sketch of forehearth

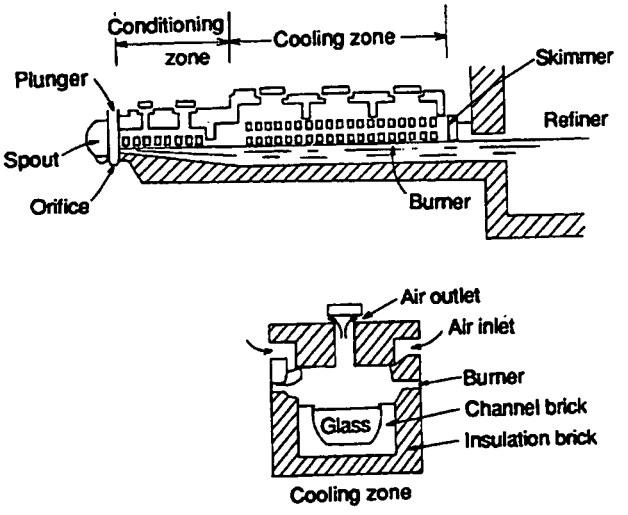


Figure 17. Gas burner system

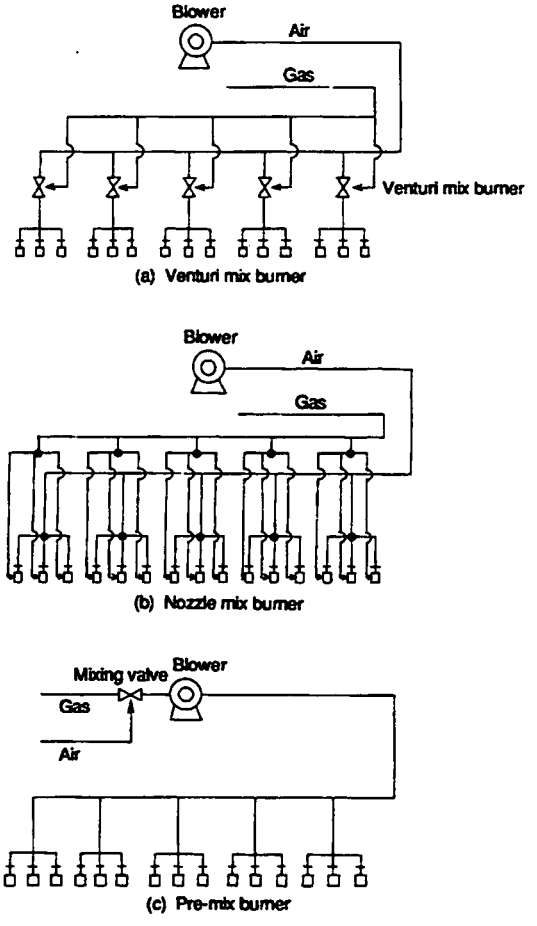
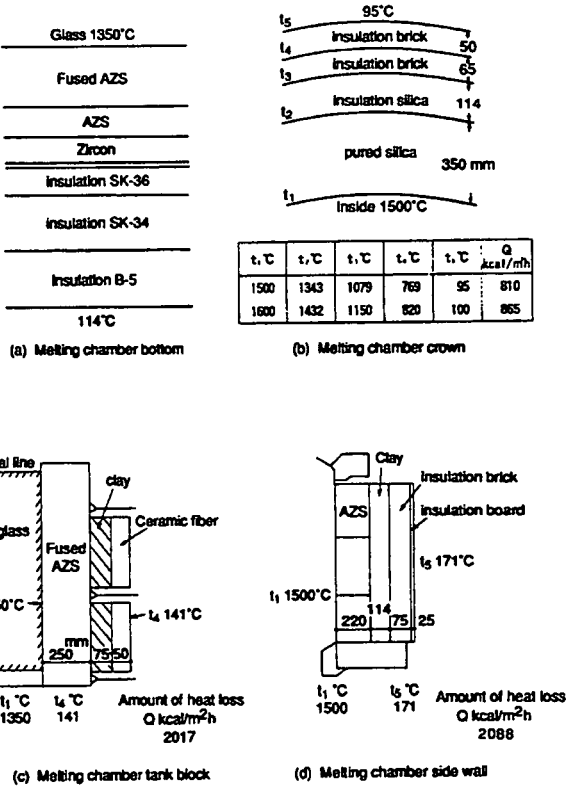


Figure 18. Examples of furnace insulation



is used for the small- or medium-size furnace where the amount of exhaust gas is smaller, and is featured by its capacity of ensuring the stable preheating air temperature. However, the maximum temperature of the preheated air does not reach that in the case of a regenerator.

The air leakage through the wall into the exhaust gas side occurs in the brickwork-type recuperator. Exhaust gas is analyzed for a change in oxygen to determine whether leakage has occurred to the recuperator. If air has entered the exhaust gas due to leakage, the gas temperature will drop and the increased amount of exhaust gas will cause a greater loss of the exhaust gas. If air leaks into the exhaust gas through the secondary air passage, the amount of secondary air will become insufficient in an extreme case, resulting in combustion failure.

Table 3 shows the leakage of the recuperator used in the pot furnace:

Regarding 4 furnaces, the content of oxygen (O_2) was analyzed in the exhaust gas inside the furnace and at the recuperator outlet, and the air ratio (m) was compared. The value "m" was 1.05 to 1.3 in the furnace C where the difference was the minimum, and 1.17 to 2.2 in the furnace B where the difference was greatest, showing an increase of about 1.8 times. As can be seen, entry of air is unavoidable for the recuperator, and this trend becomes more conspicuous as the furnace becomes older. Daily care is therefore essential.

Figures 19 (a), (b) and (c) show the relation between the percentage of conserving the fuel and the preheated air temperature when the exhaust gas is used to preheat the secondary air. Figure 19 (a) shows an example in the case of heavy oil. When the temperature at the regenerator inlet is 1200° C, about 50 percent of fuel will be saved if the air temperature is preheated to 900° C. If the air temperature is raised to 600° C when the exhaust gas temperature is 800° C, fuel of about 28 percent can be saved. In this way, the furnace with higher exhaust gas provides the better effect of air preheating, according to this figure.

Figure 19 (b) illustrates the situation with LPG, while figure 19 (c) represents the situation with LNG.

B. Lehr

Annealing is a process specific to glass manufacturing. If the glass is left as it is after having been formed, strain will occur due to the temperature differences on the surface and interior, and will break when it has exceeded a certain amount. Annealing is performed to minimize the possibility of strains occurring during the cooling process. To rationalize the cooling process, it is essential to obtain correct information on why stain occurs to the glass.

Lehr is available in two types; a direct-fired type where the combustion gas contacts the product directly, and a muffle type where gas and products are separated from each other by the partition. The muffle type permits the use of less expensive heavy oil but the heat efficiency is low.

The directly fired type uses gas and electricity as fuels, and features high heat efficiency and easy temperature control. So the directly fired type is coming to be used in greater numbers.

Figure 20 provides an example of the lehr based on the forced circulation convection system. Gas inside the furnace is force-circulated by the fan to ensure a uniform temperature distribution, improving heat transfer efficiency. It permits annealing in a shorter time than the conventional lehr.

Energy conservation of the lehr should be carried out, with consideration given to the following:

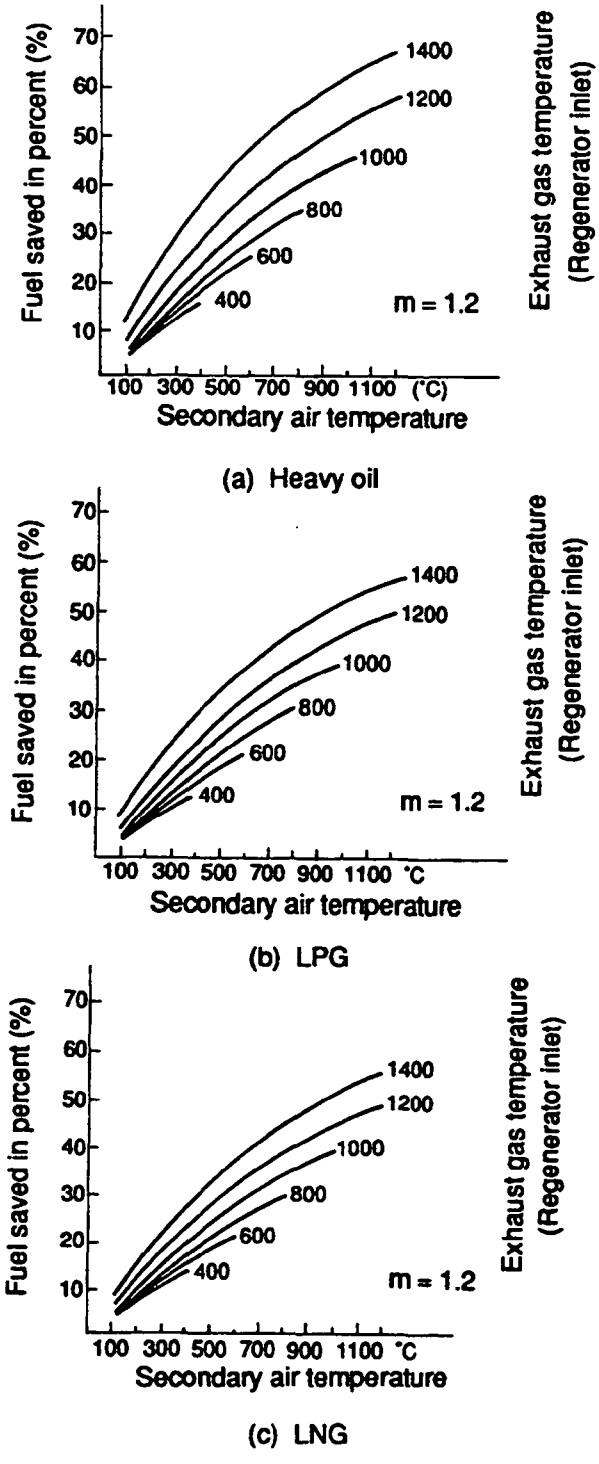
(a) **Heat insulation of the furnace wall**

The conventional wall materials were mainly the refractory bricks and insulating bricks. For the furnace wall, it is effective to directly use the heat insulating materials made of fibres having the minimum thermal capacity, when the temperature is as low as 600° C as in the lehr

Table 3. Air ratio of exhaust gas for pot furnace and recuperator

	A	B	C	D
Furnace outlet O_2%	0.2	3.3	1.0	0.6
Air ration (m)	1.01	1.17	1.05	1.02
Recuperator outlet O_2%	6.2	11.8	5.6	8.9
Air ratio (m)	1.4	2.2	1.3	1.7

Figure 19. Savings in fuel due to preheated air



and the operation may have to be stopped during the night. Since the furnace, having the minimum thermal capacity, is susceptible to temperature variation, sufficient consideration must be given to the control system. As the products with very high temperature are charged into the lehr, the amount of fuels for heating can be reduced by providing sufficient insulation.

(b) **Preventing cold air from entering through the inlet opening**

The lehr has a short distance between the inlet and the heating zone, and the soaking zone is quite close to the inlet. Therefore, entry of cold air from the inlet will have a serious influence; for example, it will disturb the temperature distribution inside the furnace. Since the opening serves as an inlet for the products, it is designed to be wide open. It will be necessary to install a damper or insulating curtains, without keeping it open. This opening also serves to discharge the heat of high temperature from the soaking zone.

(c) **Preventing the outlet opening from being opened**

As the inner part of the lehr outlet has a higher temperature, air flows toward the inner part. Air entering the outlet will disturb the temperature distribution in both the vertical and horizontal directions inside the furnace. It is desirable to provide covers above the belt conveyor as well as below it to enclose the space whenever possible.

(d) **Alleviating the mesh belt heating**

The mesh belt is made of steel wire or stainless steel. When it enters the furnace and is heated, the caloric output will be very high. For example, assume the following:

Weight of products to be processed: 630 kg/h
Temperature of the product entering the lehr: 400° C
Soaking temperature: 550° C
Specific heat: 0.252

Then, the caloric output required to heat the product is given by:

$Q_1 = 0.252 \times (550 - 440) \times 630 = 23814$ kcal/h

where:

Belt width: 1500 mm
Belt weight: 20 kg/m^2
Belt speed: 380 mm/min.
Temperature of product entering the lehr: 15° C
Soaking temperature: 550° C
Specific heat: 0.132

The caloric output required for belt heating is given by:

$Q_2 = 0.132 \times (550 - 15) \times 20 \times 0.38 \times 1.5 \times 60 = 48304$ kcal/h

The caloric output required to heat the belt is more than twice that required to heat the product. To save this heat, the belt wire diameter is minimized, and the weight is reduced by making the pitch loose. However, this method has a defect: it causes a reduction in strength. The returning belt passes outside the furnace. To prevent the temperature from lowering to the room temperature, some plants provide improvements so that the belt will pass

through the bottom inside the furnace, and the heated belt will enter the heating zone.

(e) **Making the temperature inside the lehr uniform**
The lehr interior is designed so as to have a certain temperature curve with respect to the flow, but the temperature distribution in vertical and horizontal directions with respect to the flow cannot be controlled. If this temperature distribution is not uniform, the strain may be removed differently depending on the position on the belt conveyor. This will give an adverse effect on the production yield. To improve the temperature distribution, the forced circulation convection system is used, as illustrated in figure 20.

(f) **Temperature of the product entering the lehr**
After being formed, the product is carried by the conveyor and is charged into the lehr. The product temperature differs depending on the distance to be carried by the conveyor. When energy conservation is considered, the product should enter the lehr after being carried over the minimum possible distance. As this is related to the total layout of all the production processes, modification is not very simple. However, if layout modification is possible in future, the possibility of this improvement should be studied.

C. Heat balance (in melting furnace and lehr)

Measuring the furnace temperature or observing the combustion is the routine procedure to ensure a stable furnace operation and high-quality products. Heat balance is an effective means of promoting energy conservation. A heat balance table is made to numerically grasp the present situation of heat loss and efficiency in furnace operation.

For the concrete heat balancing technique and calculation formula, see the relevant publications. The following shows major points for measurements in heat balancing procedure:

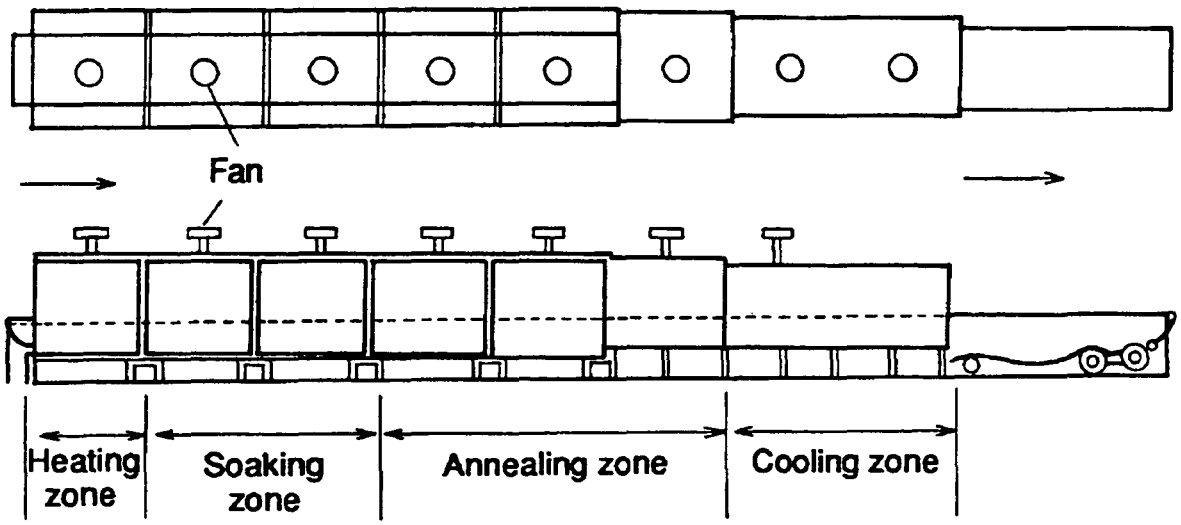
(a) **Heat input**

Combustion heat of the fuel
Lower calorific value of the fuel
Sensible heat of the fuel
This may be omitted when fuel is not preheated.
Sensible heat of air for combustion:
caloric output of the air preheated by the regenerator, etc. The flow rate is calculated from the inlet area and air flow rate.
Batch sensible heat
This is omitted except when it is not preheated.

(b) **Heat output**

Heat carried out by glass
It is a common practice to take heat balance including that of the refiner. The glass temperature in this case is measured at the forehearth inlet. The amount of the glass should be the amount taken out of the forming machine or the amount of the loaded batch. Table 4 illustrates the caloric output of the glass.
Heat loss from furnace wall
The heat loss of the crown, side wall, bottom, etc. are measured by the heat flow meter. One or more points for 5 m^2 must be measured. When the heat flow meter is not available, use the surface thermometer to measure the surface temperature, and obtain the answer by calculation. It should be noted that calculation assumes the air flow close to the furnace wall as natural convection.
Latent heat of vaporization for batch moisture
For measurement, sample the batch moisture from the hopper located in front of the furnace.

Figure 20. Outline sketch for lehr



When the batch charger and throat are cooled, add them to the amount of heat loss.

Furthermore, if the electric booster is used for auxiliary heating, it is necessary to add its heat input and heat output.

An example of a heat balance chart for glass melting tank is shown in figure 21.

Tables 5 to 8 show examples of the heat balance of the furnace, forehearth and lehr.

Table 5 indicates the heat balance for three furnaces produced at different times. It shows that good results are obtained according to the progress of the energy conservation efforts. Tables 6 and 7 show the heat balance of the forehearth. The positions for measuring the temperature are illustrated in figure 22.

Table 8 presents an example of the lehr heat balance. The characteristic of this case is that the other heat outputs are greater. Amount of caloric output to heat the chain belt appears to be included.

D. Other measures

(a) Use of electric booster

To increase the pull without changing the furnace size, alternating current (AC) is supplied to the melting chamber or heating. This method is often used for the bottle making furnace. Since this electricity is used for glass melting at the efficiency of close to 100 percent, the method is very effective.

Since the electricity required to increase the pull by 1 ton is said to be 22 to 28 kW. Assuming it to be 28 kW, input of 24080 kcal is sufficient since 1 kW corresponds to 860 kcal. The use of the booster to increase the pull will reduce the specific energy consumption.

(b) Bubbling

Air is put through the bottom of the melting chamber, and glass is agitated by the bubble, thereby speeding up the homogenization and improving the product quality. Bubbling increases the temperature at the bottom of the melting chamber, resulting in increased furnace temperature. Thus, this method directly contributes to energy conservation. Moreover, improved product quality reduces the failure rate, and decreases the specific energy consumption.

The bubbling method

Several nozzles or ten or more nozzles are installed, perpendicular to the flow of the glass, at the bottom close to the hot spot of the melting chamber, and 1 to 10 litres of air per hour are fed into molten glass.

(c) Electric heating of forehearth

It is extensively known that direct heating of the forehearth by electric power will greatly save energy. In the case of borosilicate glass, the entire forehearth is enclosed without contact surface between air and glass; this method ensures high-quality glass. Since this method, however, is not often used, its advantages or disadvantages are not so clear at present.

(d) Use of cullet

Figure 23 illustrates that use of a large amount of cullet saves energy. When no cullet is used at all in the furnace with a daily production capacity of 150 tons, 200 kg fuel/kg-glass is used. On the other hand, when 50 percent cullet is used, spent fuels will be reduced to about 180 kg/kg-glass.

The use of only the cullet produced in the plant may be satisfactory. However, the generation of such a great deal of cullet means a high failure rate in production; this is not desirable. Cullet placed on the market is inevitably mixed with foreign substances, and it is expensive to

Table 4. Heat required for production of various kinds of glass at various temperatures (thioretical value)

Kinds of glass	Temperature °C	Heat required for melting glass kcal/kg glass					
		Cullet addition rate (%)					
		0	20	40	60	80	100
Tableware glass	1400 1250	576 530	543 497	510 464	477 431	444 398	411 365
Sheet glass	1400 1150	666 571	615 520	563 468	512 417	460 365	409 314
Bososilicate glass	1400 1300	508 477	482 451	455 424	429 398	402 371	376 345
Lead crystal glass	1400 1100	496 391	472 367	448 343	424 319	400 295	376 271

Figure 21 Heat balance chart for glass melting tank

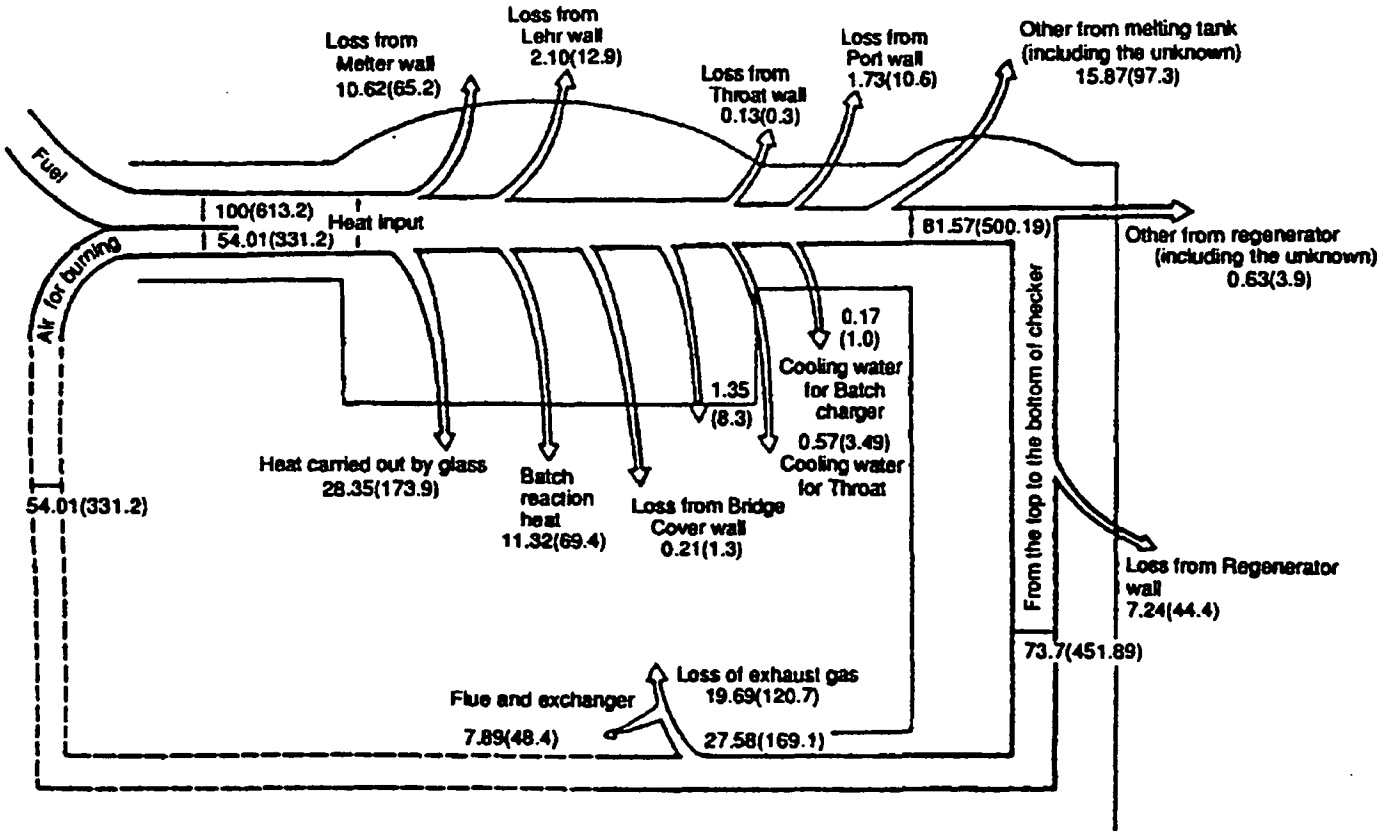


Figure 22. Measured positions for heat loss measurement from forehearth

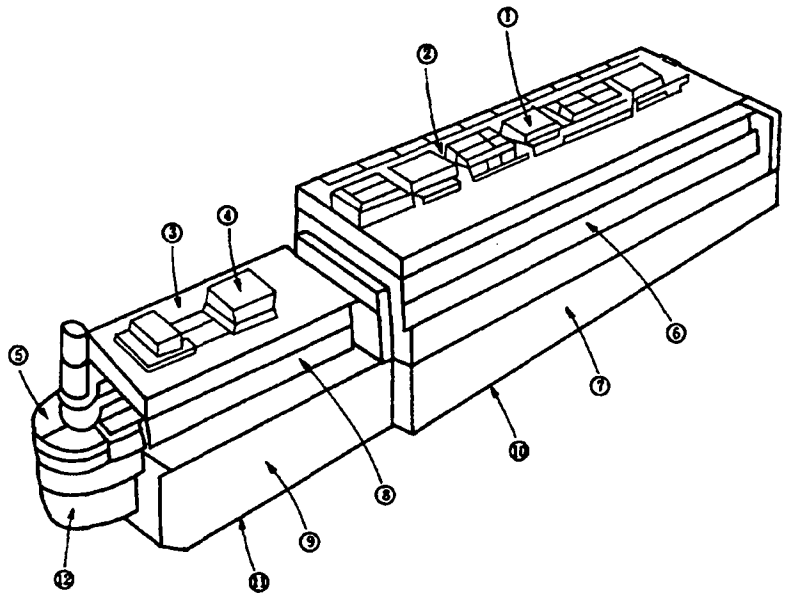


Table 5. Heat balance of three generation furnaces

		A After 1972	B	C
Pull	(t/day) (fx^2/t) (1000 kcal/t)	266 4.25 1323.0	121 5.58 1215.0	264 5.53 1107.0
Heat loss	($kcal/m^2h$) x 1000 kcal/t.d	1666.1 256.0	1223.2 268.0	677.5 135.0
Heat efficiency %		34.1	39.7	44.0
Heat carried out by glass (%) Reactor heat by batch (%)		27.4 67 (Cullet 38%)	27.4 11.3 (Cullet 23%)	31.4 12.6 (Cullet 16%)

		A		B		C	
H e a t Input	Fuel	100		100		100	
	Secondary Air	50.7		54.0		56.6	
-	Melter wall	12.0		10.82		5.8	
	Refiner wall	2.0		2.1		0.8	
	Port wall	1.7		1.7		1.4	
	Throat wall	0.1		0.13		0.1	
	Batch moisture	2.3		1.35		2.50	
	Loss by water cooling for throat	0.2		0.57		0.33	
	Loss by water cooling for batch charger	0.2		0.17		0	
	Others	21.1		15.9		27.0	
	Heat carried out by glass	27.4	34.1	28.4	40.0	31.4	44.0
	Reactor heat of batch	6.7		11.3		12.6	
	Total	73.7		72.4		81.9	
	Regenerator heat loss wall	3.6		7.2		3.7	
	other	5.4		0.63		0.5	
	Total	9.0		7.9		4.2	
	Heat loss by exhaust gas	17.3		19.7		13.9	

Source: New Glass Tech Vol. 3 (1983), No. 4

Figure 23. Relationship between pull and fuel amount for various cullet content

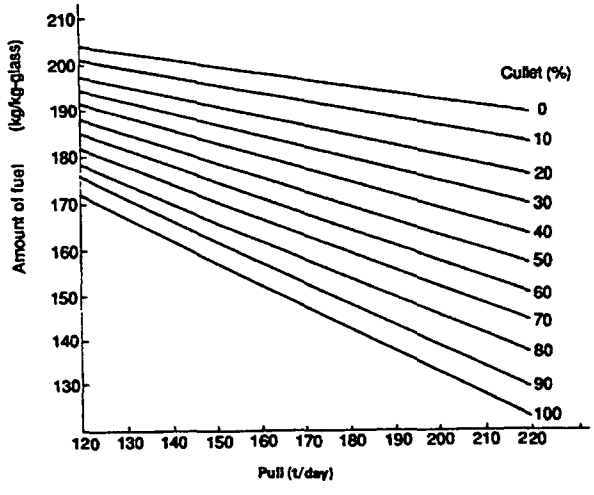


Figure 24. Viscosity versus Li_2O content

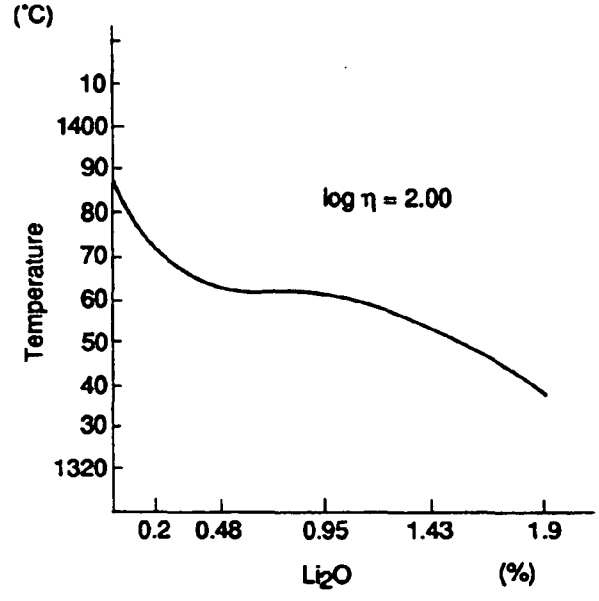


Table 6. Heat loss from forehearth

		A Area m^2	B Average Heat Loss $kcal/m^2h$	A x B kcal/h	Total heat loss kcal/d	Part loss/Total loss %	Heat loss/area $kcal/m^2h$
Crown	1	0.56	10000	5600			
	2	7.30	519	3788			
	3	1.80	885	1593	372000	37.3	1526
	4	0.11	9000	990			
	5	0.39	9050	3530			
Side wall	6	7.48	1206	9017			
	7	7.84	751	5886			
	8	1.0	1290	1290	411000	41.2	959
	9	1.90	490	931			
Bottom	10	8.43	695	5860			
	11	2.05	387	793	214000	21.4	768
	12	1.11	2030	2253			
Total		39.97		41531			

Table 7. Heat balance of forehearth

		$x\ 10^4$ kcal/d	%	as 100% heat bring of glass
Input	Heat bring of glass	2184.5	83.0	100
	Heat of Combustion	448.8	17.0	20.5
		2633.3	100	120.5
Output	Heat carried out by glass	2104.6	79.9	96.3
	Heat loss from wall	99.7	3.8	4.6
	Exhaust gas and other	42.9	16.3	19.6
		2633.3	100	120.5

Table 8 Heat balance of lehr

Heat Input			Heat Output		
	kcal/kg	%		kcal/kg	%
Fuel	450	79.5	Slide wall heat loss	27.4	4.8
Heat Carried in by glass	116.3	20.5	Open space heat loss	139.1	24.5
			Exhaust gass heat loss	134.0	23.7
			Heat carried out by glass	14.0	2.5
			Other	251.8	44.5
Total	566.3	100		566.3	100

maintain quality. If high-quality cullet can be ensured in ground form, the use of large amounts of cullet will contribute to energy conservation.

(e) **Development of low melting temperature batch**
Various studies have been made on the batch for reducing melting temperature without deterioration in the quality of the glass. The method considered to be most effective is to add lithium. Lithium carbonate or spodumene (Li_2O, Al_2O_3 $4SiU_2$) is used. The spodumene is composed of 5 percent of Li_2O, 18.7 percent of Al_2O_3, 74.7 percent of SIO_2 and 0.1 percent of Fe_2O_3. Their quality must be checked before use.

The addition of a small amount of lithium reduces the high temperature viscosity of the glass, and reduces the foam breaking temperature. Using glass composed of Na_2O-CaO-SIO_2 as an example in figure 24, the temperature decreasing by $\log \eta = 2.0$ was 1400° C when 0 percent of Li_2O was used. When 0.2 percent of Li_2O is used, that temperature is reduced by 30° C. When 1.9 percent of Li_2O is used, that temperature is reduced by 60° C to 1340° C. Thus, the addition of a small amount of lithium reduces the viscosity. This has been demonstrated by the reduced bubble breaking time in the commercial furnace. However, the lithium material is expensive. Therefore, a study will be made according to the trade-off between the energy conservation and material cost.

(f) Furthermore, for the small furnace with a daily production capacity of 10 tons or less, the conversion to the fully electric furnace, addition of oxygen in the burner combustion and introduction of gas into the primary air atomizer must be studied, but they will not be described in this paper.

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* This is the second issue of the *Energy and Environment Series* to cover energy conservation in industry. For additional references, please see issue Number 1.

0001 HEAT ENERGY DISSIPATION IN FATIGUE DAMAGE PROCESS OF MATERIALS. [BIB-199301-31-0320]

Using the dissipated energy as an essential parameter, the energy dissipative structure in the process of fatigue damage of materials (e.g. 40CrNiMoA) has been established. Through thermodynamic analysis for irreversible energy dissipation in the fatigue damage process, the heat dissipative variations in cyclic loading process and in a cycle have been systematically studied on the basis of low cycle fatigue tests and infrared measurement of self-heating thermography. Meanwhile, the cyclic hysteresis energy and efficient energy dissipation (stored energy) have been proposed during fatigue damage process. Graphs. 4 ref. (Tung, X.; Wang, D.; Xu, H.; ACTA METALLURGICA SINICA (CHINA), (18 APR. 1992), 28, (4), pp. A163-A169 [in Chinese]. ISSN 0412-1961)

0002 THE WAY OF ENERGY SAVING IN THE SINTER PLANT IN WISCO. [BIB-199301-41-0053]

In the past decade, considerable achievements have been made in the sinter plant of Wuhan Iron and Steel Co. In comparison with 1980 the process energy consumption and solid fuel consumption in 1989 reduced by 21.20% and 52.90%, respectively. This can be attributed to a series of improvements, including sintering technology and equipment, operating skill, and energy management. Energy consumption of sintering process takes a high portion of total energy consumption for a steel complex. In WISCO, the ratio of sintering energy consumption to the total was 10.84% in 1988. Therefore, it is necessary to pay special attention to developing advanced sintering technology to save more energy for the sintering process. Graphs. 7 ref. (Li, Y.s.; Liao, G.r.; 3RD INTERNATIONAL SYMPOSIUM ON BENEFICIATION AND AGGLOMERATION, BHUBANESWAR, INDIA, 16-18 JAN. 1991, Publisher: INDIAN INSTITUTE OF METALS, c/o RRL, Bhubaneswar 751 013 Orissa, India, (1991), (Met. A., 9301-72-0056), pp. 639-643 [in English].)

0003 OPTIMIZATION OF ACTIVATION CONDITION FOR SULFIDE MINERALS—FINE GRINDING PRETREATMENT OF ZINC SULFIDE CONCENTRATE. [BIB-199301-41-0059]

A zinc sulfide concentrate was selected as an example to investigate the influence of grinding conditions on the mechanical activation of metallic sulfide minerals. The correlation among the grinding time, energy consumption and leaching rate of value metals was discussed. The proper grinding conditions determined from the optimizing tests are as follows: the stirring rate of mill (Attritor): 1000 r/min. The experimental results showed that the measurement of slurry viscosity could be a simple and feasible method for the determination and characterization of grinding efficiency on site. The effect of fine grinding on the settlement of leach residues and separation was also briefly discussed. Graphs. 6 ref. (Li, X.; Kammel, R.; Pawlek, F.; HUAGONG YEJIN (ENGINEERING CHEMISTRY AND METALLURGY), (MAY 1992), 13, (2), pp. 134-138 [in Chinese].)

0004 APPLICATION OF VANYUKOV PROCESS FOR MELTING LOW SULPHUR GOLD CONTAINING CONCENTRATES. [BIB-199301-42-0054]

To develop guidelines for the selection of a particular melting process for low-sulphur Au-containing pyrites, material and heat balances were calculated for the Vanyukov and electromelting processes. In terms of fuel efficiency, the Vanyukov process is preferable for S concentrations of 15-20% and higher, while the elecromelting process is ore fuel-efficient for lower S concentrations. Some additional factors to be considered in the selection of the best process are briefly discussed. Graphs. 10 ref. (Galushchenko, V.V.; Tarasov, A.V.; Bagrova, T.A.; Generalov, V.A.; TSVETNYE METALLY, (FEB. 1992), (2), pp. 13-15 [in Russian]. ISSN 0372-2929)

0005 CHARACTERISTICS OF MAGNETIC ROLLING FEEDER SYSTEM. [BIB-199301-42-0070]

Three characteristics of the magnetic rolling feeder system, i.e. enlargement of the falling time difference of all components of mix, increase of the thickness of feeding mix and strengthening of tumbling of dropping granule, are analyzed. After feeding, a looser sinter mix bed with reasonable segregation in particle size and chemical composition and perfect order in distribution can be formed. The productivity of the sintering machine can be increased by 4%. Iron ores are discussed. 1 ref. (Chen, S.; IRON AND STEEL (CHINA), (APR. 1992), 27, (4), pp. 1-4, 35 [in Chinese]. ISSN 0449-749X)

0006 STUDIES ON LARGE SCALE PRODUCTION OF CHROMITE BRIQUETTES FOLLOWED BY SMELTING. [BIB-199301-42-0104]

Details of investigations on briquetting of chromite on laboratory and pilot plant scale followed by their charging in an arc smelting furnace for production of silico-chrome are given. About 50 tonnes of briquettes were prepared and charged with 20% replacement of ore by briquettes in a 9 MVA furnace. The briquettes prepared with molasses and lime as binder had the desired strength after natural curing for a period of one week, the briquettes were acceptable to the furnace and some indications on the improvement in productivity and reduction in electrical energy requirement were observed. 6 ref. (Mohanty, J.N.; Banerjee, G.N.; Dey, D.K.; Ray, S.C.; Tripathy, A.K.; Jouhari, A.K.; Dey, D.N.; Parida, R.C.; Padhi, A.K.; Patel, b.B.; Das, Y.C.; 3RD INTERNATIONAL SYMPOSIUM ON BENEFICIATION AND AGGLOMERATION, BHUBANESWAR, INDIA, 16-18 JAN. 1991, Publisher: INDIAN INSTITUTE OF METALS, c/o RRL, Bhubaneswar 751 013 Orissa, India, (1991), (Met. A., 9301-72-0056), pp. 602-605 [in English].)

0007 BASIC CONSIDERATIONS REGARDING ENVIRONMENTAL POLICY AND ENERGY SAVING. [BIB-199301-45-0042]

There is a complex and strong relationship between energy and environmental projects. Environmental projects always have to be judged by their energy-related consequences and vice versa. Projects which from an environmental viewpoint have the same influence on acidifying emissions, may strongly differ in terms of energy-related results. On the other hand, the saving of 1 GJ of natural gas has a different effect on the reduction of SO emissions than the saving of 1 GJ of boiler fuel oil. Weighing these aspects in the decision-making process enables the most efficient employment of capital investment. 3 ref. (Pronk, K.; SEMINAR ON IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, METALLURGICAL PLANT AND TECHNOLOGY INTERNATIONAL, (JUNE 1992), 15, (3), pp. 24-26, 28, 31 [in English]. ISSN 0935-7254)

0008 ENERGY AND COST SAVINGS WITH THE UNARC DC ELECTRIC ARC FURNACE. [BIB-199301-45-0043]

In 1980, MAN GHH started to develop the dc arc furnace. Initial furnace capacities of 12 and 35 t evolved into a furnace design series which today has a capacity of up to 150 t and 80 MW electrical power rating. With Unarc dc arc furnaces, savings in energy, electrodes and refractory material are achieved and maintenance is reduced. Another benefit is the lower flicker level. Larger and more powerful units will be available in the near future. Graphs. (Schubert, M.; METALLURGICAL PLANT AND TECHNOLOGY INTERNATIONAL, (JUNE 1992), 15, (3), pp. 32-34, 36 [in English]. ISSN 0935-7254)

0009 IRON AND STEEL INDUSTRY AND ATMOSPHERIC ENVIRONMENT. [BIB-199301-45-0054]

The greenhouse effect of CO_2 and other gases in the atmosphere has been discussed. The exhausting of waste gases in the iron and steel industry has been analysed. To achieve the aims of development of iron and steel production and protection of the atmospheric environment, six technical measures have been presented. Graphs. 10 ref. (Yin, D.; IRON AND STEEL (CHINA), (APR. 1992), 27, (4), pp. 73-76, 79 [in Chinese]. ISSN 0449-749X)

0010 GAS UTILIZATION OF BF WITH OXYGEN ENRICHMENT AND PCI OPERATION. [BIB-199301-45-0055]

BF with O_2 enrichment and PCI operation consumes more power and its gas becomes rich with carbon monoxide and H_2, which must be used properly. It is suggested that a self-powered generator is needed which uses surplus of the gas as fuel. This measure will reduce the shortage in power supply and increase the economical benefits. 4 ref. (You, W.; IRON AND STEEL (CHINA), (APR. 1992), 27, (4), pp. 77-79 [in Chinese]. ISSN 0449-749X)

0011 PROCESS OF FERROCHROMIUM NOW AND IN THE FUTURE. [BIB-199301-45-0056]

The most essential objectives in the development of the ferrochromium process are the reduction of energy consumption and improvements in the recovery of Cr. For measuring the activity of chromium oxide in slags, there was developed

a measuring system based on an oxygen-ion conductive solid electrolyte. Owing to the high temperature and aggressive nature of the slags, there were difficulties in the measurements as for the life of cell and crucible materials. Progress was made by developing the technique. Measurements were carried out for the basic slag system $CaO—SiO_2—Cr_xO$ and for individual four-component slags, and reproducible results were obtained. (Kojo, M.; Holappa, L.; GOVERNMENT RESEARCH ANNOUNCEMENTS AND INDEX, (1991), DE92506510/XAB, Pp 52 [in Finnish]. ISSN 0097-9007)

0012 THE IRON AND STEEL INDUSTRY AND THE ENVIRONMENTAL CHALLENGES. [BIB-199301-45-0068]

Some efforts that have been undertaken over the past ten years in the field of controlling energy cost and energy consumption in the Dutch iron and steel industry are described and the relationship between these measures and environmental policies for reduction of SO_2, CO_2 and NO_x emissions is discussed. The challenges in balancing the need for emission reduction and the need for energy saving are then detailed. Several challenges to the realization of policy objectives for these two objectives are delineated. These include: the need to formulate an internationally solid policy that also takes into account other important social items such as population growth and development of the third world; definition of standards for target groups within the industry; selection of a policy instrument that offers sufficient security and which also offers sufficient flexibility to choose the most efficient and effective application of implementation means; and development of process integrated solutions where energy saving, environmental, and economic aspects reinforce each other. Graphs. 3 ref. (Pronk, K.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 82-95 [in English].)

0013 CO-GENERATION WITH COREX. [BIB-199301-45-0069]

The COREX technology is described and its benefits compared with the conventional blast furnace/coking plant route for steelmaking are delineated. Benefits of the process include: elimination of coking plant through use of non-coking coal; elimination of agglomeration plants through the input of 100% lump ore (pellets and/or sinter may also be used); minimization of environmental loads; high operational flexibility with respect to production capacity, raw material changes and stopping times; production of hot metal of at least blast furnace quality. A further benefit of the process is the production of 2.5 times more medium caloric gas (COREX gas) that can serve as a basic material for the chemical industry or as a reducing agent for metallurgical purposes and fuel gas for various combustion processes, especially in electric. Properties of the export COREX gas are briefly described. The overall energy balances are calculated for a given set of parameters for both the COREX process and the coke oven/blast furnace route. The calculation shows that the net energy demand for the COREX process is 4.9 MWh/ton of pig iron compared with 5.6 MWh/t for the blast furnace route. Graphs. 3 ref. (Lemperle, M.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 104-122 [in English].)

0014 THE DRIVE TOWARD COKE RATES LESS THAN 300 KG FROM CONCEPTS TO PRACTICE. [BIB-199301-45-0071]

Measures taken to reduce the coke rates in blast furnace operation to 300 kg/thm are discussed. Operation of blast furnaces at this low rate is indicated to be the consequence of the control of the coal injection technique. A new process for drying, grinding, and transportation of coal that plays a central role in providing for this improved process is described along with combustion conditions at the tuyeres. Typical blast furnace operation with coke rates (Graffeuille, F.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 134-161 [in English].)

0015 HEAT RECOVERY FROM THE SINTER LINE DL5 AT COCKERILL-SAMBRE. [BIB-199301-45-0072]

To improve the utilization of energy on the DL5 sinter plant of Cockerill Sambre, a new type ignition apparatus, designed to produce a quite impressive reduction of the ignition energy consumption (fuel: coke oven gas), was installed and a heat recovery steam generator was introduced to recover thermal energy remaining in the gas at the cooling area exhaust and use it to generate low pressure superheated steam. To finance all the costs of these two projects, the original concept of "third party financing" was used. The resulting energy savings generate a yearly profit of approx 50 000 000 BEF, or 1 200 000 ECU. 1 ref. (Bischops, P.; Massin, J.R.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 162-177 [in English].)

0016 BOS GAS RECOVERY USING AN EXPERT SYSTEM. [BIB-199301-45-0073]

During the steelmaking process a waste gas product, BOS gas, is generated. The gas is approx 70% carbon monoxide. The BOS gas was drawn from the vessel through the OG gas cleaning system by an ID fan to be flared at the stack. The BOS gas recovery system is an additional feature downstream of the ID fan utilising the original OG system. The gas is collected on a batch basis, the frequency of which is dependent on steel production rate, approximately once every half-hour. The average gas collected on a weekly basis is 47 000 GJ or pounds sterling 95 000. Each collection is worth approx pounds sterling 400 at current gas price. Approximately pounds sterling 200k was lost due to gas recovery faults each year. With the use of the expert systems this has been reduced to pounds sterling 100k/year over the last three months since being fully commissioned. At first, gas recovery was achieved on 84% of casts with a target of 90%. This has now risen to 94% due to reduced faults on the system. The BOS gas recovery system was designed on the basis of using the BOS gas within the mills area where it is used in a reheating role. Improved utilisation in this area has led to an even greater need for increased collections. (Tindle, J.Y.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 186-201 [in English].)

0017 NEW TECHNOLOGIES IN TARANTO STEEL PLANT TO SAVE ENERGY. [BIB-199301-45-0074]

Energy saving initiatives that were undertaken at the Taranto steel works during the 1980s are described. The installation of several recovery plants in various production areas and implementation of a computer process control system are highlighted. Areas in which recovery plants were installed included: heat recovery for the sintering plant; blast furnace expansion turbines; cowpers heat recovery for two blast furnaces; powder coal injection in blast furnaces; oxygen gas recovery in two steel making plants; improvement and revamping of the slab furnace; heat recovery from the power plant smoke. Details are given concerning the hardware configuration and the real time process control pattern for the computer control system. Graphs. (Pavone, S.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 202-228 [in English].)

0018 WASTE HEAT RECOVERY APPLICATIONS AT HOOGOVENS IJMUIDEN STEELWORKS. [BIB-199301-45-0075]

Energy conservation accomplishments during the past ten years at Hoogovens are briefly described and aims that have been drafted for the coming period up to the year 2000 are described. Energy saving goals up to the year 2000 have been defined as 10% by the year 1995 and another 10% by the year 2000. The primary measures to be taken to obtain the first 10% reduction are: extension of the BOF gas recovery from two converters; extension of pulverized coal injection in blast furnaces; use of a gas turbine fired with natural gas for electricity and steam (vessel) production; a "Wechselspeicher" in the oxygen production plant; various good house-keeping projects; residual heat recovery for steam production and for preheating in combustion processes; and heat insulation of installations. The second 10% is viewed as more complicated. To attain this goal, the focus will be on residual heat recovery using thermal heat pumps; residual heat utilization in a natural gas expansion turbine; energy improvement in the coal drying mills by a gas combustion engine, a cogeneration application. (Krom, R.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF EN-

ERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 252-265 [in English].)

0019 ENERGY UTILISATION IN THE ELECTRIC ARC FURNACE. [BIB-199301-45-0076]

Techniques and methods that have been implemented by United Engineering Steels to reduce energy consumption in their steelmaking plants are described. Topics covered include: the effect of changing practice on energy usage; changes in furnace operations; furnace linings; transformer uprating; use of oxygen/fuel, oxy-coal and oxy-gas burners; carbon injection. Reductions in electrical energy due to implementation of these measures have varied with the proportion of low carbon steels produced. Savings range from as low as 5 kWH/tonne of liquid steel to as high as 17 kWH/tonne. Time saving is reported to equate to five min/cast. Yield improvements have also resulted from the reduction of iron oxide in the slag in the region of 1%. Finally, the use of deep injection into the steel following C injection into the slag can give significant reductions in the quantity of Al used to deoxidize the steel due to reduction of the O content of the steel. Graphs. (Garbutt, F.R.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 306-319 [in English].)

0020 DIRECT CURRENT ELECTRIC ARC FURNACE AND CONTINUOUS CHARGING OF FURNACES. [BIB-199301-45-0077]

The design and operation of a mini-steel mill owned by the Societe Metallurgique de l'Escaut (SME) are described. The mill was designed for feeding a rolling mill that produces a large range of merchant bars such as flats, squares, equal and unequal angles. It is equipped with a direct current arc furnace built by CLECIM and a CONCAST continuous caster that is equipped with five lines. Two billet sections are cast: 120 and 133 mm square. Evolution of furnace performances over the period 1986-1991 is shown. Productivity increases over this time are attributed to reduction of failure rate, staff training, improvement of productivfity of the continuous casting, and start up of a ladle furnace. Graphs. (Ozenne, C.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 320-334 [in English].)

0021 ENERGY CONSUMPTION IMPROVEMENT BY OPTIMUM INPUT CONTROL. [BIB-199301-45-0078]

A new computer control device for electric arc furnaces that measures and calculates the various electrical characteristics values is described. The device, called ARMS, was developed by Inseriales and is based on a control device that was previously developed by Daido Steel. The ARMS won the acceptance of the Energy Commission of the European Communities as a demonstration project and with the collaboratoion of Ente Vasco de la Energia, was installed at ACENOR (Basauri-Spain). Since December 1988, the system has been controlling the arc furnace production special steels. An average savings of 35 kWH/liquid steel ton has been realized. Graphs. (Arana, J.L.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 336-351 [in English].)

0022 NET AND NEAR NET SHAPE CONTINUOUS CASTING: NEW DEVELOPMENT IN MINI-MILLS. [BIB-199301-45-0079]

Conventional technology for the production of hot rolled coils is based on continuous casting of thick slabs, which are then reheated before rolling. Conventional process has obvious limitations: high energy consumption, in part associated with slab reheating; high labour costs; large areas for the facilities; and great investment costs. These considerations led Danieli to develop a new process for the continuous casting of thin slabs, whose thickness allows direct rolling in one finishing stand, with complete elimination of the roughing mill. (Gottardi, R.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 360-369 [in English].)

0023 COKELESS CUPOLA TO CHANNEL FURNACE DUPLEXING: A MELT PLANT FOR THE FUTURE. [BIB-199301-51-0047]

A melting process is introduced, based on traditional shaft furnace and induction furnace technology. In the shaft furnace, natural gas is used for melting energy, and in the induction furnace, electric energy provides superheat. After eight years of successful practice in the foundry at Laufach, the melting method is ready for the market. This melting process is especially appropriate for the production of ductile iron. Compared to other processes, it offers low cost, minimum energy consumption and is easily controlled environmentally because SO_2, CO_2 carbon monoxide and dust are minimized. The operation is flexible and adaptable to varying Fe demands meeting high quality standards. Most important to this technology is the regulation system for the gas burners using a computer-operated control system and monitoring and optimizing slag chemistry by responsive calculation of the slag charge components. The combination of the natural gas-fired cokeless cupola and a superheater provides a time proven melting system using clean energy sources and requiring a minimum cost effluent control system—a most attractive and cost-effective option for future Fe melting. Graphs. (Graf, R.; NINETY-FIFTH ANNUAL MEETING AMERICAN FOUNDRYMEN'S SOCIETY, BIRMINGHAM, ALABAMA, USA, 5-9 MAY 1991, Publisher: AMERICAN FOUNDRYMEN'S SOCIETY, INC., Des Plaines, Illinois 60016-8399, USA, (1991), (Met. A., 9301-72-0001), pp. 691-695 [in English].)

0024 CONTINUOUS CASTING PROCESS AND DESIGN ENGINEERING FOR REALISTIC ENERGY EFFICIENCY BY HOT LINKING. [BIB-199301-51-0128]

As a processing step in the overall steelmaking route, continuous casting uses relatively little energy but is the handling agent for the release from the product of an enormous quantity of previously imparted energy. The effectiveness of this energy handling significantly affects the efficiency of the overall steelmaking process. There are a number of technologies which can be engineered into the continuous casting machine and process to improve the overall energy efficiency by enabling hot linking of the product from the caster to the mill. Such technologies are described, including "cast" hot technology and various means of effecting the actual hot linking. It is important, though, that hot linking objectives are realistic when considered together with other business objectives. The paramount objective is to produce quality product. Measures to achieve this are discussed, including basic quality measures which can be designed into the continuous casting machine and computer evaluation to give assurance of the product quality fed directly to the mill. Graphs. 2 ref. (Reynolds, T.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 388-404 [in English].)

0025 ELECTRICITY CONSUMPTION IN IRON FOUNDRY ELECTRIC FURNACES USED FOR HOLDING (INCLUDING AUTOPOUR). [BIB-199301-51-0153]

In January 1990, ETSU conducted a postal survey of the industry requesting information on electrical energy use and other factors relating to furnaces used primarily for holding. A summary of the conclusions from the survey is given, and the factors that determine energy efficient operation are indicated. It is clear that holding metal in furnaces must be carefully watched to avoid high specific energy consumptions. There are a number of factors which are important: Large furnaces have higher annual energy consumptions and, for a given throughput, have a higher specific energy consumption than smaller furnaces. Channel holding furnaces can give better specific energy consumptions if throughput is improved or if the furnace is made to operate more efficiently. The holding of relatively small throughputs should be closely examined to see if an alternative, more efficient production route can be found. Graphs. 3 ref. (Titchell, I.; FOUNDRYMAN, (JUNE 1992), 85, (5), pp. 176-177, 179-180 [in English]. ISSN 0007-0718)

0026 ENERGY CONSUMPTION IN IRON FOUNDRY CORELESS INDUCTION FURNACES. [BIB-199301-51-0178]

The melting performance and energy consumption of coreless electric furnaces are influenced by a number of design and operational factors. Some of the latter factors are highlighted. Nevertheless, furnace utilisation is a most important factor and this depends upon the operational practices in individual foundries. Coreless furnaces should be operated at full power for the maximum possible times to ensure maximum output and minimum energy usage. The cold start characteristics of medium frequency furnaces are a distinct advantage since heel practice can be eliminated in the majority of cases and holding periods kept to a minimum. The adherence of supervision and staff to laid down operating procedures cannot be overemphasised, and it is important that all operatives receive adequate instruction so that factors affecting energy consumption are fully appreciated. Graphs. 2 ref. (Powell, J.; FOUNDRYMAN, (JUNE 1992), 85, (5), pp. 187-189 [in English]. ISSN 0007-0718)

0027 DETERMINATION OF PRODUCT TEMPERATURE ON DRAWING OF COPPER AND BRASS. [BIB-199301-52-0010]

The energy expended on plastic deformation of metal and partly converted to heat influences both the deformation process and the product. The empirical formulae determining the temperature on drawing of Cu and of brass give the values 360 x V^{0}.08 and 366.9 x V^{0}.105, respectively, where V is the drawing rate. Graphs. 3 ref. (Taslakov, Z.; Kutchukov, J.; GODISHNIK NA VISSHIYA KHIMIKOTEKHNOLOGIYA INSTITUT SOFIYA, (1990), 30, (3), pp. 77-79 [in Bulgarian]. ISSN 0489-6211)

0028 INDUCTIVE FORGE HEATING WITH PROCESSOR CONTROL. (INDUKTIVE SCHMIEDEERWARMUNG MIT PROZESSORSTEUERUNG.) [BIB-199301-52-0031]

In a joint project with the system manufacturers, opportunities to incorporate the automatic microprocessor supported program functions, and thus achieve an optimization of energy costs, have been examined. As operation with reduced throughout is associated with reduced power consumption, the opportunity of advantageous incorporation of the inductive forging block heaters in a power limitation system results. The examples show that with the use of the modern process controllers interacting with the power limitation system for the workshop as a whole, considerable potential cost reductions can be exploited. Graphs. 3 ref. (Sonnenschein, P.; ELEKTROWARME INTERNATIONAL B, INDUSTRIELLE ELEKTROWARME, (AUG. 1992), 50, (B2), pp. B155-B159 [in German]. ISSN 0340-3521)

0029 INDUCTION HEATING OF PLATE EDGES. [BIB-199301-52-0175]

At the end of 1989 the hot strip mill at Sollac Fos was fitted with a system for induction heating of the edges of the strip going through. Owing to heat loss by radiation, these edges form a "cold" region which would have a bad effect on product quality. The heating system, built by Rotelec, runs at 1.5 MW and corrects the "cold" region as the strip passes through. The system and the industrial results are presented in terms of efficiency, temperature profile and energy savings. Graphs. (Dantin, —.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 370-386 [in English].)

0030 ECONOMICAL PRODUCTION OF HOT STRIP WITH THE COMPACT STRIP PRODUCTION (CSP) PROCESS. [BIB-199301-52-0176]

The 3.5 years of trials with the casting technology on the pilot plant and the subsequent two years of production at NUCOR Steel have set the CSP process on a sound and healthy footing. CSP is not only an alternative but the more economical alternative for production of hot strip and is becoming accepted as a production line for a wide range of today's hot strip production. Graphs. (Kolakowski, M.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 406-424 [in English].)

0031 DEVICE AND PRODUCT OF MSB-650 6 HIGH COLD ROLLING MILL. [BIB-199301-52-0226]

Design parameters, components and characteristics of MSB-650 six-high cold rolling mill are introduced. Size of roller system is diameter 165/190/500 x L 650 mm. Strip steel shape is controlled by shifting of intermediate roller and bending of intermediate and work rollers. Good shape high precision of size, heavy reduction, reduction of pass number, high yield and good energy saving are proved by production data of the mill. Strip thickness and width is 0.2-3 x 300-520 mm. Rolling carbon steels is shown. Graphs. 6 ref. (Du, M.; Han, X.; Zhang, S.; IRON AND STEEL (CHINA), (APR. 1992), 27, (4), pp. 41-45 [in Chinese]. ISSN 0449-749X)

0032 THE BORONIZATION OF PRECISION FORGING DIE OF 5CrMnMo STEEL IN THE SUPERPLASTIC FORMATION. [BIB-199301-56-0099]

The direct boronization of 5CrMnMo bevel gear precision forging die during superplastic formation of subcritical temperature range is described. Also, the effect of direct quenching at 810 °C and tempering at 500 °C after superplastic formation on the structures and properties of 5Cr—MnMo steel is discussed. Photomicrographs. 9 ref. (Li, Y.; Zhang, Y.; Wang, S.; Zhang, J.; TRANSACTIONS OF METAL HEAT TREATMENT (CHINA), (1992), 13, (1), pp. 28-34 [in Chinese]. ISSN 0254-587X)

0033 REDUCTION HEATING TECHNOLOGY OF STEEL SHEETS BY DIRECT FIRE. [BIB-199301-56-0106]

NKK has adopted reduction type direct-fired furnace for continuous annealing process of steel sheets including CGL (continuous galvanizing line). A direct-fired furnace method has many advantages such as better tracking of steel sheets, minimizing-heat inertia of the furnace and compact equipment. NKK has further advanced improvement and development concerning this direct fired heating technology, thus establishing direct fired heating equipment which has high level reduction heating performance. Major technological characteristics are as follows: nozzle-mixing type direct reduction heating burner provided with powerful reduction performance and energy-saving system; two-pass direct-fired furnace and its optimum combustion control technology corresponding to large type equipment and high speed; and automatic control system of high accuracy steel sheets temperature. NKK has applied the direct-fired method to No. 3 CGL in Keihin Works, No. 3 CAL (continuous annealing line) and No. 2 CGL in Fukuyama works, thereby resulting in an effective manufacturing of high quality steel sheets, stable and high speed travel operation, energy saving, etc. NKK has also scheduled application to three lines being newly provided. Graphs. 8 ref. (Kurihara, M.; Honda, A.; Uchino, S.; Shoji, M.; DEVELOPMENTS IN THE ANNEALING OF SHEET STEELS, CINCINNATI, OHIO, USA, 22-24 OCT. 1991, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1992), (Met. A., 9301-72-0037), pp. 117-132 [in English].)

0034 THE DEVELOPMENT OF THE NEW NON-CYANIDE LIQUID CARBURIZING AGENT. [BIB-199301-56-0124]

The new non-cyanide carburizing agent was analyzed for composition, technology, property and microstructures. By production tests for parts of bicycles, sewing machines, chains and 20 and 20CrMnTiA steels, the results showed that it has many advantages such as non-cyanide, high efficiency, energy saving, less slag, pollutionless and low cost. It can be substituted for the cyanide salt, yellow prussiate of potash and 603 carburizing agent. The economic benefit is very remarkable. Graphs, Photomicrographs. 2 ref. (Long, C.; Yao, Z.; Tong, J.; Li, X.; Yao, D.; Jiang, Z.; HEAT TREATMENT OF METALS (CHINA), (NOV. 1991), (11), pp. 24-28 [in Chinese]. ISSN 0254-6051)

0035 THE ALUMINIUM COILED STRIP ANNEALING FURNACE WITH LOAD-CARRYING CAPACITY OF 40 TONS. [BIB-199301-56-0130]

An annealing furnace for Al coiled strip was developed in the application for 2800 mm hot rolling mill of an Al work. The furnace lining was made of a light fiber glass composite material. The thermal capacity of the furnace lining is small; fast heating and cooling can easily be accomplished and energy consumption is reduced. Three high temperature fanners and uniformly distributed wind tunnels were used to constitute the forced cycling system of furnace gas. The

uniform distribution of temperature in coiled strips with different dimensions can be ensured by running the cycling system of gas. According to the standard of Westinghouse, US, high temperature gears with self-lubricity were made of T4 high graphite alloy. The gears were used to run wheels of the furnace carriage. All stages of treatment including entry of coiled strips, cycling of gas, start of heating, isothermal annealing, cooling and exit of coiled strips, etc. were programmably controlled by a computer. The annealing furnace decreases the cost of products, consumption of energy and occupied area. Numeric Data. (Lu, S.; Li, D.; HEAT TREATMENT OF METALS (CHINA), (NOV. 1991), (11), pp. 50-53 [in Chinese]. ISSN 0254-6051)

0036 RJT-240-8 TYPE HYDRAULIC FURNACE FOR ANNEALING. [BIB-199301-56-0131]

An annealing furnace was developed for nodular annealing of forging stocks made of GCr15 bearing steel. The main annealing processes of the forging stocks include heating to 740 °C , 0.5 h; 810 °C ,1.5 h; 800 °C ,1 h and 700 °C 3 h; cooling down to 650 °C and output. All of the processes can be completed in the new annealing furnace which consists of six regions with different temperatures. Forging stocks to be treated are put in tanks which are set on 23 pieces of movable base plates. A hydraulic pusher can slowly move the base plates on tracks at the bottom of the furnace chamber. The stock tanks successively pass through the six regions. Therefore, steel stocks are in different temperature regions to complete a designed heat treatment. The total load capacity of steel stocks is 7.475 tons. The regions No. 4 and No. 6 are two cooling regions without heaters. The cooling rate can be controlled by cool wind from fans. The annealing furnace produces qualified forging bearing stocks with a constant hardness 179-207HB and uniform and fine microstructure. The annealing furnace reduces the cost of products and 49.4% consumption of energy. Graphs. (Tai, W.; HEAT TREATMENT OF METALS (CHINA), (NOV. 1991), (11), pp. 53-55 [in Chinese]. ISSN 0254-6051)

0037 THEORY OF DYNAMIC OPTIMIZATION FOR MATERIALS HEATING PROCESS—CRITERION RESTRAINING METHOD. [BIB-199301-56-0133]

A criterion restraining method adopted to the dynamic optimization for materials heating process has been developed, regarding it as controlled object of a regulator in control theory and combining the optimal criterion of it. The method may be available to optimize fuel supply along furnace length and to provide a theoretical basis for the optimization of fuel supply in time-varying. For soaking pit applied to heating steel ingots, the calculation shows that in the case of optimization by criterion restraining method, the thermal efficiency is 3.1% higher than the modelling prediction result. In comparison with heat flux-decomposing method, the thermal efficiency increased from 43.1 to 43.8%, and the energy consumption was reduced by 7.28% relative to the practical production data. Graphs. 7 ref. (Li, Z.; Lu, Z.; ACTA METALLURGICA SINICA (CHINA), (18 APR. 1992), 28, (4), pp. B141-B144 [in Chinese]. ISSN 0412-1961)

0038 INTEGRATED COMPUTER CONTROL OF INDUCTION HARDENING. [BIB-199301-56-0146]

Induction hardening demands a high level of quality assurance and quality control. This is an integrated control system based primarily on a system which provides computer control of all the factors involved in heating and cooling in induction hardening: this system fully automates the entire range of processes from preparatory processes, induction hardening post-stage processes, testing and inspection, to transfer of the products. Also, by monitoring data on all heat-treated products, this system carries out and provides quality assurance for all such heat-treated products. The process which combines both induction hardening and induction tempering is also included in this system. Induction hardening using this kind of integrated computer control system is an excellent system for quality assurance. It also provides energy-savings, and implements a high-quality, precision heat treatment system. How this system operates is reported with an example of induction hardening of automotive parts. 4 ref. (Kanetake, N.; ASM HEAT TREATMENT AND SURFACE ENGINEERING. II, AMSTERDAM, NETHERLANDS, 22-24 MAY 1991, MATERIALS SCIENCE FORUM, (1992), 102-104, (2), pp. 799-807 [in English]. ISSN 0255-5476)

0039 HIGH PERFORMANCE HYDROGEN BELL TYPE FURNACE. [BIB-199301-56-0176]

High performance hydrogen (HPH) bell type furnace technique is introduced. 100% H_2 as protective atmosphere is used in annealing process and sealing system. Recirculation system, cooling system, safety and control systems are also improved in the furnace design. The productivity of HPH bell type furnace in which cast iron and Ni—Cr steels are used has been increased by 40-60%. This technique also saves energy and reduced cost. The surface quality and uniformity of mechanical properties of the annealed steel (e.g. St14 and St15) have been greatly improved. Graphs. 4 ref. (Xu, P.; IRON AND STEEL (CHINA), (JUNE 1992), 27, (6), pp. 53-57 [in Chinese]. ISSN 0449-749X)

0040 USING ENERGY EFFICIENT COMBUSTION SYSTEMS IN THE CONTINUOUS HEAT TREATMENT OF STAINLESS STEEL STRIP. [BIB-199301-56-0177]

Some of the issues considered in making a choice of energy source, technology to be used, design and realization and results achieved in the stainless steel works of UGINE are discussed. An overview of regenerative burner systems is also included. The investment decision was made in October 1990. Development of specifications and consultation took four months and an order was placed on 28 January 1991. Installation, previewed during the four weeks Works shutdown, conformed to the scenario imagined and planned. The plant had been in operation three months when the evaluation presented was made. The performance requirements of the installation have been largely attained in terms of temperatures, process control and environmental impact. (Roeck, M.C.; de Vyvere, —.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 432-450 [in English].)

0041 IMPROVING THE PERFORMANCE OF REHEATING FURNACES WITHIN ROTHERHAM ENGINEERING STEELS. [BIB-199301-56-0178]

An explanation of the operations of Rotherham Engineering Steels is given and the reheating plant is briefly described. The manner in which improvement schemes are considered is reviewed before the attempts that have been made to improve the performance of the reheating operation are described. Finally, personal views and recommendations regarding the way forward for improving reheating furnace performance are made. Graphs. (Kirk, J.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 462-478 [in English].)

0042 THE ENERGY COSTS OF ENVIRONMENTAL MEASURES AT A STRIP FINISHING MILL. [BIB-199301-57-0072]

Emission control from curing ovens of paint coating lines is used as an example to illustrate the relationship between environmental control systems on strip finishing lines and energy costs. Four generations of finishing lines are described and progressive improvements leading to reduction of emissions (i.e. solvent fumes) and energy costs are highlighted. Particular attention is paid to recuperative and incineration systems designed to optimize heat recovery from fume incineration. (Grant, A.; IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, Publisher: ETSU, Harwell Laboratory, Didcot, Oxfordshire OX11 0RA, UK, (1992), (Met. A., 9301-72-0030), pp. 236-250 [in English].)

0043 STUDIES OF IRON-SUPPORTED NI—CO—W ACTIVATE CATHODE. [BIB-199301-58-0087]

Ni—Co—W alloy cathode with low hydrogen overpotential was prepared by plating on mild steels. When used as a cathode in electrolysis in aqueous solution of 12% NaOH at 25 °C , the H evolution overpotential was approx 200 mV at cathodic current density of 250 mA/cm^2. The exchange current density was approx $8.6 \times 10^{-1} mA/cm^2$. The cathode was found to be superior to Fe electrodes and Fe-supported Ni—W electrodes. Nickel was the chief component of the Ni—Co—W cathode. The Ni and cobalt in Ni—Co—W alloy were in

metallic state. Tungsten was present in both metallic W and blue W. This electrode was tested as a cathode in 12% NaOH solution at 25 °C with 1 A/cm^2 current density applied for seven days, and no change of the appearance of the electrode surface was found. As compared with the Fe-supported Ni—W cathode, the active layer of the Ni—Co—W was more firmly adhered to the Fe base and the new electrode was expected to have long service life. Graphs, Photomicrographs. 2 ref. (Shu, D.; Zhang, S.; Hu, J.; Hao, G.; Gong, Q.; HUAGONG YEJIN (ENGINEERING CHEMISTRY AND METALLURGY), (MAY 1992), 13, (2), pp. 118-125 [in Chinese].)

0044 HEAT EXCHANGERS FOR AIR CONDITIONING SYSTEMS AND ALUMINUM. [BIB-199301-61-0107]

General aspects of plate fin heat exchangers along with recent research on increasing their efficiency and interdependence of Al and heat exchangers are reviewed. There are two types of plate fin and wind fin heat exchangers. An illustration of plate fin is shown in which the freon gas flows within pipes while exchanging heat with surrounding air. The fin's surface thermal conductivity is calculated for extremely thin wall pipes. Recently to increase efficiency, numerous cuts are being introduced on the fin surface. Comparison of new and old type heat exchangers indicates 20% less resistance and a decrease of 55% in volume. Such new technological trends in fin design are illustrated, with performance characteristics. Graphs. 5 ref. (Nakata, H.; JOURNAL OF JAPAN INSTITUTE OF LIGHT METALS, (JUNE 1992), 42, (6), pp. 354-357 [in Japanese]. ISSN 0451-5994)

0045 THE VIBRATION AGING AND ITS APPLICATION. [BIB-199302-14-0023]

Vibration aging (or stress relieving) is a process to relieve or redistribute the residue stress through vibration resonance caused by a vibration activator which supplies the proper vibration force and frequency. At the same time, due to the Bauschinger effect, the periodic force will stabilize the microplastic deformation and improve the dimension stability of the workpeice. The setup for this process, the parameters to determine the vibration force (e.g. for cast iron or steels) and frequency, and the method of inspection are described. The data of five machine parts (shafts, beams, etc.) treated by vibration aging are presented. For the same workpiece, the vibration aging method saves time (1 h as compared with 40 h by thermal aging including handling time) and energy (for every ton of workpieces, energy equivalent to 0.255 tons of coal is saved). (Chen, J.; HEAT TREATMENT OF METALS (CHINA), (APR. 1992), (4), pp. 50-51 [in Chinese]. ISSN 0254-6051)

0046 USE OF OXYGEN IN REVERBERATORY FURNACE AND TENIENTE CONVERTER AT LAS VENTANAS SMELTER. [BIB-199302-42-0123]

In September 1990, Las Ventanas smelter began the intensive use of O, to increase its concentrates smelting (Cu) nominal capacity from 325 000 to 480 000 t/year. This project also included a new 88 000 Nm^3/h sulfuric acid plant, to improve environmental conditions. The new oxygen plant has a nominal capacity of 315 t/day. The reverberatory furnace operation with oxy-fuel burners and original frontal burners, has permitted an important decrease in fuel oil consumption. The industrial O consumption varies between 180-200 t/day. On the other hand, the use of O at the Teniente converter has increased its concentrate smelting nominal capacity from 45 000 to 200 000 t/year. This increase has been attained with O enrichment level between 28-32% in blowing air, which means industrial O consumption between 100-120 t/day. (Olguin, J.; Medina, S.; Cuadro, H.; Bassa, R.; SAVARD/LEE INTERNATIONAL SYMPOSIUM ON BATH SMELTING, MONTREAL, QUEBEC, CANADA, 18-22 OCT. 1992, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1992), (Met. A., 9302-72-0067), pp. 203-213 [in English].)

0047 REACTION RATES AND RATE LIMITING FACTORS IN IRON BATH SMELTING. [BIB-199302-42-0125]

In several versions of the Fe bath smelting processes ore, coal and oxygen are added, or injected, into an Fe and slag bath. The reduction reactions occur by primarily two mechanisms: the reaction of Fe—C drops and of coal char with FeO dissolved in the slag. The fundamentals of these reactions are reviewed and a simple reduction reaction model for the process is presented. Another limiting phenomenon in the process is slag foaming. The fundamentals of slag foaming and predictions of slag foaming in the actual process are presented. A reduction model using laboratory data is capable of predicting the total production rate reasonably well. The reduction is about equally divided between that by the Fe—C drops and that by the char in the slag. The limiting production rate considering reduction and slag foaming for a hypothetical reactor is also discussed. Work to date indicates that the processes are able to produce Fe using as much, or less, coal than required for coke for a blast furnace and the smelting intensity tonnes/m^3 day could be three times. Graphs. 14 ref. (Fruehan, R.J.; SAVARD/LEE INTERNATIONAL SYMPOSIUM ON BATH SMELTING, MONTREAL, QUEBEC, CANADA, 18-22 OCT. 1992, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1992), (Met. A., 9302-72-0067), pp. 233-248 [in English].)

0048 OPERATIONAL RESULTS OF 100 TON/DAY TEST PLANT FOR SMELTING REDUCTION OF IRON ORE IN NKK. [BIB-199302-42-0135]

The core of the research program in NKK is to develop the process technology that would achieve a high post combustion degree (50-55%) coupled with high heat transfer efficiency of 85% in the smelting reduction furnace (SRF). Such a highly heat efficient SRF makes the pre-reduction unit compact (pre-reduction degree of 30%) and reduces the export energy to the level equivalent to the blast furnace process. Test operations of the 100 ton/day plant, which consists of SRF, bubbling bed type pre-reduction furnace (PRF), tapping equipment and SRF dust recycling system have been carried out in NKK Fukuyama Works. The results obtained with —8 mm sinter feed ore and high volatile matter coal of maximum 37% volatility are summarized. Graphs. 12 ref. (Kitagawa, T.; Kimura, N.; Hasegawa, T.; Takahashi, K.; Ariyama, T.; SAVARD/LEE INTERNATIONAL SYMPOSIUM ON BATH SMELTING, MONTREAL, QUEBEC, CANADA, 18-22 OCT. 1992, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1992), (Met. A., 9302-72-0067), pp. 611-612 [in English].)

0049 SO_2 ABATEMENT, ENERGY CONSERVATION, AND PRODUCTIVITY AT COPPER CLIFF. [BIB-199302-42-0159]

Inco pioneered the use of tonnage O in nonferrous metallurgy when it commissioned the first industrial O flash smelting process for the treatment of Cu concentrates in the early 1950s. This was followed by other applications of O such as the enrichment of reverberatory furnace and Pierce—Smith converter blasts; oxy-fuel smelting in reverb furnaces; and, very recently, flash conversion of chalcocite to Cu. Inco is currently implementing a sulfur dioxide abatement project designed to reduce SO_2 emissions from the smelter 60% (265 kt) in 1994. At that time, O consumption at the smelter will reach approx 1.7 t O_2/t Cu + Ni. Oxygen smelting and converting technology will lead to a substantial decrease in the use of fossil fuels and to the generation of high-strength SO_2 off-gases suitable for cost-effective fixation in a new acid plant. Graphs. 19 ref. (Landolt, C.A.; Dutton, A.; Edwards, J.D.; McDonald, R.N.; JOM, (SEPT. 1992), 44, (9), pp. 50-55 [in English]. ISSN 0148-6608)

0050 ACHIEVEMENT OF HIGH PRODUCTIVITY AT A SEMI-STRAND COOLING TYPE SINTER PLANT. [BIB-199302-42-0174]

A semi-strand cooling method and a high temperature boiler exhaust gas circulation method were employed at the Wakayama No. 4 sintering plant, Sumitomo Metal Industries in 1985. Since then, the productivity has increased and the medium pressure steam recovery has been achieved. However, the productivity of the Wakayama No. 4 sinter plant was primarily affected by the cooling speed of the sinter cake, so the following countermeasures were taken: the reduction of melting index of the sinter feed, the operation with high basicity and the usage of coarse limestone. Through these improvements, Wakayama No. 4 sintering plant has been in stable operation with high productivity (approx 37 t/m^2/day). Graphs. 10 ref. (Kitamura, K.; Miyake, T.; Yanagisawa, K.; Ono, K.; Shouho, T.; TETSU-TO-HAGANE (JOURNAL OF THE IRON AND STEEL INSTITUTE OF JAPAN), (JULY 1992), 78, (7), pp. 1037-1044 [in Japanese]. ISSN 0021-1575)

0051 ENERGY ANALYSIS AND ECONOMIC EVALUATION FOR SMELTING REDUCTION PROCESS OF IRONMAKING. [BIB-199302-42-0184]

Three kinds of processes for smelting reduction ironmaking, fluidized bed + molten Fe bath, shaft furnace + molten Fe bath, and fluidized bed + shaft furnace, with coal and oxygen injection, are simulated. Quantitative influences of raw materials and operating parameters on unit consumption of each process are evaluated. On a scale of 300 000 tons/year, these three processes are compared with each other in light of energy analysis, cost accounting and unit investment estimation. In addition, the comprehensive evaluation and comparison with conventional blast furnace are made from the viewpoints of energy consumption, cost, investment, environmental protection, etc. 8 ref. (Xie, Y.; Wang, D.; Shang, Y.; Ai, J.; Yang, G.; Zhang, H.; HUAGONG YEJIN (ENGINEERING CHEMISTRY AND METALLURGY), (AUG. 1992), 13, (3), pp. 189-196 [in Chinese].)

0052 OPTIMISING ELECTRICAL CONDITIONS OF UHP ORE SMELTING FURNACES. [BIB-199302-42-0199]

Charge conductivity currents have a marked influence on conditions and performance of the melting of ferroalloys but they are significant only at elevated temperatures. Previous confirmation of the absence in furnaces of significant currents parallel to the arc is not justified either experimentally or theoretically. The relationship between the powers in the arc, melt and solid charge is an important characteristic of the process. It depends not only on the composition of the alloy but also on the quality of the raw material and on a number of other factors including the capacity of the ore smelting furnace. Consequently, the selection and control of the electrical conditions of ultra-high power ore smelting furnaces solely as regards the relationship between the powers in the arc and the melt determined for a well-operating furnace is incorrect. 12 ref. (Tolstoguzov, N.V.; STAL', (APR. 1992), (4), pp. 34-37 [in Russian]. ISSN 0038-920X)

0053 RECOVERY OF MOLYBDENUM FROM FLOTATION TAILINGS. [BIB-199302-43-0045]

Molybdenum can be recovered from flotation tailings by various processes including sodium hypochlorite, chlorine-alkali, and electro-oxidation processes. From the comparative assessments of their technical conditions and cost-effectiveness, it is concluded that NaClO is one of the preferable leaching agents for molybdenite and it is necessary to reduce its production cost, and that chlorine-alkali and electro-oxidation processes, the modified version of sodium hypochloride process, are more preferable in terms of cost-effectiveness. Graphs. 4 ref. (Yu, Q.H.; Chen, T.Z.; MINING AND METALLURGICAL ENGINEERING (CHINA), (JUNE 1992), 12, (2), pp. 47-50 [in Chinese]. ISSN 0253-6099)

0054 ENERGY UTILISATION IN AN EAF. [BIB-199302-45-0109]

The Stocksbridge melting shops feature two EAFs with tap weights of 95 and 145 t. They are complemented by secondary steelmaking units. A tank degassing unit serves for the degassing of all steels and, acting as a VOD unit, for the production of stainless steels, Modifications to the hydraulics of the EAF, changes in scrap density and the substitution of refractories of furnace sidewalls and roofs with water-cooled panels led to a decrease in energy consumption. Transformer uprating, oxy-fuel burners and carbon injection are further measures beneficial to energy utilization which are described. Graphs. (Garbutt, F.R.; SEMINAR ON IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, METALLURGICAL PLANT AND TECHNOLOGY INTERNATIONAL, (AUG. 1992), 15, (4), pp. 52-54, 56, 58, 60 [in English]. ISSN 0935-7254)

0055 REDUCING ENERGY COSTS IN ELECTRIC STEELMAKING PLANTS WITH A LOAD CONTROL SYSTEM. [BIB-199302-45-0110]

The agreements on the basis of which utility companies provide large industrial customers with their electrical power requirements take into account not only the actual level of power consumption but also the maximum load input within a charge period. In electric steelmaking plants, the load is determined largely by just a few major consumers in the form of the electric arc furnaces and ladle furnaces. The load control process described has been specifically tailored to the situation which prevails in electric steelmaking plant on the basis of user know-how. Graphs. (Bock, M.; Hohendahl, K.; Puchinger, B.; METALLURGICAL PLANT AND TECHNOLOGY INTERNATIONAL, (AUG. 1992), 15, (4), pp. 62-64, 66, 68 [in English]. ISSN 0935-7254)

0056 DEVELOPMENT OF SHAFT FURNACE. [BIB-199302-45-0124]

To produce economically quality steels, the Danish Steel works was led to study and build an electric "shaft" furnace. In this process, scraps are charged by means of the shaft. Hot gases are extracted from the furnace through the shaft and preheat the scrap. The results are energy savings and reduction of the melting time and of electrode consumption. Graphs. (Overgaard, J.; Erichsen, K.; REV. METALL., CAH. INF. TECH., (JUNE 1992), 89, (6), pp. 533-537 [in English]. ISSN 0035-1563)

0057 IMPROVEMENT OF SECONDARY CONDUCTOR IN ELECTRIC ARC FURNACE. [BIB-199302-45-0137]

The productivity of a 50 t electric arc furnace has been increased through improving its secondary conductors. To decrease resistance, the oxygen-free rolled Cu was used to replace cast Cu for conductors above the furnace, Cu to replace Al for terminal heads, the size of electrodes increased from 18 to 20 in., and the length of water cooling cables shortened. The vertical electrodes and improved H-type layout of conductors were used to reduced reactance. Test results indicate that, compared to conventional electric arc furnaces, the impedance of the renovated furnace decreases by approx 22%, input power increases by approx 6.5%, and tap-to-tap reduces by nearly 3 min. Graphs. (Abe, T.; TETSU-TO-HAGANE (JOURNAL OF THE IRON AND STEEL INSTITUTE OF JAPAN), (MAY 1992), 78, (5), pp. T85-T88 [in Japanese]. ISSN 0021-1575)

0058 ANALYSES OF PYROLYTIC GAS AND STEAM FLOW DURING CARBONIZATION. [BIB-199302-45-0140]

The outflow rates of pyrolytic gas are measured in a small-sized coke oven which is heated from only one side. The pyrolytic gas flows out only from the heated side until the heated wall temperature reaches 1000 K, the flow-out direction of the pyrolytic gas then switches over, and most of the pyrolytic gas flows out from the insulated side. A one-dimensional mathematical model is developed to estimate the pyrolytic gas behavior including the conservation equations of mass and energy and the releasing rates of pyrolytic gases. The flow patterns of pyrolytic gas from the heated and the insulated sides and the temperature distribution in the coke oven are well estimated compared with the experimental ones. The total coking period is estimated, being longer than the case without the gas flow since the pyrolytic gas flow having a lower temperature decreases the heat transfer rate at the heated side. Furthermore, in case of wet coals containing 10% moisture, the coking time is lengthened by approx 3% compared with that of dry coal because the heat is consumed as the latent heat of evaporation on the higher temperature side in the boiling zone. Graphs. 15 ref. (Nogami, H.; Nakashima, H.; Miura, T.; TETSU-TO-HAGANE (JOURNAL OF THE IRON AND STEEL INSTITUTE OF JAPAN), (JULY 1992), 78, (7), pp. 1085-1092 [in Japanese]. ISSN 0021-1575)

0059 INTRODUCTION OF TECH INNOVATION OF TILTING MECHANISM FOR SMALL CONVERTER. [BIB-199302-45-0174]

In a small converter, the tilting mechanism possesses the following two advantages: simple structure and low construction cost, and simple disassembling procedures. However, there also exist two disadvantages: fractured gears, and short bearing lifetime. The main cause is associated with the deformation of the shaft-bearing assembly, which in turn is due to the severe environment and over-loading. To avoid excess on certain teeth of gears, the gearing system was redesigned. To increase the bearing lifetime, the shaft-bearing system was redesigned. (Cai, C.Y.; Fang, K.F.; METALLURGICAL EQUIPMENT (CHINA), (JUNE 1991), (3), pp. 31-33 [in Chinese]. ISSN 1001-1269)

0060 INJECTION INTO THE ELECTRIC ARC FURNACE—THE K-ES PROCESS. [BIB-199302-45-0201]

Steel production on scrap basis in the electric arc furnace has a steadily increasing share. Today nearly 30% of the total world raw steel production is manufactured in the electric arc furnace. Of course, also in this process, the technologies initiated by Mr. Savard and Mr. Lee have a field of application. The electric arc furnace was shown, especially during the last 20 years, to be a very efficient tool in scrap melting. Additionally, melting of direct reduced iron is actually realized by 100% in the EAF. During the two last decades very important progress was obtained in productivity of the EAF. It was the result of a constant improved combination of electric design and electrical furnace operation with metallurgical operation practice. The power of the transformers was constantly increased as soon as an improved operation with foamed slag allowed an increase in secondary voltages and power factor. Graphs. (Ballandino, W.; Hauck, F.G.; Klintworth, K.; SAVARD/LEE INTERNATIONAL SYMPOSIUM ON BATH SMELTING, MONTREAL, QUEBEC, CANADA, 18-22 OCT. 1992, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1992), (Met. A., 9302-72-0067), pp. 565-576 [in English].)

0061 A SURVEY OF DEVELOPMENT IN DIRECT MELTING REDUCTION PROCESSES FOR IRONMAKING INDUSTRY. [BIB-199302-45-0225]

The new ironmaking process of the direct melting reduction technique is discussed. The new technique employs Fe ore powder as the Fe resource and raw coal as the major fuel and reducer. The main trend of the ironmaking industry in the world is to develop a new direct melting reduction process instead of the old blast furnace which results in very high consumed energy and serious atmosphere pollution. Several successful processes are introduced in detail: KR-COREX process from Germany and South Africa has been operated in a plant producing Fe 300 kT/year; CRA-Hismelt (high indensity direct smelting) process from USA and Australia results in lower consumed energy and higher quality Fe; RHF (rotary hearth furnace) process from USA and Canada can combine with submerged arc furnace to supply cheaper products of Fe (130-160/T); SL/RN process from USA and Canada was developed in 1960s and any kind of Fe ore can be used in this process. Up to now 5.5 million tons of Fe products were made by the SL/RN process. 23 ref. (Qiu, Y.-F.; Zheng, J.R.; Liu, S.X.; Yang, M.G.; Chen, J.L.; TECHNOLOGY AND TRAINING (TAIWAN), (APR. 1992), 17, (2), pp. 28-43 [in Chinese].)

0062 INTRODUCTION OF THE MELTING PROCESS OF STAINLESS STEEL USING BESSEMER CONVERTERS. [BIB-199302-45-0226]

The melting process of stainless steel using Bessemer converters is discussed. Several successfull melting processes, such as the Ar—O decarburization (AOD) process from Union Carbide, USA, the vacuum oxygen decarburization from Witten, Germany, the RH oxygen blowing process from Japan, CLU process from France and Switzerland and LD converters plus AOD process are discussed and compared. The metallurgical thermodynamics of the melting process of stainless steel is expounded. Some metallurgical reactors of the melting process, such as decarburization, dephosphorization, and desulphurization, etc. are analyzed. A special hot compensation technique including additions of coke and enhancement of post combustion for using LD converters is introduced in detail. The technique can save a great deal of energy for melting stainless steel. Graphs. 11 ref. (Zhang, Y.; Chen, D.; TECHNOLOGY AND TRAINING (TAIWAN), (APR. 1992), 17, (2), pp. 86-96 [in Chinese].)

0063 SCRAP MELTING PROCESS—CURRENT STATUS AND FUTURE PROSPECT. [BIB-199302-45-0229]

A review contains the varieties of scrap melting processes and their technical trend, including preheating technology for scrap, secondary combustion processes, and melting techniques with fuel supply; scrap melting processes in converters and their problems; the resources and environmental problems from scrap melting and its developments in the future. Scrap melting processes in converters were developed on the basis of existing technology such as oxygen blowing, top and bottom blowing, injection and refractories, but some problems remain to be resolved. Graphs. 37 ref. (Umezawa, K.; TETSU-TO-HAGANE (JOURNAL OF THE IRON AND STEEL INSTITUTE OF JAPAN), (APR. 1992), 78, (4), pp. 520-526 [in Japanese]. ISSN 0021-1575)

0064 MIXED CHARGING OF ORE WITH COKE AT 300 M^3 BLAST FURNACE. [BIB-199302-45-0256]

Mixed charging of ore and coke has been carried out at 300 m^3 blast furnace. The ferric burden consists of sinter and pellets. The blast furnace operation is stable. Production is increased by 6.68% and coke rate is decreased by 4.1%. Graphs. (Wang, W.; Xu, J.; Zhao, Y.; Lin, R.; Shi, X.; IRON AND STEEL (CHINA), (MAY 1992), 27, (5), pp. Ironmaking [in Chinese]. ISSN 0449-749X)

0065 CONTINUOUS CASTING PROCESS AND DESIGN ENGINEERING FOR REALISTIC ENERGY EFFICIENCY BY HOT LINKING. [BIB-199302-51-0181]

As a processing step in the overall steelmaking route, continuous casting uses relatively little energy but is the handling agent of an enormous quantity of previously imparted energy. A number of technologies can be engineered into the continuous casting machine and process to improve energy efficiency by enabling hot linking of the product from the caster to the rolling mill. The desire to attain the highest energy efficiency often has to be balanced with the need to achieve operational flexibility. Graphs. 2 ref. (Reynolds, T.; SEMINAR ON IMPROVED TECHNOLOGIES FOR THE RATIONAL USE OF ENERGY IN THE IRON AND STEEL INDUSTRY, BIRMINGHAM, UK, 11-13 FEB. 1992, METALLURGICAL PLANT AND TECHNOLOGY INTERNATIONAL, (AUG. 1992), 15, (4), pp. 96-97, 100, 102, 104, 106, 108-109 [in English]. ISSN 0935-7254)

0066 MATERIAL AND ENERGY BALANCES IN PARTS FABRICATION—CASTINGS LEAD TO MATERIAL AND ENERGY SAVINGS AND REDUCE THE CO_2 EMISSIONS. (MATERIAL- UND ENERGIEBILANZEN BEI DER TEILEFERTIGUNG—GUSSTEILE FUHREN ZU EINSPARUNGEN UND REDUZIEREN DEN CO_2 -AUSSTOSS.) [BIB-199302-51-0240]

The production of a part requires energy, normally generated by the combustion of fossil fuels. On this basis, the energy consumption is the total of producing the material for a part and the machining operations. Evidently, when a part is cast to close dimensions, little machining is necessary, energy savings result, and environmental effects are reduced, due to less use of fossil fuels to generate the energy. Cupolas also reduce energy consumption, because the fuel is directly used in melting. Graphs. 12 ref. (Herfurth, K.; KONSTRUIEREN & GIESSEN, (1991), 16, (3), pp. 29-32 [in German]. ISSN 0341-6615)

0067 LOW TEMPERATURE ROLLING AND HOT ROLLING LUBRICATION. [BIB-199302-52-0347]

The results of simulative tests on resistance to deformation of 25SiMn and AY3F steels at different deformation speeds, different deformation temperatures and different deformation degrees and the comparison of the results with rolling force measured under corresponding conditions on pilot rolling mill are described. Energy consumption for heating and rolling was measured. The effect of hot rolling lubrication on resistance to deformation was also studied. The results indicate that reducing heating temperature can greatly save total energy consumption for heating and rolling. Hot rolling lubrication can compensate for a part of the energy which was increased by low temperature rolling. Graphs, Photomicrographs. 3 ref. (Li, X.; Pang, S.; Feng, S.; Wang, P.; IRON AND STEEL (CHINA), (MAY 1992), 27, (5), pp. 28-32, 69 [in Chinese]. ISSN 0449-749X)

0068 THE SUPERSONIC FREQUENCY POWER WITH THYRISTOR AND ITS APPLICATION. [BIB-199302-55-0270]

A power supply for induction heating by utilizing a thyristor with the performance of 20-50 kHz, 100-200 kW was successfully manufactured. The power supply system design used a multifrequency inverter which promotes the off time of the thyristor. Thus, the frequency of the inverted power supply could be increased to 50 kHz. To protect the thyristor from a sudden inverter failure, an extra circuit to seal the anode and a bleeding circuit were added to the standard protection system. All designs adopted integrate circuits. This type of power supply has been successfully used in the induction units for the following applications: brazing of alloy cutting tool; brazing of Cu tube used in the compressor of refrigerator; and surface hardening (or annealing) of rolls for roller bearing. (Wang, Y.; Wang, F.; HEAT TREATMENT OF METALS (CHINA), (FEB. 1992), (2), pp. 40-42 [in Chinese]. ISSN 0254-6051)

0069 A SUBCRITICAL AND RAPID SPHEROIDIZE ANNEALING. [BIB-199302-56-0230]

A subcritical and rapid spheroidizing process for cold-drawn steel wire (e.g. 60, T8MnA or T9A) and cold-rolled steel sheet is recommended. Not only a better result of energy saving could be achieved, but also its technological process is simple and the spheroidization quality stable. Photomicrographs, Numeric Data. 6 ref. (Cai, X.; Ou, P.; HEAT TREATMENT OF METALS (CHINA), (APR. 1992), (4), pp. 8-11, 17 [in Chinese]. ISSN 0254-6051)

0070 SOME PROBLEMS IN DESIGN AND CONSTRUCTION OF ANNEALING FURNACE WITH FULL CERAMIC-FIBRE. [BIB-199302-56-0262]

To improve the life of the existing annealing furnace (operating temperature: 900 °C), alumina silicate fiber material was used for furnace insulation to replace fire bricks. Compared with the old design, the fiber insulation saved 30% of heating cost and saved 40% of repair cost. For general construction, plate of 40 mm thickness with the fiber composition of (Al_2O_3 + SiO_2) 96 (45-52% alumina) was used. It was found: in a high temperature zone (1000-1100 °C), high purity material (alumina 60%, alumina + silicate 99%) should be used; steel parts should not be exposed in the heating zone; parts made of 1Cr18Ni9Ti stainless steel parts should be used in these locations. Fiber plates reinforced with steel rod or stainless tube (in a high temperature zone) will increase furnace safety. A detailed description of the furnace construction is presented. (Tang, D.-M.; HEAT TREATMENT OF METALS (CHINA), (FEB. 1992), (2), pp. 32-34 [in Chinese]. ISSN 0254-6051)

0071 THE APPLICATION OF "U" TYPE INDUCTOR FOR THE HARDENING OF INNER CONE HOLE OF SPINDLE. [BIB-199302-56-0300]

A process using "U" type inductor is developed to replace salt bath heating which was unable to produce the required hardness on the surface of inner tapered cone holes of spindles. The U-type inductor utilizes a conductor to create lateral magnetic field which penetrates the workpiece to generate heat. For larger holes, e.g. Morse taper standard No. 6, the high freuqnecy heating and subsequent water quenching are used; and for smaller holes, e.g. 1:20, medium frequency heating and quenching are used. The HRC readings (between 54-57) of the spindles thus treated are uniform along the cone hole surface. The method reduces heating time from 20 min (as needed by salt bath heating) to 5 min. The power required drops from 25 to 4.5 kW h, a saving of 20.5 kW h. A detailed description of the U-inductor is presented. 2 ref. (Li, B.; HEAT TREATMENT OF METALS (CHINA), (MAR. 1992), (3), pp. 42-44, 59 [in Chinese]. ISSN 0254-6051)

0072 RESEARCH ON THE MECHANISM AND APPLICATION ON QUICK-NITRIDING. [BIB-199302-56-0311]

New quick-nitriding processes—cyclic two-stage "C-TS", pre-strongly absorbing nitrogen-pulsating "PS-P" and double "DB"—were designed on the basis of chemical thermodynamics and kinetics, surface science, internal diffusion theory and inter-promotion mechanism of some elements in diffusion. Using these processes, no catalyst and new equipment are added. Not only time is saved, and therefore energy and material are economized, but also good effect is achieved. These processes have been used in production successfully, and large profit has been made. The new processes are suitable for specialized nitriding steel such as 38CrMoAlA, and 42CrMo, 40Cr, 30CrMnTi and 23Mn3V2Al. The application future of these new processes is very bright. Graphs, Photomicrographs. 7 ref. (Shen, S.t.; Tan, C.y.; CHINESE JOURNAL OF MECHANICAL ENGINEERING (NOW: JIXIE GONGCHENG XUEBAO (CHINESE JOURNAL OF MECHANICAL ENGINEERING)), (JUNE 1992), 28, (3), pp. 97-103 [in Chinese]. ISSN 0577-6686)

0073 THE INTERCRITICAL HEAT TREATING FOR ELECTROSLAG REMELTED AND CAST 45 STEEL CRANKSHAFT. [BIB-199302-56-0342]

The crankshafts made with electroslag remelted 45 steel tend to deform after being heat treated with the standard process. Since the electroslag remelting greatly decreases the impurities, an intercritical heat treating process can minimize the deformation. The experiment used a crankshaft with the composition: 0.44 carbon, 0.27 Si, 0.65 Mn, 0.13 phosphorus, and 0.006 sulfur. The process comprises: normalizing: 790 °C for 1 h then air cooled; hardening: 760 °C for 30 min then water quenched; and tempering: 400 °C for 1.5 h then air cooled. The microstructure displays refined undissolved ferrite and laminar carbide uniformly distributed in sorbite. The mechanical properties are the same as, if not better than, those treated with the standard method. The intercritical heat treating process can save 15-20% of electricity and 10-20% of manhours. Graphs. (Rao, Y.F.; Wu, W.X.; Guo, D.H.; Kong, R.M.; HEAT TREATMENT OF METALS (CHINA), (APR. 1992), (4), pp. 46-47 [in Chinese]. ISSN 0254-6051)

0074 THE STUDY AND APPLICATION OF BIMETAL FORGING DIE BY ELECTROSLAG CASTING. [BIB-199302-56-0360]

The heat treating process and main application properties of bimetal forging die of 4Cr2NiMoV/30CrMnSi steels by electroslag casting are described. The result shows that the service life of this new forging die may be increased approx 47% and it possesses obvious economic benefit. Graphs, Photomicrographs. 6 ref. (Yan, Z.J.; Zheng, C.Y.; HEAT TREATMENT OF METALS (CHINA), (OCT. 1991), (10), pp. 6-11 [in Chinese]. ISSN 0254-6051)

0075 TECHNIQUE OF HEATING SEMI-HOT INGOTS. [BIB-199302-56-0366]

Semi-hot ingot is the one with temperature between cold and hot. If the semi-hot steel ingots are heated as cold ingots, its energy consumption increases and productivity decreases. If the semi-hot ingots are heated as hot ingots, cracks may arise, so a technique of heating the semi-hot ingots is necessary. The technique is studied and discussed. The conception of the semi-hot ingot and technical parameters of heating the semi-hot ingot are given. 6 ref. (Qi, Z.; IRON AND STEEL (CHINA), (MAY 1992), 27, (5), pp. 54-56 [in Chinese]. ISSN 0449-749X)

0076 HIGH QUALITY INFRARED COATING AND ITS APPLICATION IN RESISTANCE FURNACE. [BIB-199302-57-0183]

The conditions for energy savings were discussed. By using infrared resistance tape and infrared complex furnace liner, energy savings up to 30-50% were provided. The method of preparation of high quality infrared coatings and the way to solve the adhesion problem of coating to metallic substrate (e.g. 1Cr18Ni9Ti) were recommended. The application of the infrared coatings in resistance furnaces for heat treating 45 and casting steels, etc. is discussed. Graphs, Spectra. 25 ref. (Zhou, J.; Chen, J.; Tu, P.; HEAT TREATMENT OF METALS (CHINA), (MAR. 1992), (3), pp. 7-11 [in Chinese]. ISSN 0254-6051)

0077 DIESEL COATINGS FOR REDUCING EMISSIONS AND BOOSTING PERFORMANCE. [BIB-199302-61-0251]

Based on technology borrowed from the aerospace industry, ceramic thermal barrier coatings (TBCs) such as zirconium oxide, are cost-effectively reducing emissions from diesel engines in power generation, marine, and other applications. TBCs help to boost engine performance and eliminate many of the problems associated with low-cetane fuels. Diesel engine TBCs are plasma-sprayed ceramics that insulate combustion system components—such as pistons, valves, and cylinder head fire decks—from heat and thermal shock. The TBCs protect metal components against high-temperature corrosion, reduce component temperatures and thermal-fatigue effects, and help convert more heat into useful energy. In three large stationary diesel engine plants in the US, in which engine combustion chamber components were thermal sprayed with diesel TBCs, the plants reported that NO_x, carbon monoxide, and particulates were reduced, and that there were significant improvements in fuel consumption and engine component wear. Similar results have been demonstrated in marine applications, including a ferry with twin Caterpillar D-3516 diesel engines, in which TBCs were applied to piston crowns, cylinder-head fire decks, and valve faces of the engines. The use of TBCs has been explored actively by major engine builders. Photomicrographs, Graphs. (Winkler, M.F.; Parker, D.W.; DIESEL AND GAS TURBINE WORLDWIDE, (JULY-AUG. 1992), 24, (6), pp. S8, S10, S12 [in English]. ISSN 0278-5994)

0078 PLASMA SMELTING OF PRECIOUS METAL SLIMES. [BIB-199304-42-0481]

Precious metal slimes are formed when fire-refined Cu is anodically dissolved. The impurities which do not dissolve in the electrolyte are collected at the bottom of the cell. These slimes contain precious metals such as Au, Ag and the Pt-metals. Also, Ni, cobalt, Cu, Fe, Se and Te are present. In this work, the precious metal slimes were treated in a plasma furnace. The following operating variables were studied: energy consumption, charge weight, charcoal additions, cycling at 3 kwh, flux additions, and addition of reductants such as FeSi and Al. These variables were evaluated in terms of the metal recovery and the matte and slag composition. The behavior of the metallic elements in the process is discussed. Graphs, Diffraction patterns, Photomicrographs. 14 ref. (Pickles, C.A.; Utigard, T.A.; WASTE PROCESSING AND RECYCLING IN MINING AND METALLURGICAL INDUSTRIES, EDMONTON, ALBERTA, CANADA, 23-27 AUG. 1992, Publisher: CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM, Xerox Tower, 1210-3400 de Maisonneuve Blvd. W., Montreal, Quebec H3Z 3B8, Canada, (1992), (Met. A., 9304-72-0210), pp. 293-306 [in English].)

0079 INFLUENCE OF VARIOUS FACTORS ON BEHAVIOUR OF ZINC IN BLAST FURNACE. [BIB-199304-42-0486]

Previously abstracted from original as item 9111-42-1005. In spite of withdrawing from circulation Zn-bearing slurries from the blast furnace gas cleaning and the converter shops, the problem of Zn remained acute with an intake of 1.9-2.1 kg/t of Fe. Zinc was deposited in the gas outlets. Factors were investigated which reduced the negative effect of Zn and a distinct connection was found between the behaviour of Zn in the blast furnace and the stack thermodynamics, particularly at the throat. Condensation of Zn vapours on the relatively cool burden is especially important as it affects the structure of the circulating Zn and the coke consumption for the direct reduction of the secondary Zn. The results of thermodynamic calculations relating to throat temperature are discussed in relation to several plants. The best way to reduce the harmful effect of the liquid phase of Zn is to eliminate conditions for the condensation of its vapours on the surface of lumps of the burden and of the furnace lining and to reduce the evacuation of metallic Zn formed directly from vapours 419 °C into the free space of the throat and gas outlets. Graphs. 11 ref. (Shchukin, Yu.P.; Kaporulin, V.V.; Novikov, V.S.; Marsuverskii, B.A.; Chernavin, A.Yu.; Ivonina, I.E.; Steel USSR, (May 1991), 21, (5), pp. 189-194 [in English]. ISSN 0038-9218)

0080 ENVIRONMENTAL ASPECTS OF MAGNESIUM PRODUCTION BY ELECTROLYSIS. [BIB-199304-42-0498]

Electrolysis of magnesium chloride ($MgCl_2$) is the dominant method for the production of Mg metal. Norsk Hydro has developed extensive experience for preparing this feed material through both the chlorination process which uses Cl and carbon and the dehydration route which makes use of hot hydrogen chloride. Process parameters which affect the generation of chlorinated organics and control technology considerations are presented along with results from environmental surveys and requirements by Canadian and Norwegian Environmental Authorities. A comparison of the use of Mg, Al and steel in automotive applications is given with reference to energy and Co_2 considerations. Graphs. 10 ref. (Ongstad, L.; Mezzetta, G.; Haugerod, O.; ADVANCES IN PRODUCTION AND FABRICATION OF LIGHT METALS AND METAL MATRIX COMPOSITES, EDMONTON, ALBERTA, CANADA, 23-27 AUG. 1992, Publisher: CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM, Xerox Tower, 1210-3400 de Maisonneuve Blvd. W., Montreal, Quebec H3Z 3B8, Canada, (1992), (Met. A., 9304-72-0248), pp. 231-244 [in English].)

0081 THERMO-ELECTRIC ANALYSIS OF ALUMINUM REDUCTION CELLS. [BIB-199304-42-0511]

The cathode of an Al reduction cell consists of a steel structure lined with bricks and other insulation materials. An efficient cell cathode design has an optimum heat balance that minimizes energy consumption and cell failure. The design relies on the solidification of the electrolyte against the side of the cathode to provide a "freeze" layer which protects the lining against erosion. The thermo-electric analysis capabilities of the commercially available finite element code ANSYS were used to model the freeze profile of reduction cells. The geometry of the structure was defined parametrically to allow for quick evaluation of design alternatives. For a specific cell and cathode design, at a given level of heat input, the freeze profile was automatically adjusted to arrive at the converged profile. 2 ref. (Dupuis, M.; ADVANCES IN PRODUCTION AND FABRICATION OF LIGHT METALS AND METAL MATRIX COMPOSITES, EDMONTON, ALBERTA, CANADA, 23-27 AUG. 1992, Publisher: CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM, Xerox Tower, 1210-3400 de Maisonneuve Blvd. W., Montreal, Quebec H3Z 3B8, Canada, (1992), (Met. A., 9304-72-0248), pp. 55-62 [in English].)

0082 ON THE EFFECTS OF THE INDUCED CURRENTS IN ELECTROLYSIS REDUCTION CELLS. [BIB-199304-42-0512]

To improve the Faraday efficiency, the energy consumption and the lifetime of the electrolysis reduction cells (Al), modelling and numerical simulation play a chief role. Three dimensional modellings are considered for stationary and non-stationary systems. The importance of the induced currents is emphasized. 2 ref. (Antille, J.; Kaenel, R.; ADVANCES IN PRODUCTION AND FABRICATION OF LIGHT METALS AND METAL MATRIX COMPOSITES, EDMONTON, ALBERTA, CANADA, 23-27 AUG. 1992, Publisher: CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM, Xerox Tower, 1210-3400 de Maisonneuve Blvd. W., Montreal, Quebec H3Z 3B8, Canada, (1992), (Met. A., 9304-72-0248), pp. 63-73 [in English].)

0083 HIGH-QUALITY ANODE PRODUCTION WITH STATE-OF-THE-ART BAKING TECHNOLOGY. [BIB-199304-42-0517]

High quality anodes are consistently produced with optimized bake furnace design and computerized process control providing defined uniform temperatures in each step (preheat, firing and cooling) of the process. Energy savings can be achieved and environmental emissions are reduced. A high degree of mechanization contributes to cost savings. 9 ref. (Engelsman, R.; Sommer, P.; ADVANCES IN PRODUCTION AND FABRICATION OF LIGHT METALS AND METAL MATRIX COMPOSITES, EDMONTON, ALBERTA, CANADA, 23-27 AUG. 1992, Publisher: CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM, Xerox Tower, 1210-3400 de Maisonneuve Blvd. W., Montreal, Quebec H3Z 3B8, Canada, (1992), (Met. A., 9304-72-0248), pp. 137-150 [in English].)

0084 EFFECTS ON THE ELECTRIC ENERGY AND ELECTRODE CONSUMPTION OF ARC FURNACES. (EINFLUSSGROSSEN DES ELEKTRISCHEN ENERGIEVERBRAUCHS UND DES ELEKTRODENVERBRAUCHES VON LICHTBOGENOFEN.) [BIB-199304-45-0386]

From evaluating data of 14 ac arc furnaces with tap weights from 64-147 t, a formula is derived for calculating the specific electric energy demand which meets very well the actual consumption values from approx 380-600 kWh/t. From this formula it is deduced how the electric energy consumption is affected by modifying its various influence variables. Also, the effects on electrode consumption are deduced by using formulas given by Bowman. For a fictitious model furnace the formulas give an electrode consumption of 330 kWh/t and an electrode consumption of 1.37 kg/t under a power-on-time of 32 min. Finally, a relation is constructed to the complete energy balance of arc furnaces. Graphs. 15 ref. (Kohle, S.; Stahl und Eisen, (9 Nov. 1992), (11), pp. 59-67 [in German]. ISSN 0340-4803)

0085 LOWERING ENERGY COSTS IN LIQUID PHASE REDUCTION PROCESS DURING REDUCTION SMELTING OF OXIDISED RAW MATERIAL. [BIB-199304-45-0426]

Previously abstracted from original as item 9111-45-1481. The Novolipetsk Iron and Steel Combine is developing a new practice for the direct production of iron using a liquid phase reduction. This includes a furnace for reduction melting oxidised ferruginous raw material in a bubbling slag bath and a boiler condenser. Details of the equipment and practice are given and the heat balances when melting basic oxygen furnace slurries are stated for oxygas and oxyair bottom blowing. The most promising practice is the use of O-free blast for bubbling the slag bath. Graphs. 4 ref. (Karpushin, V.K.; Timin, E.I.; Romenets, V.A.; Valavin, V.S.; Beremblyum, G.B.; Shkatov, N.M.; Steel USSR, (May 1991), 21, (5), pp. 199-200 [in English]. ISSN 0038-9218)

0086 PROSPECTS FOR SEMICONTINUOUS INGOT CASTING PROCESS. [BIB-199304-51-0581]

Previously abstracted from original as item 9111-51-1979. The possibility of using semicontinuously cast slabs instead of mould-cast ingots is shown. The use of semicontinuous casting makes it possible to mechanise the casting of large cross-section strands, reduce metal losses, lower energy costs, and improve working conditions in the steelmaking and foundry shops. The process can be used for producing semiproducts for rolling and forging and consumable electrodes. Graphs. 3 ref. (Marchenko, I.K.; Brovman, M.Ya.; Anikeev, V.V.; Steel USSR, (Apr. 1991), 21, (4), pp. 164-166 [in English]. ISSN 0038-9218)

0087 APPLICATION OF HOT-PIPE HEAT EXCHANGER TO THE REHEATING FURNACE IN STEEL-ROLLING. [BIB-199304-52-0568]

Hot-pipe heat exchanger has high heat efficiency and a broad prospect for its application. The technical characteristics and economic benefits of gas/gas hot-pipe heat exchanger and gas/liquid hot-pipe waste heat boiler applied to the reheating furnace in steel-rolling are described. (Wang, L.Q.; Shanghai Jinshu (Shanghai Metals), (Sept. 1992), 14, (5), pp. 59-60 [in Chinese]. ISSN 1001-7208)

0088 OPTIMISATING ROLL PASS DESIGN FOR ROLLING STEEL ANGLES ON 320/150 MILL. [BIB-199304-52-0658]

Previously abstracted from original as item 9109-52-1589. The continuous light section and rod mill at the Amurstal' works was commissioned in 1987. The mill was built in eastern Germany and details are given of the suggested pass design. The shortcomings of the suggested practice are outlined and the new pass design was developed for rolling angles. Details are given of the energy force parameters in the intermediate and finishing stands when rolling St3 steel angles at optimum speeds. The influence of the number of passes on power consumption is tabulated. 4 ref. (Smirnov, V.K.; Yatsenko, V.F.; Limankin, V.V.; Shilov, V.A.; Inatovich, Yu.V.; Steel USSR, (Feb. 1991), 21, (2), pp. 73-75 [in English]. ISSN 0038-9218)

0089 GRINDING OF COLD ROLLS USING CONTINUOUS WHEEL DRESSING. [BIB-199304-53-0255]

A study is carried out on the operational characteristics of various grinding wheels with different characteristics. The wheels suffer a constant reduction in their cutting power on account of continuous dressing with a diamond pencil. It is established that, with continuous dressing of the wheel, there is a significant reduction in power consumption in the grinding process and an increase in its productivity. The grinding of steel 60Kh2SMF is described. Graphs. 4 ref. (Noskov, V.V.; Khimach, O.V.; Dudnik, I.F.; Donchak, V.I.; Sverkhtverdye Materialy, (1992), (5), pp. 43-46 [in Russian]. ISSN 0203-3119)

0090 EXTENDING THE WAY OF ENERGY SAVING IN HEAT TREATING. [BIB-199304-56-0537]

The manufacturing processes of five parts from the respective different machines are modified by heat treating method to save energy. The nut made of 45 steel for the diesel engine cylinder head is forged to shape in a forging press at 1200-1250 °C . The finished part which still has a residual temperature of 780-850 °C is immediately quenched and tempered at 540 plus/minus 10 °C . This process can save 49 000 kWh/year. An elevator pulling rod made of carburized 12CrNi3 steel is replaced by a 45Cr steel rod. The replacement provides the required hard case (56-59HRC) and soft core (302-319HB) after being water quenched (from 860 °C x 2 h) and tempered (160 plus/minus 10 °C). A boring machine main shaft (1059 mm) with three different diameters made of 45 carbon steel is interruption quenched in the following sequence: water cool, 2.1 s; air cool, 4 s; water cool, 3 min; air cool, 5 s; and water cool to room temperature. This process controls the proper distribution of martensite, bainite, and sorbite. The hardness and bending deformation of the main shaft meet the specification. Carburized 20CrMnTi steel for harvester shaft is replaced with 40Cr steel. The 40Cr steel shaft is treated through an inductor and quenched in 15% emulsified liquid. This modified process saves 85% electricity. The jig for hardening the boring bar made of 20CrMnTi is too short for quenching. A new fixture is designed. (Xhen, S.L.; Heat Treatment of Metals (China), (Sept. 1992), (9), pp. 53-55 [in Chinese]. ISSN 0254-6051)

0091 WALKING BEAM TYPE REHEATING FURNACE AT HOT STRIP ROLLING MILL OF SHANGHAI BAOSHAN IRON AND STEEL COMPLEX. [BIB-199304-56-0560]

The features of the third generation of walking beam type reheating furnace used in the hot strip rolling mill of shanghai Baoshan Iron and Steel Complex are described. Allocation of walking beams, structure features, and the characteristics of its hydraulic system are also discussed. Finally, the characteristics of its nozzle, blower, heat exchanger and heavy oil supply system used in the furnace are briefly introduced. Heating of steels is discussed. (Wu, Z.B.; Shanghai Jinshu (Shanghai Metals), (Nov. 1992), 14, (6), pp. 30-36 [in Chinese]. ISSN 1001-7208)

0092 THE GAS-FIRED HICON-H_2 BELL-TYPE ANNEALING FURNACE. [BIB-199304-56-0561]

The development and features of gas-fired HICON/H_2 bell-type furnace are introduced. The detailed introduction of the gas-fired HICON/H_2 bell-type furnace imported from EBNER Industrial Furnace Inc., Austria, by Shanghai Yichang Steel Strip Co. Ltd. for Sn-plated steel plates is also presented. Graphs. (Chen, B.L.; Shanghai Jinshu (Shanghai Metals), (Nov. 1992), 14, (6), pp. 37-42 [in Chinese]. ISSN 1001-7208)

0093 THEORY AND PRACTICE OF PRELIMINARY HEAT TREATMENT OF LARGE PRODUCTS AND SEMIPRODUCTS (FORGINGS). [BIB-199304-56-0576]

Previously abstracted from original as item 9207-56-0930. The scientific base for developing an energy-saving practice for the preliminary heat treatment of large parts involves a knowledge of the hydrogen saturation of the metal, the kinetics of phase transformations under isothermal conditions and with continuous cooling and the kinetics of the formation of temporal and residual stresses throughout the entire heat treatment cycle. Details are given of the following: variation in the temperature of the melting chamber, of the surface of the forging at a distance of one-third of the radius from the surface and at the centre of a 1300 mm diameter CrNi steel forging during normalising and high tempering, the preliminary heat treatment of heavy forgings with and without recrystallization and anti-flake heat treatment. Graphs. 5 ref. (Bashnin, Yu.A.; Steel USSR, (Aug. 1991), 21, (8), pp. 373-376 [in English]. ISSN 0038-9218)

0094 PUSH TYPE PICKLING LINE AND ITS COMMISSIONING PRACTICE. [BIB-199304-57-0470]

Through installing and commissioning the push type pickling line, properties and advantages of this technology are described, and exact technical parameters and operating data are presented. Experience thus gained has provided a chance of applying this technology in China. Pickling of steels is discussed. (Cheng, Y.L.; Shanghai Jinshu (Shanghai Metals), (Nov. 1992), 14, (6), pp. 48-52 [in Chinese]. ISSN 1001-7208)

0095 AN EXPERIMENTAL INVESTIGATION INTO UNCOOLED DIESEL ENGINE WITH CERAMIC COATINGS. [BIB-199304-61-0401]

An experimental investigation into 6135 uncooled diesel engine with ceramic coatings is presented to solve the problems occurring in the uncooled engine. A series of effective measures ensured the operating reliability and greatly improved the performance of the engine. The piston is made of Al and steel. The cylinder pads are made of Fe or steel wire. Graphs. 4 ref. (Wei, K.; Liu, Y.; Du, Q.; Yang, C.; Cui, L.; Zhao, K.; Transactions of Chinese Society for *Internal* Combustion Engines, (1992), 10, (3), pp. 199-206 [in Chinese]. ISSN 1000-0909)

0096 DESIGN OF PERMANENT MAGNET BIASED MAGNETIC BEARINGS FOR A FLEXIBLE ROTOR. (RETROACTIVE COVERAGE). [BIB-199304-61-0422]

The design and construction of a set of permanent magnet biased, actively controlled magnetic bearings for a flexible rotor is presented. Both permanent magnets and electromagnets are used in a configuration which effectively provides the necessary fluxes in the appropriate air gaps, while simultaneously keeping the undesirable destabilizing forces to a minimum. The design includes two radial bearings and a thrust bearing. The theoretical development behind the design is briefly discussed. Experimental performance results for a set of operating prototype bearings is presented. The results include measurements of

load capacity, bearing stiffness and damping and the dynamic response of the rotor. With few exceptions, the experimental measurements matched very well with the predicted performance. The power consumption of these bearings was found to be significantly reduced from that for a comparable set of all electromagnetic bearings. Graphs. 11 ref. (Sortore, C.K.; Allaire, P.E.; Maslen, E.H.; Humphris, R.R.; Studer, P.A.; CURRENT PRACTICES AND TRENDS IN MECHANICAL FAILURE PREVENTION, VIRGINIA BEACH, VIRGINIA, USA, 3-5 APR. 1990, Publisher: VIBRATION INSTITUTE, 6262 S. Kingery Highway, Willowbrook, Illinois 60514, USA, (1990), (Met. A., 9304-72-0184), pp. 183-192 [in English].)

0097 A FULL ELECTROCHEMICAL APPROACH IN PROCESSING JUNK BATTERIES. [BIB-199306-42-0708]

The CX-EW technology, developed by B.U.S. Engitec, is improved, introducing besides the battery paste electrowinning, the direct electrorefining of metallic lead (grids and poles) obtained from CX breakers. This new concept of electrorefining the antimonial Pb scrap is aimed to the production of 99.99 Pb and of slimes with high antimony content, avoiding gaseous emissions in melting Pb scrap, and expensive and pollutant thermic refining operations. In this way, practically all Pb content in the battery is available as 99.99 Pb, hence with a wider market for the Pb recyclers. This paper describes the tests performed on a pilot plant scale with special reference to the relatively low energy consumption of the process. 4 ref. (Olper, M.; EPD CONGRESS 1993, DENVER, COLORADO, USA, 21-25 FEB. 1993, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1992), (Met. A., 9306-72-0303), pp. 959-966 [in English].)

0098 TiB_2—COMPOSITE AS INERT CATHODE MATERIALS IN HALL—HEROULT CELLS FOR ALUMINIUM ELECTROLYSIS. [BIB-199306-42-0722]

The TiB_2 refractory ceramic material is an important material used for energy saving inert cathode of aluminium electrolysis. However, it has been found that a TiB_2—C composite material is better than TiB_2 when used as such cathodes. Its cost is lower, its corrosion resistance to molten Al is higher, while its other properties are almost the same as those of TiB_2 material. The TiB_2—C inert cathode tended to run cleanly, while the carbon cathode surface tended to be in a muck during electrolysis. When the TiB_2—C inert cathode is used, the electrical energy consumption would be approx 30% less than that of the conventional cell with a C cathode in a pilot cell. Graphs. 4 ref. (Xu, W.; Li, R.N.; Zhang, X.W.; Sun, X.; Li, M.Q.; Rare Metals (China), (Oct. 1992), 11, (4), pp. 260-264 [in English].)

0099 EMERGING TECHNOLOGIES FOR IRONMAKING—AN INDIAN PERSPECTIVE. [BIB-199306-42-0727]

India is endowed with adequate reserves of raw materials to sustain a large iron and steel industry. However, a major constraint is availability of good quality coking coal. Development of smelting reduction (SR) process for making liquid Fe using non-coking coal as an alternate to coke based blast furnace route has gained significant thrust in recent years in the industrialised countries, and this is also of great significance for India. This paper deals with the rationale for development of suitable SR process with respect to raw materials available in India, particularly non-coking materials. The theoretical concept behind SR processes currently under development, as well as effect of post-combustion on process viability has been dealt with in depth. The paper concludes with indicative techno-ecnomic projections under Indian context. Graphs. 9 ref. (Aeron, S.M.; Chaudhuri, P.K.; Gupta, S.K.; Mukherjee, A.K.; PRODUCTION OF IRON, STEEL, AND HIGH-QUALITY PRODUCT MIX: LATEST TECHNOLOGICAL INNOVATIONS AND PROCESSES, CHICAGO, ILLINOIS, USA, 2-5 NOV. 1992, Publisher: ASM INTERNATIONAL, Materials Park, Ohio 44073-0002, USA, (1992), (Met. A., 9306-72-0310), pp. 125-132 [in English].)

0100 PERFORMING PRODUCTION PROCESS OF LITTLE WASTE IN DZHEZKAZGAN COPPER SMELTER. [BIB-199306-42-0747]

A low-waste technology for processing high-silica and low Fe—Cu concentrates was developed. The technology enhances the amount of copper extracted to 98.3%, reduces the amount of converter slag to 35-40%, improves productivity of electrical furnaces and converters, significantly reduces energy consumption and improves safety. During the smelting the pyrite is removed from the charge as well as Cu—Fe concentrates. During converter treatment quartz ore is removed. 4 ref. (Kvyatovski, A.N.; Urumov, T.M.; Abrakhmanov, T.M.; Bodrov, V.M.; Il'yasov, N.I.; Polyanskii, V.G.; Tsvetnye Metally, (Sept. 1992), 9, pp. 14-16 [in Russian]. ISSN 0372-2929)

0101 STABILISING BLAST FURNACE TOP BURDEN DISTRIBUTION. [BIB-199306-42-0756]

A gas seal of a novel design has been introduced for No. 5 blast furnace at the Kuznetsk Works, to stabilise the irregular distribution of charge materials in the large bell of the furnace charger, in the furnace top and in the furnace column. Such irregularities are caused by the kinetic energy of the gas stream as the interbell spacing is filled. Advantages of the system include reductions in coke and natural gas consumption, and the amount of blast furnace top gas produced. Graphs. 3 ref. (Sleptsov, Zh.E.; Kotukhov, V.I.; Korshikov, S.V.; Stolyar, A.A.; Polyanskii, D.S.; Stal', (Aug. 1992), (8), pp. 4-6 [in Russian]. ISSN 0038-920X)

0102 NICKEL LATERITES OF CENTRAL DOMINICAN REPUBLIC. II. PYROMETALLURGY, FUEL, AND POWER GENERATION. [BIB-199306-42-0769]

Commercial volumes of nickeliferous laterite ores overlie part of a 90 km long belt of peridotites in central Dominican Republic. Protores are serpentinized harzburgites and dunites, with lesser serpentinite. The ore mineralogy consists mostly of goethite, serpintine-group minerals, quartz and poorly crystallized, X-ray amorphous materials. Minor constituents are hematite, gibsite, olivine, and enstatite. In the ore dressing plant, the mine feed is subjected initially to proper sizing and blending to produce a homogenized mix. Subsequent drying and upgrading by selective crushing and screening of rock fragments through a Barmac circuit, complete preparation of the ore for pyrometallurgical processing. Falcondo's energy requirements are based on oil which is refined on site to provide distillate to carry out drying and selective reduction of the nickeliferous ore in the shaft furnaces, plus bunker oil to produce electrical power for process melting, refining, and ancillary use. The dryer product at 1.68% nickel is briquetted and passed counter current to hot reducing gas in 12 vertical shaft furnaces. The hot calcine discharge is melted in two high power electric furnaces at very high secondary voltage. The crude ferronickel is ladle refined and cast as 15 kg ingots or 125 gm ferrocones. Graphs, Maps. 2 ref. (Corrigan, J.H.; EXTRACTIVE METALLURGY OF COPPER, NICKEL AND COBALT. VOL. I: FUNDAMENTAL ASPECTS, DENVER, COLORADO, USA, 21-25 FEB. 1993, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1993), (Met. A., 9306-72-0325), pp. 427-440 [in English].)

0103 A NOVEL COMBINED PROCESS FOR OBTAINING HIGH GRADE NI—CU MATTE FROM NI—CU SULFIDE CONCENTRATES DIRECTLY. [BIB-199306-42-0789]

A new technological process developed uses thermal plasma arc smelting to obtain high grade nickel matte directly from Ni—Cu concentrates containing 5-7% Ni and 3-8% sulfur. In comparison with conventional smelting and converting processes the plasma arc smelting process has many advantages over conventional processes, such as lower energy consumption, lower capital investment and freedom from SO_2 pollution by transforming the sulfides into elemental S with microwave irradiation under controlled oxygen potential. The process is simple and easily controlled due to less magnetite trouble in the operation. Therefore, this new technological process can be used as an alternative to the conventional process for Ni—Cu concentrate smelting. The main economical technical index is summarized. Diffraction patterns, Graphs, Photomicrographs,

Phase diagrams. 9 ref. (Liu, C.; Zhu, Z.; Xu, Y.; Peng, J.; EXTRACTIVE METALLURGY OF COPPER, NICKEL AND COBALT. VOL. I: FUNDAMENTAL ASPECTS, DENVER, COLORADO, USA, 21-25 FEB. 1993, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1993), (Met. A., 9306-72-0325), pp. 1063-1080 [in English].)

0104 ENERGY CONSERVATION IN NON-FERROUS INDUSTRIES BY THE SUBSTITUTION OF NATURAL GAS. [BIB-199306-42-0792]

The utilization of natural gas in non-ferrous industries during smelting and refining stages of copper, aluminum, zinc and lead was studied. The total amount of nonelectrical energy consumed in the production of Zn, CU, Pb and Al, are 96.5, 93, 92, and 6% respectively. It is calculated that 9.45 wt.% of air of stoichiometric amount can be substituted by natural gas to the total air input in the nonelectrical energy utilization processes. The results showed that the non-electrical energy nay be substituted to an amount of 71, 52, 35, 32, and 26%, in the production of Pb, Al (plates, foils) Cu, Al, Zn, respectively. Similar calculations are carried out in terms of energy in Btu for the total production of non-ferrous metals in the US. It shows that 51.866 x 10^6 millions of Btu of nonelectrical energy can be substituted by 54.58 x 10^6 ft^3 of natural gas. Finally, the substitution of non electrical energy in terms of equivalent coal energy is discussed. It is shown that total non-electrical energy is equal to 1.852 million tones of coal. If this 1.852 million tones of coal is replaced by natural gas, a total savings of $22.14 million are achieved. The total or partial substitution of coal by the natural gas in the existing industrial processes and modification of redesigning the processes is discussed. (Chetty, S.V.; Reddy, R.G.; Lingras, A.P.; EXTRACTIVE METALLURGY OF COPPER, NICKEL AND COBALT. VOL. I: FUNDAMENTAL ASPECTS, DENVER, COLORADO, USA, 21-25 FEB. 1993, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1993), (Met. A., 9306-72-0325), pp. 1179 [in English].)

0105 THE RECYCLING OF NON-FERROUS METALS. [BIB-199306-42-0795]

With growing emphasis on energy conservation and increased concern over the presence of heavy metals in the environment, it is fortunate that most metals are readily recycled. In this respect, metals have a significant advantage over plastics and similar materials used as metal substitutes. For many years a secondary industry has processed scrap copper, nickel, lead, and zinc to produce refined metal which has, to varying degrees, influenced the price and displaced the production of primary metal. This paper reviews some of the challenges the industry will face and the changes in process technology which will be required as pressure mounts to increase the amount of metal recycled. In the case of most base metals, this will have an impact on primary metal production; as the tonnage of metal recycled increases, the requirement for primary production, or new metal, will depend more and more on the growth in consumption. 18 ref. (Taylor, J.C.; EXTRACTIVE METALLURGY OF COPPER, NICKEL AND COBALT. VOL. I: FUNDAMENTAL ASPECTS, DENVER, COLORADO, USA, 21-25 FEB. 1993, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1993), (Met. A., 9306-72-0325), pp. 1199-1209 [in English].)

0106 USE OF KINETIC PLOTS FOR RELATIVE ASSESSMENT OF REACTOR THROUGHPUT AND ENERGY CONSUMPTION. [BIB-199306-45-0553]

The progress of high-temperature processes is generally described in terms of variation of the degree of conversion (alpha) with time (tau). A procedure is outlined for making use of alpha - tau plots for comparative assessment of productivity and energy requirements for a test system with respect to a reference, on the basis of some simplifying assumptions. It is assumed that the throughput is inversely proportional to reaction time as in the case of batch reactors and plug flow reactors. It is also assumed that the energy requirement is a simple function of process temperature. The principles outlined is illustrated with reference to some laboratory data for reduction of iron oxide by coal. Graphs. 7 ref. (Prakash, S.; Ray, H.S.; Gupta, K.N.; Journal of Thermal Analysis, (Nov. 1992), 38, (11), pp. 2467-2482 [in English]. ISSN 0368-4466)

0107 THE SHEARNESS SHAFT ELECTRIC FURNACE. [BIB-199306-45-0572]

In a conventional arc furnace, 20% of the overall energy requirement is lost with the off-gases. The use of a Fuchs furnace, installed at Shearness Steel, UK, which incorporates a shaft for preheating the scrap, enables approx 60% of energy losses to be recovered. Melting energy requirements are reduced thus shortening the heat cycle and increasing productivity by approx 20%. Energy savings of 70 kwh/tonne of steel are anticipated. Graphs. (Clayton, J.W.; Ehle, J.; Turiselton, J.C.; Knapp, H.; Steel Technology International, (1993), pp. 97-101 [in English]. ISSN 0953-2412)

0108 THE INTELLIGENT ARC FURNACE. [BIB-199306-45-0573]

In 1991, a neural network-based computer called the Intelligent Arc Furnace (IAF) was introduced to control an electric arc furnace. (Neural networks are mathematical models capable of quickly learning complex relationships). Within 30 min, problems in furnace operation never understood by humans were solved. The way in which the IAF system revolutionised electric arc furnace control is examined. Typical cost savings are 6.5% for power usage, 22.5% for electrode usage, and 11.0% in terms of productivity. Graphs. (Staib, W.E.; Steel Technology International, (1993), pp. 103-107 [in English]. ISSN 0953-2412)

0109 ALLOY STEEL INDUSTRY IN INDIA—CONTRIBUTION OF ASP, DURGAPUR AND SALEM STEEL PLANT. [BIB-199306-45-0576]

The role of ASP and Salem steel as leaders in developing an alloy and special steel industry in India is discussed with reference to planning, market studies, and equipment developments. The roles of EAF development, secondary metallurgy techniques in melting, continuous casting, and automation and computerization are discussed. Problems for the industry include shortage of electric power, scrap shortages, poor indigenous refractories, and lack of widespread modern technology and practices. The future is expected to see rationalization of smaller inefficient producers, use of high power furnaces, and continuous upgrading and modernisation of existing good facilities such as those at ASP and Salem. (Dastur, M.N.; Tool and Alloy Steels, (1991), Silver Jubilee Commemoration Volume, pp. 15-19 [in English]. ISSN 0377-9408)

0110 CURRENT STATUS AND COMMERCIAL POTENTIAL OF SMELT REDUCTION TECHNOLOGY. [BIB-199306-45-0591]

References have been made to the current status of smelt reduction technologies advocated many years back and their commercial applications to date. Some of these processes have not been reported upon beyond their earlier laboratory scale and pilot plant operations, and possibly the latter are no longer active or leading to/sustaining any commercial scale implementation. However, submerged arc smelting in shallow open baths of rectangular furnaces with three electrodes has made considerable headway on commercial scale to produce liquid Fe suitable for ladle metallurgy to produce steel. Results of some very recent operations producing high quality low phosphorus liquid pig iron have been referred to using directly reduced/sponge iron fines as the feed in electric submerged arc furnace. The rotary hearth furnace/FASTOMET process for sponge production using iron oxide fines and coal fines and the EOF (energy optimizing furnace) processes have been touched upon as also the Corex process. It is concluded that much patience and caution are required in applying these hybrid technologies on industrial scale operations. 11 ref. (Nijhawan, B.R.; PRODUCTION OF IRON, STEEL, AND HIGH-QUALITY PRODUCT MIX: LATEST TECHNOLOGICAL INNOVATIONS AND PROCESSES, CHICAGO, ILLINOIS, USA, 2-5 NOV. 1992, Publisher: ASM INTERNATIONAL, Materials Park, Ohio 44073-0002, USA, (1992), (Met. A., 9306-72-0310), pp. 227-234 [in English].)

0111 EMERGING STEEL TECHNOLOGIES AND FUTURE IN THE STEEL INDUSTRY. [BIB-199306-45-0592]

The continuing refinements in Fe and steel technologies and the emergence of new technological concepts are attuned to energy optimisation, higher productivity, improved quality, cost-effective production, and zero pollution. The 1990s and the early part of the 21st century will witness further refinements and

technological advances. The bulk of steel production will continue to come from the BF-BOF route. In cokemaking, the trend is toward building energy-efficient, environment-friendly jumbo coke ovens. In ironmaking, the BF is expected to maintain its predominance. The continuing innovations and improvements in BF practice, as well as use of artificial intelligence have given a new lease of life to it, despite the challenges from emerging processes. However, the technological thrust will be on the development of ironmaking processes such as smelt-reduction without using coke. Concurrently, there has been rapid progress in the development of alternative materials, light metals and their alloys as substitutes to steel in many engineering components. However, the development of newer, improved quality steels with special properties will enable steel to retain its predominant position. The steel industry will have to reorient itself to more exciting consumer demands and stringent quality requirements, while remaining cost-effective. Graphs. 20 ref. (Dastur, M.N.; PRODUCTION OF IRON, STEEL, AND HIGH-QUALITY PRODUCT MIX: LATEST TECHNOLOGICAL INNOVATIONS AND PROCESSES, CHICAGO, ILLINOIS, USA, 2-5 NOV. 1992, Publisher: ASM INTERNATIONAL, Materials Park, Ohio 44073-0002, USA, (1992), (Met. A., 9306-72-0310), pp. 241-248 [in English].)

0112 THE DC ARC FURNACE—AN IMPORTANT TOOL IN MODERN STEELMAKING. [BIB-199306-45-0599]

ASEA designed the first dc arc furnace 100 years ago, but it is only in the last five years that it has made a definitive breakthrough worldwide. Advantages of the dc arc furnace include electrode consumption, energy consumption, heat distribution, refractory consumption, metallurgical consumption, maintenance and flicker control. It has been estimated that, taking only the first two advantages into consideration, annual savings of US$2 376 000 are achievable over a comparable ac furnace installation. Reported operational results testify to such benefits and recent innovations are expected to enhance the popularity of the steel dc alternative further. (Stickler, H.; Stenkvist, S.-E.; Steel World, (1992), 1, (4), pp. 30-36, 38 [in English]. ISSN 0964-6264)

0113 APPLICATION OF THE MICRO-DIFFERENTIAL PRESSURE TECHNOLOGY IN THE CONVERTER GAS RECOVERY. [BIB-199306-45-0649]

Practical experience in application of the micro-differential pressure technology to the converter mouth to recover gas from the converter for steel making in Shanghai No. 5 Iron & Steel Works was described and the main factors affecting the automatic-control level were discussed. The practical application results indicated that introduction of this technology can effectively improve the quality and quantity of the gas recovered from the converter and save energy. Graphs. (Liu, Y.M.; Shanghai Jinshu (Shanghai Metals), (Feb. 1993), 15, (1), pp. 51-54 [in Chinese]. ISSN 1001-7208)

0114 INDUSTRIAL EXPERIMENT OF BITUMINOUS COAL INJECTION INTO BF AT ANSHAN IRON AND STEEL CO. [BIB-199306-45-0650]

Experiences and achievements in the industrial experiment of bituminous coal injection into BF Anshan Iron and Steel Co. are summarized. Important technique consists in controls of oxygen concentration and fire-source. An integrated technology system with bituminous coal injection has been formed. This system has completely satisfied the requirements of high volatility bituminous coal injection. During the experiment, the furnace operated smoothly. All technical and economic indexes have been improved. At Anshan Iron and Steel Co., five BFs operate 100% bituminous coal injection, injection rate increases by 30%, output of hot metal increases by 3.6%, coke ratio decreases by 25 kg/t, replacing ratio of coke by coal increases by 0.1-0.2, and cost decreases by 4.12 yuan/ton hot metal. Graphs. (Gao, G.C.; Chen, Z.D.; Tang, Q.H.; Luo, R.Q.; Iron and Steel (China), (July 1992), 27, (7), pp. 13-19 [in Chinese]. ISSN 0449-749X)

0115 AIR ENTRAINMENT RATE OF BROKEN-UP CASTING STREAMS. [BIB-199306-45-0653]

In order to estimate air entrainment rate of broken-up casting streams in molten steel, a mathematical model has been established on the basis of the energy conservation law. Graphs. 6 ref. (Sun, T.W.; Iron and Steel (China), (July 1992), 27, (7), pp. 28-29 [in Chinese]. ISSN 0449-749X)

0116 OPERATION OF 2000 KVA SINGLE ELECTRODE DC SUBMERGED ARC FURNACE. [BIB-199306-45-0654]

The structure, operating state, and environment estimation of 2000 kVA single electrode dc submerged arc furnace for ferrous alloys are described. The effect of dc polarity connection on metallurgical condition is discussed. It is also compared with 3200 kVA three phases ac submerged arc furnace. Design of the 2000 kVA single electrode dc submerged arc furnace is proved successful by one year's operating results. Saving smelting electric energy and decreasing paste consumption have been achieved. Graphs, Photomicrographs. (Liao, S.M.; Jiang, B.Q.; Zheng, T.H.; Iron and Steel (China), (July 1992), 27, (7), pp. 60-63 [in Chinese]. ISSN 0449-749X)

0117 DEVELOPMENT OF BOTTOM-BLOW STIRRING SYSTEM FOR ELECTRIC ARC FURNACE. [BIB-199306-45-0661]

Sanyo Special Steel has introduced the bottom-blow technology into its 160 t continuous electrical arc furnace (70 000 KVA). The structure of various furnaces used during development is described. The arc furnace with bottom blow systems has a solid bottom of 1777 mm in a diameter with three tuyeres, which can be exchanged for a hydraulic pusher. N_2 gas at 88.3 x 10^4 Pa is introduced form tuyeres into liquid steel to form bubbles stirring melts. The bottom-blow equipment of bottom exchange type results in the 100% bottom-blow operation. It can increase the recovery factor of stainless steel (SUS 304) by 1.34% and its productivity by 7.4 t/h and decrease refractory consumption by 4.1 kg/t steel. Graphs. 3 ref. (Kawakami, K.; Tetsu-to-Hagane (Journal of the Iron and Steel Institute of Japan), (Sept. 1992), 78, (9), pp. T161-T164 [in Japanese]. ISSN 0021-1575)

0118 OPTIMIZATION OF ESR SLAG PARAMETERS. [BIB-199306-51-0953]

The theories and practices of optimization of the ESR slag parameters are presented. The production results show that 45% of slag amount can be reduced and 19.4% electric consumption be saved while the steel (e.g. Ni—Cr—Mo steel) quality can still be guaranteed. Therefore, outstanding economic benefits have been achieved. Graphs. 3 ref. (Xu, H.W.; Gao, R.J.; Liu, F.Z.; Shen, F.X.; Shanghai Jinshu (Shanghai Metals), (Feb. 1993), 15, (1), pp. 46-50 [in Chinese]. ISSN 1001-7208)

0119 MAIN PRINCIPLES OF SELECTION OF A RATIONAL ARRANGEMENT OF A CONTINUOUS CASTER— WIDE HOT STRIP MILL COMPLEX. [BIB-199306-51-0975]

Basic schemes for the lay-out of equipment for combining continuous casting installations and strip mills are illustrated, particularly taking account of priority factors such as quality and energy saving. Energy consumption in Russian hot wide strip mills is 1.5 times higher than in Japanese mills. The complex difficulties associated with energy saving in continuous casting installations are discussed. Principles connected with arranging the directions of discharge from the continuous slab caster, the slab storage bays and the rolling mill to optimise transportation, spacing and hot charging are considered. The order of selecting he optimum (as regards heat conservation) lay- out of equipment for transferring the continuous casting slabs to the rolling mill is recommended. (Beigel'zimer, E.E.; Konovalov, Yu.V.; Ostapenko, A.L.; Tishkov, V.Ya.; Nagornyuk, V.M.; Stal', (Nov. 1991), (11), pp. 38-41 [in Russian]. ISSN 0038-920X)

0120 THE EAF BOTTOM GAS INJECTION: A TECHNO-ECONOMICAL EVALUATION. [BIB-199306-51-0986]

The bottom natural gas injection system for EAF has been installed and operated at a sponge iron based production facility. The main benefits observed under different conditions of sponge iron melting are reported. The economic benefits such as lower energy consumption and higher metal scrap yield are described. Graphs. 4 ref. (Camacho-Becerra, J.; Tito-Vanegas, J.; Lule, R.; Vargas-Gutierrez, G.; Maroto-Cabrera, C.; Lazcano-Ponce, A.; PRODUCTION OF IRON, STEEL, AND HIGH-QUALITY PRODUCT MIX: LATEST TECHNOLOGICAL INNOVATIONS AND PROCESSES, CHICAGO, ILLINOIS, USA, 2-5 NOV. 1992, Publisher: ASM INTERNATIONAL, Materials Park, Ohio 44073-0002, USA, (1992), (Met. A., 9306-72-0310), pp. 83-88 [in English].)

0121 EXPANSION OF PC MILL APPLICATIONS TO PLATE MILL AND TANDEM COLD MILL. [BIB-199306-52-0902]

The first PC mills to be used in actual plants were put into operation on all six finishing stands of a 1840 mm hot strip mill at Nippon Steel Corporation's Hirohata Works in 1984. Since then, a total of 36 PC mills have been put into operation or are being constructed not only in Japan but also in other parts of the world. At the moment, the application of PC mill technology is further expanding to such areas as plate mills (e.g. Kimitsu Works, Nippon Steel Corporation) and cold strip mills (e.g. Kashima Works, Sumitomo Metal Industries, Ltd). The specifications and performance of typical PC mills, and an expansion of application to the field of plate rolling and cold strip rolling are described. Graphs. 7 ref. (Nakano, T.; Aratani, H.; Ozono, R.; Tsukamoto, H.; Morimoto, K.; Mitsubishi Heavy Industries Technical Review, (Oct. 1992), 29, (3), pp. 159-164 [in English]. ISSN 0026-6817)

0122 DEVELOPMENT OF ON-LINE ROLL GRINDING SYSTEM WITH PROFILE METER. [BIB-199306-52-0904]

As a technique to make the schedule free rolling (SFR) practical, Mitsubishi Heavy Industries, Ltd. (MHI) has developed a non-driven cup-type on-line roll grinder (ORG) which smooths wear of the work roll on the line. MHI's experiments have proved that the ORG has the basic capabilities required for an on-line roll grinder: high grinding capacity; long grinding wheel life; and appropriate roughness of finished surface. In addition, the ORG is free from welding and dulling and maintains stable grinding characteristics for a long time. MHI has also developed an on-line roll grinding system equipped with an on-line roll profile meter (OPM) which can measure the profile of a revolving roll without contact. The data obtained by these profile meters are fed back to the ORG, thereby increasing its grinding accuracy and allowing it to grind a roll to the required profile. Graphs. 3 ref. (Hayashi, K.; Shimazutsu, H.; Nishizaki, J.; Mitsubishi Heavy Industries Technical Review, (Oct. 1992), 29, (3), pp. 171-176 [in English]. ISSN 0026-6817)

0123 DEVELOPMENT AND APPLICATION OF CERAMIC REGENERATIVE HEAT EXCHANGER. [BIB-199306-52-1024]

A new kind of ceramic regenerative heat exchanger, which is of a novel construction, used in heating furnaces in rolling mills is described. Refractory balls are used as regenerative material. It has an automatic reversing mechanism with pneumatic cylinder driving. It is capable of dedusting and protecting itself. The temperature efficiency is up to 75%. Comparing with conventional heat exchanger, it has the advantages of being compact in volume, lower in cost and easy to maintain. Graphs. 5 ref. (Hou, C.L.; Yang, X.Y.; Iron and Steel (China), (July 1992), 27, (7), pp. 64-67, 63 [in Chinese]. ISSN 0449-749X)

0124 REVAMPING OF REHEATING FURNACE OF HOT STRIP MILL AT WAKAYAMA STEEL WORKS. [BIB-199306-52-1026]

The Wakayama Steel Works, Sumitomo Metal Industries, has used No. 1 reheating furnace (450 t/h) and No. 2 (225 t/h) to replace previous furnaces for hot strip mills to shorten the distance of the reheating furnaces from continuous casters, improve operational flexibility, homogenize heating, and reduce energy consumption. The effective length of the No. 1 and No. 2 reheating furnaces of walking beams is 55 and 31 m, respectively, and the width is 12.7 m. Slabs of 100-270 mm thickness, 650-1970 mm width, and 12 000 mm maximum length can be reheated by axial flow and roof burners in furnaces. The characteristics of the equipment and fuel consumption are illustrated. Graphs. 3 ref. (Kimura, T.; Tetsu-to-Hagane (Journal of the Iron and Steel Institute of Japan), (Sept. 1992), 78, (9), pp. T165-T168 [in Japanese]. ISSN 0021-1575)

0125 IMPROVING THE QUALITY OF THE ROLLED PRODUCT UNDER CONDITIONS OF DEFORMATION AT LOW HEATING TEMPERATURES. [BIB-199306-52-1043]

Under production conditions on a 250 mill using Mn steel, the possibility is indicated of excluding post-rolling heat treatment of wire rod when low temperature austenitising of the feedstock is used combined with accelerated cooling of the rolled product. The principal advantages of low temperature austenitising are reduced fuel consumption in the furnace, low melting losses, stabilisation of the structure, improved ductility of the finished product and a reduction in, or the exclusion of, the heat treatment cycle. The drawbacks involved are increased electricity consumption for driving the rolls and reduced stability of the mechanical equipment of the mill. 13 ref. (Kuznetsov, Yu.V.; Brovkin, V.L.; Ivanova, G.N.; Duduka, V.A.; Stal', (Nov. 1991), (11), pp. 65-67 [in Russian]. ISSN 0038-920X)

0126 HEAT TREATMENT OF BAINITIC CARBON STEEL FOR SPRINGS. [BIB-199306-56-0927]

An experiment to substitute bainitic carbon steel for 60Si2Mn steel in heavy duty helical springs or leaf springs is conducted. The chemical composition of the bainitic steel is 0.44 carbon, 2.54 manganese, 1.18 silicon, 0.037 phosphorus, 0.011 sulfur, and 0.00028 boron. Heat treating improves the mechanical properties of bainitic steel over those of the 60Si2Mn steel. The production study was conducted with a small batch of helical springs made of 16 mm diameter bainite steel rods. The spring dimensions were: outside diameter, 115 mm; length, 315 mm; number of coils, 10.5. The rods were wound into spring at 950 °C , cooled to room temperature, and then tempered at 440 °C for 1 h. Each spring had a hardness of HRC 41-43. The performance test of the springs met all the specifications. Since the bainite steel springs meet the specifications without quenching and subsequent tempering, production energy is saved. The production rate is also increased because there are no rejections due to quench defects (such as cracks, deformation). Photomicrographs. 2 ref. (Yang, Z.R.R.; Wang, X.Y.; Chen, D.M.; Kang, M.K.; Materials for Mechanical Engineering (China), (June 1992), 16, (3), pp. 54-56 [in Chinese]. ISSN 1000-3738)

0127 EXPERIMENTAL METHOD FOR THE DETERMINATION OF THERMAL TRANSMITTANCE OF METALLIC WINDOW FRAMES. [BIB-199306-61-0592]

The heat flow through metallic window frames was studied to calculate their global thermal transmittance. Measurements were made for different kinds of double-glazed window (with 10 mm air gap) with and without thermal barrier and the results are compared. Graphs. 5 ref. (Baleynaud, J.M.; Petit, M.; High Temperatures—High Pressures, (1991), 23, (4), pp. 383-388 [in English]. ISSN 0018-1544)

0128 EARTH ENVIRONMENT AND IRON BASED HEAT-RESISTANT MATERIALS DEVELOPMENT TREND. [BIB-199306-61-0668]

Running-out of fossil fuels, wherein the dependency of energy from fossil fuel resources is critically discussed for the year of 2075-2100; energy resources in the world; meaning of global warming; energy saving strategy wherein energy savings for utility, Fe and steel, automobile industries are discussed; iron-base heat-resistant materials for automobiles; transformation of materials for waste gas discharge in automobiles; high temperature materials (e.g. nodular iron, austenitic and ferritic stainless steels, etc.) for automobile waste gas; fuel oil costs for power plants wherein energy costs for generating powers by coal burning, oil burning, fast-breeder, natural energy, and nuclear energy, and nuclear fusion reactor industries are discussed; and energy saving by ultra-super critical steam condition are described. Graphs. 3 ref. (Asakura, K.; Metals and Technology (Japan), (Nov. 1992), 62, (11), pp. 2-8 [in Japanese]. ISSN 0368-6337)

0129 TECHNOLOGICAL INNOVATIVE RESTRUCTURING OF THE STEEL INDUSTRY IN CENTRAL AND EASTERN EUROPE INCLUDING THE FORMER USSR. [BIB-199306-71-0210]

The paper introduces UNIDO's technical cooperation projects in the iron and steel sector. Many Eastern European countries have turned to UNIDO for technical cooperation and advice. The iron and steel sector is charracterized by obsolete technology, overmanning, and poor performance. It is an area of particular concern. Based on imminent needs, special emphasis will be placed on improving management skills, improving plant profitability, preparing industries for privatization, advising on marketing/sales of products, reducing air and water pollution and utilizing wastes, as well as introducing cleaner technologies and energy conservation measures. Examples of completed, ongoing, and pipeline (planning stage) projects are provided. Though UNIDO is certainly in a position to provide unbiased independent advice which is required by these countries, technical cooperation is restricted by the scarce available funds and donor financing is often the only solution to project approval to help metallurgical industries in central and eastern Europe to survive and become "clean". 1 ref. (Krouzek, J.V.; PRODUCTION OF IRON, STEEL, AND HIGH-QUAL-

ITY PRODUCT MIX: LATEST TECHNOLOGICAL INNOVATIONS AND PROCESSES, CHICAGO, ILLINOIS, USA, 2-5 NOV. 1992, Publisher: ASM INTERNATIONAL, Materials Park, Ohio 44073-0002, USA, (1992), (Met. A., 9306-72-0310), pp. 43-50 [in English].)

0130 CHARACTERISTICS OF HIGH-CARBON HIGH SPEED STEEL ROLLS FOR HOT STRIP MILL. [BIB-199305-31-2086]

In the field of hot strip mill finishing train, the demands for not only high quality of sheet product shape and sheet surface condition but also high productivity and energy saving in rolling are increasing. In this circumstance, new type compound roll which is composed of high-carbon high speed steel of outer shell and forged steel of core material to meet the requirement of high reliability and high wear resistance has been developed completely. After many experiments, the first trial of this new compound high-C high speed steel rolls was made in 1987 in finishing train of hot strip mill. Since then, 150 new compound roll have been used in hot strip mill finishing train. These new compound rolls are contributing to the high productivity of rolling and the improvement of sheet products. Graphs, Photomicrographs. 6 ref. (Sano, Y.; Hattori, T.; Haga, M.; ISIJ International, (Nov. 1992), 32, (11), pp. 1194-1201 [in English]. ISSN 0915-1559)

0131 POSSIBILITY OF REDUCING CO_2 EMISSIONS FROM ALUMINA AND ALUMINUM INDUSTRIES. [BIB-199305-41-0161]

World alumina and aluminum industries emitted CO_2 of 16.6 and 35.9 Mt-C in 1991. This total amount of 52.5 Mt-C/y corresponds to 0.9% of world man-made CO_2. For the stabilization of CO_2 emissions in 2006 at the present level, unit amounts of CO_2 emissions from alumina and Al industries should be reduced by 25%. For this purpose, new technologies to reduce lime and caustic soda consumptions for alumina refinery and a non-consumable anode system should be developed other than energy saving technologies. Graphs. 3 ref. (Yamada, K.; LIGHT METALS 1993, DENVER, COLORADO, USA, 21-25 FEB. 1993, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1992), (Met. A., 9305-72-0288), pp. 61-64 [in English].)

0132 FROM BAYER PROCESS LIQUORS TO BOEHMITE AND, THEN, TO ALUMINA: AN ALTERNATIVE ROUTE FOR ALUMINA PRODUCTION? [BIB-199305-41-0169]

In the Bayer process, the aluminate solutions resulting from bauxite leaching are decomposed at 60 °C yielding aluminium hydroxide (gibbsite, beta -$Al(OH)_3$), which then is calcined to alumina (Al_2O_3). The possibility of precipitating an aluminium oxy-hydroxide (boehmite, gamma -AlOOH) rather than gibbsite is discussed. A thermodynamic analysis of the system reveals that boehmite is the stable phase at temperatures 100 °C , and gibbsite at lower temperatures. Experimental results confirmed that boehmite can be precipitated at 100-150 °C in the presence of large quantities of boehmite seed particles. The first experimental results show that boehmite precipitates at very slow rates. However, the advantage of boehmite precipitation over gibbsite precipitation is the significant energy savings in the subsequent calcination step; energy savings in the order of 20% of the total energy consumption of the Bayer process can be achieved due to the lower enthalpy of boehmite calcination, and the lower quantity of mass that has to be calcined to alumina. Graphs. 16 ref. (Filippou, D.; Paspaliaris, I.; LIGHT METALS 1993, DENVER, COLORADO, USA, 21-25 FEB. 1993, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1992), (Met. A., 9305-72-0288), pp. 119-123 [in English].)

0133 OCCURRENCE STATE OF VALUABLE METALS IN THE EAST PACIFIC OCEAN AREA AND THE WAYS TO RECOVER THEM. [BIB-199305-41-0193]

Occurrence state of such valuable metals as copper, cobalt, and nickel in manganese nodules from the East Pacific Ocean area and new schemes for recovering them using ion flotation are described. Fundamental data of process mineralogy for their beneficiation and metallurgy processes are provided. (Xu, Z.; Cheng, X.; Luo, J.M.; Zhuang, M.F.; Mining and Metallurgical Engineering (China), (Sept. 1992), 12, (3), pp. 24-28 [in Chinese]. ISSN 0253-6099)

0134 THE SIGNIFICANCE OF THE PRICE OF ELECTRICITY FOR INDUSTRY LOCATED IN GERMANY. (DIE BEDEUTUNG DES STROMPREISES FUR DEN INDUSTRIESTANDORT DEUTSCHLAND.) [BIB-199305-42-0581]

Three-fourths of the electricity produced in Germany is consumed by commercial, industrial, and transportation enterprises. In the 1980s, total electricity produced increased by 18.2%. The cost of electric power is an important factor in pricing of electricity-intensive materials, such as Zn and Al. Therefore, the location of extraction facilities for these metals is strongly influenced by the price of electricity. Free trade by an electric power network should be an objective for the European Common Market to benefit all member countries. Graphs. 7 ref. (Ropenack, A.; GERMAN FORUM ON ENERGY SUPPLY IN THE NEXT MILLENIUM—THE ROLE OF NUCLEAR ENERGY, BONN, GERMANY, 29-30 OCT. 1991, Erzmetall, (Nov. 1992), 45, (11), pp. 567-575 [in German]. ISSN 0044-2658)

0135 ABSOLUTE AND SPECIFIC ENERGY DEMAND IN ZINC METALLURGY. (ABSOLUTER UND BEZOGENER ENERGIEEINSATZ IN DER ZINKMETALLURGIE.) [BIB-199305-42-0582]

In the zinc foundry Freiberg (Saxonia), closed by this time, the hydrometallurgical production amounted to 21 kt of Zn yearly. To that a specific energy demand of nearly 40 GJ/t Zn (distributed among seven energy carriers) was necessary; half of it for the thermal processing of residues with low Zn content. An analysis has shown, energy is needed for three purposes: (a) the manifold conversion of ZnS to Zn (main process), (b) the auxiliary processes, necessary for the principal process and the operation of all equipments for own use and the ancillary processes. The positions (a) and (b) are load energy and dependent on flow rate, the position (c) as maintenance energy only at times. The equation of the total energy demand consequently contains two terms, fi for the foundry Freiberg: W_{Ges} 200 + 31 m_{Zn} in TJ/y. Logically the specific energy demand is not constant. Moreover its quantity will be determined whether this value is related to flow rate and moment ($epsilon_p$) or to quantity and period ($epsilon_w$). The value $epsilon_p$ is constantly lower than $epsilon_w$. Energetical comparisons with other foundries or technologies are only valid with restrictions, because the energy contents of the different energy carriers can practically not be added. The energetical analysis has demonstrated, a total energy reduction of nearly 12% (5 GJ/t) is possible. Graphs. 9 ref. (Engshuber, M.; Schulz, V.; Erzmetall, (Nov. 1992), 45, (11), pp. 576-582 [in German]. ISSN 0044-2658)

0136 THE IMPLEMENTATION OF DYNAMIC VOLTAGE OPTIMISATION TO A FULL POTLINE. [BIB-199305-42-0592]

Potline three at the Alcan Kurri Kurri Smelter is a 175 kA end-to-end potline, containing 120 point breaker feed pots. A distributed pot control system was developed over several years on five pots, enabling improvements to be made to the way the pot is scanned and controlled. This enabled a dynamic voltage optimisation strategy to be developed, whereby the pot's anode-cathode distance (ACD) is controlled to the instability of the pot, and not to a target resistance. In 1992, this new control package was implemented on a full potline. The pot's instability level was halved, resulting in significant improvements in current efficiency and energy consumption. Graphs. 1 ref. (Shaw, B.; LIGHT METALS 1993, DENVER, COLORADO, USA, 21-25 FEB. 1993, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1992), (Met. A., 9305-72-0288), pp. 285-289 [in English].)

0137 SOME UNACCOUNTED SOURCES OF HEAT PROMOTING THE RATE RISING OF ALUMINUM ELECTROLZYER INTENSIFICATION. [BIB-199305-42-0655]

Some heat sources contributing to the intensification of aluminum electrolysis that generally are not considered in the thermal balance of Al electrolzyers are examined. In particular, attention is given to a heat source associated with the incorrect calculation of the heat of anode burnout. It is shown that this heat source leads to anode superheating because of the slow heat transfer from the hot zone (anode bottom) to the cold zone (electrolyte bulk and surface). The heat source associated with anode burning during the anode effect is also analyzed. 5 ref.

(Revazyan, A.A.; Izvestiya Vysshikh Uchebnykh Zavedenii, Tsvetnaya Metallurgia, (June 1991), (3), pp. 73-77 [in Russian]. ISSN 0021-3438)

0138 STUDY AND PRACTICE ON TECHNICAL REFORMATION OF SMELTING ALUMINUM REFLECTION FURNACE. [BIB-199305-42-0661]

Technical reformation of smelting aluminum reflection furnace (SAFE) under the guidance of comprehensive heat engineering theory was carried out. The consumption of light diesel oil per ton Al (80 kg/t Al) and heat efficiency of the furnace (26-29%) reached or surpassed the national advanced level for the same kind of furnace. The optimation principle and methods provided, which are about strengthening convection shallowing smelting pond, lowering the chest and top of furnace, optimizing the thickness of furnace's wall and making use of remained heat, have theoretical and practical value for the technical reformation of medium and small sized SARF. 6 ref. (Meng, B.L.; Xiang, D.H.; Fu, Z.H.; Huang, S.H.; Wang, C.S.; Gi, M.Z.; Journal of Central-South Institute of Mining and Metallurgy (China), (June 1992), 23, (6), pp. 681-686 [in Chinese]. ISSN 0253-4347)

0139 THE HEAT BALANCE MODEL OF COKE/PULVERIZED-COAL ADDITION IN CONVERTER STEEL MAKING. [BIB-199305-45-0491]

Excessive heat is needed when large amounts of scrap are used for steel making in an oxygen converter. The best method to increase the heat supply is to add coke or pulverized coal during the blowing process. This paper presents a model of heat balance between the amount of scrap and the required coal or coke. This model can also be used to control phosphorus, and silicon as well as the carbon content in high C steel. The control of oxidation of steel in the later blowing stage at different temperatures is discussed in detail. The effects of coke or coal addition on the Si, manganese, P, and sulfur are also discussed. Graphs. 7 ref. (Chang, Y.; Li, W.; Chen, T.; Technology and Training (Taiwan), (Feb. 1992), 17, (1), pp. 1-7 [in Chinese].)

0140 VERTICAL FLOTATION MELTER. [BIB-199305-51-0711]

The paper shows a new concept in melting shredded material by floating the shreds on a hot gas stream to achieve low metal loss and energy consumption. Described is how the process was developed in University Laboratories and applied to production plant. The University used advanced computer graphics for flow modelling and the flows within the furnace chamber. Compared are performances of vortex melters and induction melting furnaces with that of the new vertical flotation melter. How UBC, foil and various packaging materials can be melted more efficiently than designs that have gone before is shown. Graphs. (Perry, O.H.; LIGHT METALS 1993, DENVER, COLORADO, USA, 21-25 FEB. 1993, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1992), (Met. A., 9305-72-0288), pp. 733-737 [in English].)

0141 ALUMINUM MELTING FURNACES. [BIB-199305-51-0754]

The Machinery Div. of Daido Steel Co., Ltd. has started to supply the large top charge type round Al melting furnaces in Japan, licenced by Gautschi Electro-Fours SA, Taegerwilen, Switzerland. Special features of Gautschi standard design of the furnaces, that are proven in numerous installations throughout the world, are optimum efficiency, high and variable melting rate, ease of operation, low maintenance, high operation rate, and minimum melt loss. This Europe originated furnace design concept has interesting points which differ from that of the US. The important point of the melting process is getting the highest heat transfer ratio from the burner flame jet to the piled up melting material with minimum metal oxidation. Some of the main functions of the furnaces are the sophisticated combustion control and the furnace pressure control for keeping the lowest residual oxygen with high combustion efficiency. The main specifications for typical capacity furnaces are shown in the list. 2 ref. (Mukai, S.; Nakamura, H.; Miyajima, T.; Denki Seiko (Electric Furnace Steel), (Oct. 1992), 63, (4), pp. 317-326 [in Japanese]. ISSN 0011-8389)

0142 COMPARISONS BETWEEN VARIOUS TECHNIQUES SUITABLE TO PRODUCE EQUIVALENT MECHANICAL COMPONENTS ON THE BASIS OF ENVIRONMENTAL IMPACT. INDICATIONS ON THE POSSIBLE ASSESSMENT AND COMPARISON CRITERIA. [BIB-199305-54-0494]

A brief chronicle of the topical problems linked with pollution is reported, allowing to determine a possible way of defining criteria for the comparison between different metallurgical processes. Since a standard for a pollution index is not yet available, an approximate method is proposed which implies the normalizing of various emission factors via the use of TLV/TWA. The pollution linked with the energy content of ferrous items is evaluated through the knowledge of the specific emission factors deriving from the use of fossil combustibles in electrical energy production. The proposed methodology is applied to a typical mechanical component, such as an oil pump gear that can be manufactured, alternatively, through machining or through powder metallurgy. 18 ref. (Bocchini, G.F.; Benedetti, B.; ADVANCES IN POWDER METALLURGY & PARTICULATE MATERIALS—1992. VOL. 4. SECONDARY OPERATIONS, QUALITY, AND STANDARDS, SAN FRANCISCO, CALIFORNIA, USA, 21-26 JUNE 1992, Publisher: METAL POWDER INDUSTRIES FEDERATION, 105 College Rd. East, Princeton, New Jersey 08540-6692, USA, (1992), (Met. A., 9305-72-0271), pp. 135-147 [in English].)

0143 RECENT STATUS OF HEAT TREATMENT TECHNOLOGY IN JAPAN. [BIB-199305-56-0632]

Described are the history and the present status of the heat treatment industry in Japan. On the whole, the percentage of the surface heat treatment has become larger and the industry is aiming at a higher performance of heat treatment and a higher quality of the heat treated products. In the future, the industry will continue to develop a new technology for energy saving and rationalization of the process for an operator-free plant. In addition, new heat treatment technologies which make use of a vacuum atmosphere or ions are expected. Graphs. (Tamura, I.; HEAT & SURFACE '92, KYOTO, JAPAN, 17-20 NOV. 1992, Publisher: JAPAN TECHNICAL INFORMATION SERVICE, Tokyo, Japan, (1992), (Met. A., 9305-72-0258), pp. 13-18 [in English].)

0144 DECADES OF ADVANCEMENT IN SURFACE HEAT-TREATMENT OF AUTOMOTIVE COMPONENTS. [BIB-199305-56-0651]

Japanese automobile industry has raised its reputation in quality, economy and customer satisfaction during past several decades. Surface heat-treatment technologies have supported the advancement of the automotive products in performance and reliability in addition to productivity and energy conservation. The outline of the improvements in heat treatment technologies are summarized, covering furnace design, atmosphere control, steels and quenchant developments necessary for energy conservation and quality assurance in the processes fulfilling the needs of automotive industries and markets. 8 ref. (Funatani, K.; HEAT & SURFACE '92, KYOTO, JAPAN, 17-20 NOV. 1992, Publisher: JAPAN TECHNICAL INFORMATION SERVICE, Tokyo, Japan, (1992), (Met. A., 9305-72-0258), pp. 373-376 [in English].)

0145 HEAT TREATING FURNACE TECHNOLOGY: PRESENT STATUS AND CHALLENGES. [BIB-199305-56-0666]

Three primary problem areas in heat treating are reviewed: environment, manpower utilisation, and product quality. Maintenance of a clean global environment is receiving worldwide attention. This report covers the present situation in Japan. Manpower utilization, the next most important problem to solve, results from increasing labor shortages. Unfortunately, many young workers are reluctant to join the heat treating industry. Finally, overall product quality must be improved. Products of higher strength and less deformation will produce lightweight gears to lower automotive and other fuel consumption. In so doing, CO_2 emissions will be reduced also. Graphs. 14 ref. (Banno, T.; HEAT & SURFACE '92, KYOTO, JAPAN, 17-20 NOV. 1992, Publisher: JAPAN TECHNICAL INFORMATION SERVICE, Tokyo, Japan, (1992), (Met. A., 9305-72-0258), pp. 449-454 [in English].)

0146 ENERGY-SAVINGS AND ANTI-CO_2 MEASURES FOR ATMOSPHERE HEAT TREATMENT—ENERGY AND ENVIRONMENTAL SAFEGUARDS. [BIB-199305-56-0668]

Global environmental safeguards are very important problems. Industries requiring heat treatment consume great quantities of energy. The conventional atmosphere heat treatment is a process that discharges large quantities of CO_2, NO_X, etc. For safeguarding the environment, such atmosphere heat treatment should be replaced with an energy-saving heat treatment process that discharges a small quantity of CO_2 and NO_X. Among atmosphere heat treatments such as bright heat treatment, carburizing, nitrocarburizing, nitriding, and so forth, plasma heat treatment and vacuum heat treatment are superior to normal-pressure atmosphere furnace processes in terms of energy-savings and anti-CO_2 measures. Energy-savings in heat treatment must be achieved by using an integrated energy system including pre-treatment and post-treatment. 7 ref. (Kanetake, N.; HEAT & SURFACE '92, KYOTO, JAPAN, 17-20 NOV. 1992, Publisher: JAPAN TECHNICAL INFORMATION SERVICE, Tokyo, Japan, (1992), (Met. A., 9305-72-0258), pp. 463-466 [in English].)

0147 GAS UTILIZATION TECHNIQUE IN HEAT TREATMENT FURNACE. [BIB-199305-56-0669]

On-site utilization of energy is promoted, for effective utilization of the primary energy. In the case of the central power generation system, the energy utilization efficiency is approx 35%, so energy loss is large. The gas total energy system has been applied to heat treatment, whereby we have successfully produced energy utilization efficiency up to 70-80%. This report relates to the gas total energy system in the heat treatment furnace as electric power energy saving cases. Graphs. (Fujiwara, H.; HEAT & SURFACE '92, KYOTO, JAPAN, 17-20 NOV. 1992, Publisher: JAPAN TECHNICAL INFORMATION SERVICE, Tokyo, Japan, (1992), (Met. A., 9305-72-0258), pp. 467-470 [in English].)

0148 DETERMINATION OF OPTIMAL HEATING TIME WITH COMPUTER AID. [BIB-199305-56-0692]

The determination of heating time is usually contingent on an empirical formula relating to such variables as shape and size of workpieces, load, and heating mode, etc. Though many efforts have been made to optimize such formula, the calculations are still empirical and inaccurate. A technique, based on the principles of heat transfer and computer aid, is proposed for detecting the moment (t_k) when a uniform load temperature has been reached. The technique makes it possible to control heating time directly according to the requirements of phase transformation and microstructure uniformity. This not only simplifies the calculation but guarantees the qualities of heat treatment and averts the waste of energy. Graphs. 3 ref. (Huo, J.-S.; Wang, X.-C.; HEAT & SURFACE '92, KYOTO, JAPAN, 17-20 NOV. 1992, Publisher: JAPAN TECHNICAL INFORMATION SERVICE, Tokyo, Japan, (1992), (Met. A., 9305-72-0258), pp. 601-604 [in English].)

0149 A DEVELOPMENT OF ACC MODEL FOR BILLET REHEATING FURNACE. [BIB-199305-56-0807]

To obtain high quality products and save energy, an automatic combustion control (ACC) model for No. 2 billet reheating furnace was developed by considering geometric characteristics of reheating furnace and analyzing heat transfer between billets and furnace. This model is mainly divided into four-parts: calculating billets temperature, predicting staying time in furnace of billets, predicting extracting temperature of billets, and computing setting value of furnace temperature. By the computer simulation of this model, it is shown that the temperatures of the furnace can be controlled to obtain extract target temperatures and degrees of soaking of billets. Graphs. 5 ref. (Hong, S.C.; Lee, H.Y.; Baek, K.N.; Research Institute of Industrial Science and Technology (Pohang City) Technical Research Report, (Dec. 1992), 14, (48), pp. 603-608 [in Korean].)

0150 NEW BATHS AND TREATMENT PROCEDURES FOR THE NEEDS OF PLASTIC WORKING AND TEMPORARY CORROSION PROTECTION. [BIB-199305-57-0632]

The preparations for phosphating steels, used so far in Poland for the needs of plastic working and temporary corrosion protection, resulted in the formation of thick coats, their production being highly energy- and time-consuming. The newly developed preparations (KL-86, KL-89, KL-90) make it possible to prepare baths operating at lower temperatures and to achieve the formation of thinner layers. The process is thus characterized by a lower consumption of energy and material. Graphs. (Maslankiewicz, E.; Powloki Ochronne, (1992), 20, (1-3), pp. 42-45 [in Polish].)

0151 THE USE OF GAS-FIRED CERAMIC SHEATHED IMMERSION BURNERS IN ZINC BATHS: TEN YEARS ON. [BIB-199305-58-0632]

The attractions of immersion heating of zinc baths have been discussed for many years and, during this time, the gas-fired ceramic immersion tube system developed by British Gas has become widely established around the world for galvanizing, and in the Zn and aluminum industries. Process and Technology Ltd, as part of the Hi-Draw Group, develop and utilize leading technology for their customers and have recognized the benefits of this system. Hi-Draw has been involved with some past installations and have recently been appointed as an additional licensee for British Gas. This paper sets out some of the limitations of kettle and top-heated systems and also how immersion heating can address these. The British Gas immersion heater is then described—both the concepts of the design and how it has performed in practice. Some of the benefits of immersion heating are illustrated by practical examples (wire) from an installation that Hi-Draw has been involved in and another published case study. Graphs. 10 ref. (Rachwal, D.R.; Wood, S.; INTERGALVA 91: 16TH INTERNATIONAL GALVANIZING CONFERENCE, BARCELONA, SPAIN, 2-7 JUNE 1991, Publisher: EUROPEAN GENERAL GALVANIZERS ASSOCIATION, London House, 68 Upper Richmond Rd., Putney, London SW15 2RP, UK, (1991), (Met. A., 9305-72-0296), pp. GC3/1-GC3/11 [in English].)

0152 THE APPLICATION OF COATED TITANIUM ELECTRODES FOR ZINC ELECTROWINNING PROCESSES. [BIB-199307-42-0816]

The electrocatalytic properties of Ti anodes coated with ruthenium oxide were examined for the anodic oxygen evolution in zinc electrowinning processes, and the application of the coated Ti anode along with the modified anodic reaction, Fe^{2+}/Fe^{3+}, for energy saving was also studied. For the existing O evolution process, the coated Ti anodes showed the reduction of anodic potential by approx 0.5-0.8 V. The application of the coated anode with ferrous/ferritic oxidation reduced the anodic potential 1.0 V. In the latter case, anion exchange membrane should be used to avoid the transfer of iron to catholyte, but it caused an increase in the resistance in the cell. The IR drops through the membrane can be reduced by increasing the acidity of electrolytes. The modified process can reduce the energy consumption by 30-40%, compared with the existing process. Graphs. 15 ref. (Jeon, K.S.; Shin, D.Y.; Kang, T.; THE FIRST PACIFIC RIM INTERNATIONAL CONFERENCE ON ADVANCED MATERIALS AND PROCESSING. (PRICM-1), HANGZHOU, CHINA, 23-27 JUNE 1992, Publisher: THE MINERALS, METALS & MATERIALS SOCIETY, 420 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1993), (Met. A., 9307-72-0346), pp. 565-568 [in English].)

0153 STUDY ON NEW TYPE LOW GAS CONSUMPTION SINTERING IGNITOR. [BIB-199307-42-0827]

A brief description of the development of sintering ignitors now used in China and abroad is given. From hot model simulation tests of two new types of sintering ignitor, it is found that the temperature over the sinter bed of the multi-slit ignitor is more uniform and its high temperature zone can be regulated. Owing to its different construction, the temperature at the top of the burner is only 450 °C which is half that of the linear ignitor. Thus, the ignitor life is comparatively increased. Based on the above test, the cold model simulation test has been carried out for determining its optimal construction and operating parameters. Graphs. 2 ref. (Yuan, B.S.; Zhou, Q.D.; Iron and Steel (China), (Nov. 1992), 27, (11), pp. 1-4 [in Chinese]. ISSN 0449-749X)

0154 METALLURGY WITHOUT COKE-DEVELOPMENT OF SMELTING REDUCTION TECHNOLOGY. [BIB-199307-42-0828]

The definition, history, theoretical base, production methods, key problems, domestic and international status, and technical and economical indexes of the metallurgical process without coke-bath reduction technology for production of liquid ferrous alloys are summarized. Some key points such as secondary combustion, heat transfer and effectiveness, lining life, reoxidation prevention, pre-reduction by shaft furnace or fluidization, dedusting-reform-recovery of gas,

rational coordination of final reduction with pre-reduction are briefly discussed. Graphs. 4 ref. (Du, T.; Iron and Steel (China), (Oct. 1992), 27, (10), pp. 65-71, 75 [in Chinese]. ISSN 0449-749X)

0155 ENERGY CONSUMPTION IN THE EXTRACTIVE METALLURGY OF NIOBIUM AND TANTALUM. [BIB-199307-42-0850]

Each stage in the preparation of FeNb, niobium and tantalum from mineral deposits (pyrochlore, tantalite, columbite) involves energy expenditure. For the three metal products, metallurgical flowsheets are presented indicating process routes for alternative technologies. Values of the energy consumed are given for each production step (mining, dressing, Nb/Ta separation, reduction, refining). The preparation of FeNb is far less energy intensive than that of pure Nb or Ta metal. The reduction stage, mostly by consumption of aluminum, is the most expensive. (Paschen, P.; Tantalum-Niobium International Study Center Bulletin, (Mar. 1993), (73), pp. 4-6 [in English]. ISSN 1019-2026)

0156 RECYCLE OF PACKING MATERIALS. III. [BIB-199307-43-0201]

Japan relies on the resources of other countries. More than 90% of energy sources are imported. On the other hand, waste materials have been accumulated for many years and need to be treated. In 1991, a regulation was established to recycle the waste materials. The purpose of the regulation is to reduce waste and to improve living standard. As far as packing materials are concerned, the potential for recycle is very great. As an example, energy cost and environmental impact (pollution, waste water) for production of 50 000 paper bags by different techniques have been examined. The costs of different container manufacture processes, including steel, Al, glass, paper, etc. have also been examined. In addition, raw materials, energy consumption, water consumption, solid waste, waste water, solid waste from consumers, for containers made of PVC, glass, HDPE, paper, LDPE, ABS, Al, HIPS, etc. have been analyzed. Different materials will have different environmental impact. A comprehensive analysis produced quantitative results on many different kinds of containers. Approximately 50% of used papers are recycled in Japan. The recycle rate of Al cans was approx 43% in 1991. Graphs. (Yoshio, O.; Porima Daijesuto (Polymer Digest), (Sept. 1992), 44, (9), pp. 51-60 [in Japanese]. ISSN 0386-3700)

0157 PRODUCTION TEST OF HIGH-CARBON FERROMANGANESE USING A SHAFT FURNACE WITH COKE PACKED BED INJECTED WITH HIGHLY OXYGEN ENRICHED AIR AND A LARGE QUANTITY OF PULVERIZED COAL. [BIB-199307-45-0677]

High-carbon ferromanganese has been produced by electric arc furnace in Japan. But its production cost has increased because of a speedy rising of electricity cost and Japanese ferromanganese has lost competitiveness in the international market. So, for the purpose of decreasing its production cost, high-carbon ferromanganese production tests (production rate 1.9-4.3t/d) were performed using a melting tests furnace with coke packed bed injected with highly oxygen-enriched air and a large quantity of pulverized coal. Moreover the operation indices of a commercial plant of 170t/d in production capacity were estimated by heat and mass balance model, and following results were obtained. (1) In this test, high-carbon ferromanganese of Mn 75% was produced stably using the coke blended with 56% non-coking coal, with coal rate of 1087 kg/t and productivity of 3.11 t/(d.m^3). (2) The total coal consumption of the commercial plant of this method is estimated to be less than that of the blast furnace in spite of higher fuel rate because a large quantity of pulverized coal is used in this process. Through these investigations, this process seems to have a prospect of being available as a ferromanganese production process instead of electric furnace method. Photomicrographs, Graphs. 13 ref. (Kamei, Y.; Miyazaki, T.; Yamaoka, H.; ISIJ International, (Feb. 1993), 33, (2), pp. 259-266 [in English]. ISSN 0915-1559)

0158 INVESTIGATION OF SCHEELITE INSTEAD OF FERROTUNGSTEN IN STEELMAKING. [BIB-199307-45-0691]

The fundamental theory, addition methods, optimal addition weight of scheelite instead of ferrotungsten in steelmaking, and the yield of tungsten and the influence of using scheelite on the quality and the properties of steel (e.g. W18Cr4V, 3Cr2W8V, or M2 high speed tool steel) are described. Results show that the optimal addition weight of scheelite is 5% W, the yield of W is approx 98% and the economic and social benefits are obvious, on the premise of having no influence on heat time and power consumption. Graphs. 11 ref. (Chen, Z.X.; Li, J.R.; Iron and Steel (China), (Nov. 1992), 27, (11), pp. 15-18, 4 [in Chinese]. ISSN 0449-749X)

0159 PROGRESS AND PROSPECT OF IRONMAKING TECHNOLOGY IN SHANGHAI BAOSHAN IRON AND STEEL COMPLEX. [BIB-199307-45-0692]

Started in September 1985, the complex achieved design aims and improved successively. Then, the first project of the ironmaking plant of Baoshan Iron and Steel Complex acquired essential technological progress and produced data. Several of the newest techniques in the world have been incorporated in the second stage. The techniques applied in the first and new techniques in the second stage are described. Some problems which must be solved in this decade are suggested. (Dai, Y.J.; Iron and Steel (China), (Nov. 1992), 27, (11), pp. 53-58, 32 [in Chinese]. ISSN 0449-749X)

0160 CA—SI WIRE FEEDING PROCESS IN 20 T LADLE. [BIB-199307-45-0699]

The results of 109 heats in Ca—Si wire feeding tests which were carried out in a 20 t ladle at Shanghai No.5 Steel Works are described. With the wire feeding process, steel casting performance has been improved, and calcium-yield, removal of inclusions, and degree of globular inclusions have been increased, thus mechanical properties of steel have been improved. Comparing with powder injection process, production cost of the process is reduced by 5.8 yuan/t. Graphs, Photomicrographs. 6 ref. (Liu, X.L.; Pan, X.Y.; Zhang, H.J.; Xu, Z.Y.; Liu, H.T.; Sun, X.X.; Iron and Steel (China), (Aug. 1992), 27, (8), pp. 17-21, 11 [in Chinese]. ISSN 0449-749X)

0161 TRIAL PRODUCTION AND APPLICATION OF AL—SI—FE COMPLEX DEOXIDIZER FOR STEELMAKING. [BIB-199307-45-0701]

The trial's production technology and trial application of Al—Si—Fe complex deoxidizer for steelmaking process are introduced. The results show that Al—Si—Fe alloy not only can take the place of aluminum metal equivalently as a deoxidizer but also can improved deoxidation efficiency, reduce inclusions in steel, (e.g. killed steels), and improve steel purity. It provides many economic benefits and is worth popularizing. 5 ref. (Liu, L.; Iron and Steel (China), (Aug. 1992), 27, (8), pp. 26-29 [in Chinese]. ISSN 0449-749X)

0162 EXPLORING THE POTENTIAL OF EAF PROCESS CONTROL. [BIB-199307-45-0703]

Process Corp has presented a proposal to the Department of Energy for funding electric arc furnace development. The goal is to increase capacity by 20% without increasing the electrical energy consumption. For carbon steel, the saving is $20.00/ton. The development will be done at the Northwestern Steel and Wire 32 ft diameter furnace. This effort will use intelligent process control systems to improve efficiency and reduce consumable consumption. Also, the computer control system will improve operator training and maintenance practices. The goals are to reduce down time from 5-8% to 1.5%. Also, computer based expert diagnostic systems will reduce the 35% employment costs to 5% for maintenance functions. Graphs. (Huskonen, W.D.; Thirty-Three (33) Metal Producing, (Dec. 1992), 30, (12), pp. 20-23 [in English]. ISSN 0149-1210)

0163 ENERGY MANAGEMENT IN SPECIALTY STEELMAKING. [BIB-199307-45-0727]

Sound energy management has enabled Atlas Specialty Steels, a Canadian producer of stainless and high alloy steels to reduce operating costs. Changing from peak to off-peak operation has been the main point of this energy cost savings. A liberal labor agreement was the key to implementing this change. Changing traditional ways of doing business are becoming necessary in the present economic environment. This change in philosophy has saved $2 million in annual operating costs. The reduced cost of electricity from Ontario Hydro at off-peak hours is the major reason for the cost reduction. The global recession has resulted in a drop in production from 240 000 to 120 000 tons of specialty steel. Other cost cutting measures ranging from more efficient lighting to more efficient motors have also been implemented to save electrical costs. There are

five pollution control bag electric motors that consume 3200 horsepower, that represent another potential energy cost saving. (Moody, F.; Eng. Dig. (Canada), (Feb. 1992), 38, (1), pp. 17-19 [in English]. ISSN 0013-7901)

0164 STIRRING TECHNOLOGY OF BOTTOM BLOWING GAS IN EAF. [BIB-199307-45-0731]

Based on the development and application of the bottom blown EAF, its principles, characteristics, patterns, and achievements of the bottom blown EAF are introduced. The technical and economic benefits of the bottom blown EAF steelmaking are also analysed and discussed. Graphs. 7 ref. (He, P.; Zhang, D.M.; Deng, K.W.; Zhang, R.S.; Wang, Q.K.; Iron and Steel (China), (Sept. 1992), 27, (9), pp. 65-70 [in Chinese]. ISSN 0449-749X)

0165 THE ALLOYING OF STEELS AND ALLOYS WITH NITROGEN DIRECTLY FROM THE GAS PHASE. [BIB-199307-45-0751]

The application of two heat sources, i.e. electric arc (or plasma) and slag pool, is indicated to be rather reasonable for SHNS production from the point of view of electric energy saving. In PASR there is no need to inject expensive nitrogen-containing hard additions. The realization of the PASR process in industrial production of super-high nitrogen steels, such as Kh21T7AH5 and Kh25H16T7AP, is associated with the adaptation of known equipment used for electroslag remelting under pressure or with the manufacturing of special furnaces for PASR. Graphs, Photomicrographs. 9 ref. (Medovar, B.I.; Sayenko, V.Y.; Pomarin, Y.M.; Riabinin, V.A.; Velichko, O.A.; 1991 VACUUM METALLURGY CONFERENCE ON THE MELTING AND PROCESSING OF SPECIALTY MATERIALS, ATLANTA, GEORGIA, USA, 17-19 MAR. 1991, Publisher: IRON AND STEEL SOCIETY, INC., 410 Commonwealth Dr., Warrendale, Pennsylvania 15086, USA, (1992), (Met. A., 9307-72-0377), pp. 109-112 [in English].)

0166 MINI-STRATEGY OF THE VSZ KOSICE: A JOINT STOCK COMPANY EVOLUTION. [BIB-199307-45-0766]

Strategic aims of the VSZ Kosice, a producer of flat products, through 1995 include the reduction of energy consumption from 24.4 GJ/t to 20-21 GJ/t of steel, and steel consumption from 1210 kg/t to 1130 kg/t of rolled material. Progressive technologies during pig iron production, steel production, and hot and cold rolling ensuring an increase in steel cleanliness and improvement of rolled-material dimensional accuracy are introduced. (Berghauer, Z.; Hutnicke Listy, (July-Aug. 1992), 47, (7-8), pp. 5-7 [in Slovak]. ISSN 0018-8069)

0167 AUTOMATIC CASTING INSTALLATION "MELPOUR SYSTEM". [BIB-199307-51-1083]

An automatic casting installation was developed which features a direct casting weight calculation by inclined casting method, accurate casting motions all around with the casting mould line, and using the teaching play back pattern for repetition performance when an order has been singly put in. The installation is safe, reliable, and economical. Further improvement will be made according to casting site situations in the future. Casting of iron is discussed. (Satoh, J.; Yoshida, K.; Kogyo Kanetsu (Industrial Heating), (July 1992), 29, (4), pp. 19-27 [in Japanese]. ISSN 0454-1499)

0168 RECONSTRUCTION PLAN OF A GEAR FORGING SHOP TO SAVE METAL AND ENERGY. [BIB-199307-52-1202]

Measures to save metals and energy have been taken at a plant producing 3450 tons of parts from 3900 tons of steel. The measures are listed as follows: (1) in blank preparation, band saws and cold shears replace the circular saws and sash saws; (2) during heating, silicon-controlled mid-frequency induction heating replaces coal heating; (3) friction forging presses replace steam hammers; (4) air hammers are used only for small quantity productions; and (5) residue forging heat is utilized for annealing. A process to utilize these measures is presented. After the improvement, the material utilization rate increases from 40 to 50%. The energy savings amounts to 8%. The coal saving amounts to approx 1991 tons/year. The consumption of die steel drops from 18-20 kg/ton of product to 15 kg/ton. 3 ref. (Luo, Q.L.; Metalforming Machinery (China), (Aug. 1991), 26, (4), pp. 34-38 [in Chinese]. ISSN 1001-1951)

0169 OPTIMIZING REHEATING FURNACES IN ROLLING MILLS. [BIB-199307-52-1211]

Optimum parameters for pipe heating in the reheating furnace in Zeljezari Sisak are defined using a mathematical model. The algorithm of heat transfer in the reheating furnace is schematically described. The mathematical model was verified for three heating conditions—the pipe pass speeds of 0.625 m/s, 0.526 m/s, and optimized heating conditions at the pipe pass speed of 0.625 m/s. It has been found that model describes actual heating process with relatively high accuracy. At the pipe pass speed of 0.625 m/s corresponding to the furnace average capacity of 24.5 t/h, 8.9% of fuel has been saved due to optimizing the reheating process. Graphs. 5 ref. (Lazic, L.; Hutnicke Listy, (Sept. 1992), 47, (9), pp. 38-42 [in Slovak]. ISSN 0018-8069)

0170 A NEW TECHNIQUE OF REDUCING TUBE WITH ROLLER DIES. [BIB-199307-52-1220]

Reducing tube through roller dies is a new technique in seamless steel tube production. Compared with conventional die drawing method, the friction, velocity, and deformation condition in the deformation region have changed essentially. Nonuniform deformation and friction between metal and tool has been improved; therefore, residual stress is reduced. This new technique decreases power consumption, simplifies procedure, and omits lubricating process. Graphs. (Li, L.S.; Wang, L.W.; Iron and Steel (China), (Oct. 1992), 27, (10), pp. 35-37, 20 [in Chinese]. ISSN 0449-749X)

0171 APPLICATION OF GASIFIED OIL LUBRICATION TO CONTINUOUS COLD MILL. [BIB-199307-52-1238]

The gasified oil lubricated bearing has a series of advantages over the usual oil lubricated ones improving working condition, elevating rotary speed, intensifying cooling effect, saving energy and oil, and reducing environment pollution. Application of the gasified oil lubrication to continuous cold mill for rolling of steels shows that this technique may serve as the major direction for roll bearing lubrication and will be popularized. 4 ref. (Wang, B.Y.; Iron and Steel (China), (Aug. 1992), 27, (8), pp. 66-68 [in Chinese]. ISSN 0449-749X)

0172 USE OF WELDING TTT-DIAGRAMS TO OPTIMISE THE ENERGY INPUT DURING WELDING OF CAST STEEL. [BIB-199307-55-1259]

Previously abstracted from original as item 9102-55-0349. The use of TTT diagrams facilitates the welding of steel. Such diagrams were made for unalloyed casting steels C25 and C40 through C60. The diagrams with applicable mechanical property data are used to determine preheating and cooling rates. Cooling rates are recommended for various carbon contents. A table compares preheating temperatures used in Germany, FRG, UK, and Switzerland. Graphs. (Scharff, A.; Welding International, (1991), 5, (10), pp. 820-822 [in English]. ISSN 0950-7116)

0173 THE DEVELOPMENT OF ION-NITRIDING TECHNOLOGY. [BIB-199307-56-1000]

The 30-year development history and recent status of the research and application of the ion-nitriding technology in China are introduced. The advantages of the process are reviewed, indicating: high resistances to wear, corrosion, and fatigue for the treated parts; the high proficiency; low energy consumption; and good dimension stability and working condition. Some technological measures for improving the process facility and process parameters control system, the element composition and microstructure of the nitrided layer, and the selection of the base materials are discussed. The trend of the future application for the new technology is presented. Ion nitriding can be used for carbon steels, alloy steels, tool steels, stainless steels, cast iron, titanium base alloys, etc. (Chen, W.; Liu, M.C.; Heat Treatment of Metals (China), (May 1992), (5), pp. 11-13, 27 [in Chinese]. ISSN 0254-6051)

0174 DESIGN AND PRACTICE OF A NEW TYPE OF COAL-HEATED ANNEALING FURNACE WITH MACHINERY GRATES. [BIB-199307-56-1071]

The design of a new type furnace in which the heat supply method and structure has been changed from customary coal-heated furnace. A secondary combustion or mixing chamber is attached, pure fibre roof and secondary air forced heat

supply method is also used. The furnace has a series of advantages over the others of the same kind and has reached the service level of gas-heated furnace in the two year production and practice. Annealing of strip steel is discussed. (Zhang, K.M.; Iron and Steel (China), (Sept. 1992), 27, (9), pp. 56-59 [in Chinese]. ISSN 0449-749X)

0175 TECHNOLOGY OF FIPS MAT BURNER. [BIB-199307-56-1075]

A survey covers structures, characteristics, and current applications of FIPS mat burner. The burner is made of a mat of high porosity by laminating and sintering long heat resistant metal fibers (e.g. SUS 316, Hastelloy, or Inconel 600). There is a red heat layer on the burner's surface when burning. The burner is more energy saving, safer, cleaner, and smaller in volume than the conventional one, and has been used in industrial and household heatings. Heating of steel pipe is discussed. Photomicrographs, Graphs. 7 ref. (Nakamura, S.; Kogyo Kanetsu (Industrial Heating), (July 1992), 29, (4), pp. 28-38 [in Japanese]. ISSN 0454-1499)

0176 GSPS-80 TYPE HIGH PRESSURE WATER SAND-BLASTER. [BIB-199307-57-0933]

The new high pressure water sand-blaster recently developed which is suitable for the rapid cleaning of metal parts surfaces, using 10-12 MPa water pressure and 1.2-0.1 mm size sand is presented. The working principle of the blaster is briefly introduced, and the working system is diagrammatically described. The comparison of the new cleaning technique with the traditional method (pressured air sand blaster) was experimentally conducted, showing the advantages of the new technique with better working condition, higher efficiency, lower energy consumption, and product cost. Some effective and convenient methods for protection of the cleaned metals parts surfaces are provided. (Li, Z.P.; Mao, G.T.; Xia, J.F.; Ding, F.B.; Heat Treatment of Metals (China), (May 1992), (5), pp. 55-56 [in Chinese]. ISSN 0254-6051)

0177 THE HISTORY OF PROGRESS IN DIMENSIONALLY STABLE ANODES. [BIB-199307-58-0825]

This article provides a brief history of dimensionally stable anodes by reviewing innovations in the chlor-alkali industry, electroplating and electrogalvanizing, and electrowinning. these anodes are attractive for numerous reasons (e.g. long life and reduced energy consumption), but they must still overcome the hurdle of cost to gain wider acceptance for applications in the metallurgical process industries. 50 ref. (Duby, P.; JOM, (Mar. 1993), 45, (3), pp. 41-43 [in English]. ISSN 0148-6608)

0178 ANALYSIS OF SLAB HEATING IN THE PUSH FURNACE. [BIB-199307-61-0851]

Factors influencing external and internal heat exchanges are mentioned. A mathematical model for determining heat flow impinged on a slab surface is introduced. The heat field in a low-carbon steel slab of 800 x 1540 x 200 mm, weighing 15.5 t was measured by the equipment TERMOPHIL, and temperature values were registered in 1 min intervals. Reduction of energy consumption is discussed based on the heat-field analysis. Graphs. 4 ref. (Varga, A.; Hutnicke Listy, (July-Aug. 1992), 47, (7-8), pp. 72-76 [in Slovak]. ISSN 0018-8069)

0179 GAS UTILIZATION RATIO OF IRON ORE REDUCTION IN FLUIDIZED BED. [BIB-199308-42-0898]

Simulation tests were made to investigate the starting out-of-flow temperature due to sticking and the influence of airflow speed on it during iron ore reduction in fluidized bed. The influences of reducing temperature and airflow speed on the gas utilization ratio were thus found through model calculation using experimental data. Based on these results, the way for improving gas utilization ratio was discussed in combination with the conditions under which lowering the total energy consumption in smelting-reduction process is possible. Graphs. 6 ref. (Fang, J.; Gudenau, H.W.; Hirata, T.; Journal of Northeast University of Technology (China), (Oct. 1992), 13, (5), pp. 446-450 [in Chinese]. ISSN 0253-4258)

0180 TESTING FOR THE VERIFICATION OF METHODS TO DECREASE THE SPECIFIC ENERGY CONSUMPTION IN ZINC ELECTROLYSIS. (UBERPRUFUNG VON VORSCHLAGEN ZUR SENKUNG DES SPEZIFISCHEN ENERGIEBEDARFS BEI DER ZINKELEKTROLYSE.) [BIB-199308-42-0904]

Electrolytic metal recovery processes have high specific energy consumption amounting for zinc electrolysis between 2700-3600 kWh/ton of Zn. These values are affected by bath voltage and cathodic current. Newer developments concentrate on the effect of anode potential. Literature data are compared to experimental investigation of the effects of organic depolarizers, and alternative anode reactions using a 6 dm^3 laboratory cell with Pb—Ag anodes. Graphs. 14 ref. (Lange, H.-J.; Hein, K.; Bombach, H.; Neue Hutte, (Aug. 1991), 36, (8), pp. 304-307 [in German]. ISSN 0028-3207)

0181 IMPROVING TECHNOLOGY FOR PRODUCTION OF NIOBIUM IN ELECTRON BEAM FURNACES. [BIB-199308-42-0911]

A mathematical simulation method for degassing liquid metal is discussed which is based on technological parameters optimised for enhancing the productivity of Nb by reduction melting of niobium pentoxide followed by electron beam remelting to remove impurities. The proposed model is based on nitrogen removal up to 0.01% and the number of remelting cycles required for efficient refining of the metal. Based on the results of melts after remelting, the yield of metal after quadruple electron beam remelting increased by 2% while the productivity of electron beam equipment was up by 20% with reduction in specific consumption of electrical energy by 30%. 8 ref. (Tikhonovskii, A.L.; Anokhin, S.V.; Tur, A.A.; Averbukh, Yu.E.; Kobozev, V.N.; Kogtev, M.A.; Shcherbakov, E.A.; Problemy Spetsial'noi Elektrometallurgii, (1991), (3), pp. 73-78 [in Russian]. ISSN 0233-7681)

0182 IMPROVING TECHNOLOGY FOR PRODUCTION OF NIOBIUM IN ELECTRON BEAM FURNACES. [BIB-199308-42-0912]

See adjacent abstract. A mathematical simulation method for degassing liquid metal is discussed which is based on technological parameters optimised for enhancing the productivity of Nb by reduction melting of niobium pentoxide followed by electron beam remelting to remove impurities. The proposed model is based on nitrogen removal up to 0.01% and the number of remelting cycles required for efficient refining of the metal. Based on the results of melts after remelting, the yield of metal after quadruple electron beam remelting increased by 2% while the productivity of electron beam equipment was up by 20% with reduction in specific consumption of electrical energy by 30%. (Tikhonovskii, A.L.; Anokhin, S.V.; Tur, A.A.; Averbukh, Yu.E.; Kobozev, V.N.; Kogtev, M.A.; Shcherbakov, E.A.; Advances in Special Electrometallurgy (USSR), (July-Sept. 1991), 7, (3), pp. 207-210 [in English]. ISSN 0267-4009)

0183 THE BALANCED OXYGEN BLAST FURNACE COMPARED WITH OTHER ALTERNATIVES FOR HOT METAL PRODUCTION. [BIB-199308-42-0935]

Emanating from the efforts to substitute coke with coal injection, modifications of the blast furnace process have been suggested: the full oxygen and the balanced O blast furnace processes. Smelting reduction processes avoid the costly and environmentally objectionable coking and ore agglomeration. The latest developments in blast furnace operation and smelting reduction processes are discussed, mainly with respect to energy type, consumption, and utilization. Comparisons are made both for conversion of existing ironmaking facilities and greenfield establishment. The first full scale smelting reduction process, the shaft-type process COREX, is in operation, but a real breakthrough will probably not appear until the last years of this century. In-bath smelting processes are under development; it is unlikely they will reach a commercial scale before the beginning of the next century. Meanwhile, the suggested improvements in the blast furnace process are a promising way to decrease the coke consumption and operating costs considerably. Graphs. 44 ref. (Edstrom, J.O.; Scheele, J.; Scandinavian Journal of Metallurgy, (Feb. 1993), 22, (1), pp. 2-16 [in English]. ISSN 0371-0459)

0184 PRODUCTION TEST OF HIGH-CARBON FERROMANGANESE USING A SHAFT TYPE FURNACE WITH COKE PACKED BED INJECTED WITH HIGHLY OXYGEN-ENRICHED AIR AND A LARGE QUANTITY OF PULVERIZED COAL. [BIB-199308-42-0941]

High carbon ferromanganese has been produced by electric arc furnace in Japan, but its production costs has increased because electricity cost have risen quickly and Japanese ferromanganese has lost competitiveness in the international market. So, for the purpose of decreasing its production cost, high C ferromanganese production tests (production rate 1.9-4.3 t/day) were performed using a melting test furnace with coke-packed bed injected with highly oxygen-enriched air and a large quantity of pulverized coal. Moreover the operation indices of a commercial plant of 170 t/day in production capacity were estimated by heat and mass balance model, and the following results were obtained: In this test, high C ferromanganese of manganese 75% was produced stably using the coke blended with 56% non-coking coal, with coal rate of 1502 kg/t, coke rate of 1087 kg/t, and productivity of 3.11 t/(d . m^3); and the total coal consumption of the commercial plant of this method is estimated to be less than that of the blast furnace, in spite of higher fuel rate, because a large quantity of pulverized coal is used in this process. Through these investigations, this process seems to have a prospect of being available as a ferromanganese production process instead of electric furnace method. Graphs, Photomicrographs. 13 ref. (Kamei, Y.; Miyazaki, T.; Yamoaka, H.; Tetsu-to-Hagane (Journal of the Iron and Steel Institute of Japan), (Apr. 1993), 79, (4), pp. 449-455 [in Japanese]. ISSN 0021-1575)

0185 PRODUCTION TEST OF HIGH-CARBON FERROCHROME USING A SHAFT TYPE FURNACE WITH COKE PACKED BED INJECTED WITH HIGHLY OXYGEN-ENRICHED AIR AND A LARGE QUANTITY OF PULVERIZED COAL. [BIB-199308-42-0942]

High carbon ferrochrome has been produced by electric arc furnace in Japan. But its production cost has increased because electricity costs have risen quickly and Japanese ferrochrome has lost competitiveness in the international market. So, for the purpose of decreasing its production cost, high C ferrochrome production test (production rate 50-110 kg/h) were preformed using a melting test furnace with coke-packed bed injected with higher oxygen-enriched air and a large quantity of pulverized coal. Moreover the operation indices of a commercial plant of 35 t/day in production capacity were estimated, and the following results were obtained. It was confirmed that the reduction and melt down rate of chromium ore sinter were superior to that of Cr ore pellet, and the favorable characteristics of Cr ore sinter were obtained as follows: CaO/SiO_2 1.0-1.3, slag weight 1100-1300 kg/t-(Cr+Fe); It was confirmed that the fuel rate and productivity could be improved under stable operation by using the chromium ore sinter; and the fuel rate of the commercial plant of this process using Cr ore sinter was estimated to be 1967 kg/t in the case of Cr 52.2% with less net energy consumption than that of EAF. Graphs. 17 ref. (Kamei, Y.; Miyazaki, T.; Yamaoka, H.; Tetsu-to-Hagane (Journal of the Iron and Steel Institute of Japan), (Apr. 1993), 79, (4), pp. 456-463 [in Japanese]. ISSN 0021-1575)

0186 DEVELOPMENTS IN THE IRON AND STEEL INDUSTRY. I. (ENTWICKLUNGEN IN DER EISEN- UND STAHLINDUSTRIES. I.) [BIB-199308-45-0768]

The major iron-making processes are reviewed. Developments of the blast furnace are covered, including a graph on number of furnaces in Germany over the period of 1960-1988, numbers of furnaces against diameter groupings, relative fuels and their consumption patterns (coke, oil, and coal), and trends in slag composition. Processes in which iron is produced by direct reduction, (AISI/DOS Process) are also described. The use of oxygen is discussed. Graphs. (Meichsner, W.; Neue Hutte, (Mar. 1992), 37, (3), pp. 81-88 [in German]. ISSN 0028-3207)

0187 HARMONIC ANALYSIS IN ELECTRIC ARC FURNACE STEELMAKING FACILITIES. [BIB-199308-45-0771]

A properly designed electrical supply system is necessary for reliable, efficient operation of steel manufacturing facilities. Many loads in these facilities are large Mw rated loads, produce harmonic voltages and currents, and run with low power factors. The large Mva ratings can also result in system voltage depression. Power factor correction with capacitors is essential to support system voltage and reduce penalties imposed by utility companies. Correcting power factor also reduces real power losses in the system. Applying capacitors in a harmonic environment can be accomplished with thorough analysis prior to installation. Field measurements are useful in the analysis, providing input data and information to validate system models. Harmonic analysis can provide filter parameters that avoid problems and yet allow all the benefits of a capacitor bank alone. The results are reduced THD on the system, higher bus voltage, improved plant power factor and elimination of power factor penalties. Elimination of utility penalties can sometimes pay for the studies and equipment in a short time. Improvements to plant productivity, however, are the real payoff. Graphs. 8 ref. (Gilker, C.; Mendis, S.R.; Bishop, M.T.; Iron and Steel Engineer, (May 1993), 70, (5), pp. 40-44 [in English]. ISSN 0021-1559)

0188 REEMERGENCE OF DC ELECTRIC ARC FURNACE IN STEEL INDUSTRY. [BIB-199308-45-0801]

AC electric arc furnace steelmaking has been in practice over the last century and a large tonnage of quality steel is produced by the process. A number of problems, however, are associated with the process. Recent studies using direct current in steel melting have demonstrated a number of merits with the dc type furnace. The current state of development of dc furnace is discussed considering several important aspects, e.g. construction, melting, arc stability, voltage flickering, electrode consumption, etc. Because of its non-pulsating nature, the dc arc is a stable one, unlike the ac arc, and spreads uniformly hitting the liquid bath at 15-30 °. The voltage flicker value is also much less in dc type because of the change in arc change in arc voltage. A homogeneous liquid bath forms around the electrode during melting without any cold spots as in case of ac EAF. In dc type furnace the electrode consumption rate is lower by 50% as compared to ac EAF. There has been a recent trend to revamp the ac furnace to dc type and the revamping procedure is also discussed. Finally, a few drawbacks of dc EAF are also outlined. 14 ref. (Kumar, A.N.; Bhowmick, S.; Bhattacharya, S.; Tool and Alloy Steels, (Nov. 1992), 26, (11), pp. 325-329 [in English]. ISSN 0377-9408)

0189 OXYGEN BURNERS AS AUXILIARY RESOURCES TO ELECTRIC MELTING PROCESSES. (UTILIZACAO DE QUEIMADORES A OXIGENIO COMO AUXILIARES DOS PROCESSOS DE FUSAO.) [BIB-199308-45-0829]

The use of oxy-fuel burners as auxiliary tools for scrap melting, extensively used in Europe, USA, and Japan, presents noticeable advantages to production, such as: reduction of dependence on electric energy; reduction of electric power consumption; cost reduction; electrode consumption reduction; and other performance improvements. A number of conditions for improved equipment utilization are presented. Graphs. 3 ref. (Chevrand, L.J.d.S.; Metalurgia & Materiais ABM, (Nov. 1992), 48, (411), pp. 711-715 [in Spanish]. ISSN 0026-0983)

0190 THE DRYING AND HEATING EQUIPMENT OF MONOLITHIC LADLE REFRACTORY. [BIB-199308-45-0832]

To rationalize the repairing work of steel-making ladles which requires skill and hard labor, surface layers of ladles were covered by monolithic refractories instead of brick lining. To prevent breakage, the slow drying is necessary and the drying and heating equipments for effective drying and heating were developed and they were installed in April 1992. They could shorten heating time appreciably and could reduce the fuel consumption to 38% compared to the conventional method. Graphs. (Odawara, R.; Tetsu-to-Hagane (Journal of the Iron and Steel Institute of Japan), (Feb. 1993), 79, (2), pp. T13-T16 [in Japanese]. ISSN 0021-1575)

0191 SCRAPMELTING USING A SHAFT TYPE FURNACE WITH COKE PACKED BED INJECTED WITH HIGHLY OXYGEN ENRICHED AIR AND A LARGE QUANTITY OF PULVERIZED COAL. [BIB-199308-45-0833]

A scrapmelting test was performed using an experimental melting furnace with a coke packed bed injected with highly oxygen enriched air and a large quantity of pulverized coal, and the following results were obtained: (1) Scrap (100% of material) was able to be melted by using coke for blast furnace. (2) The pig iron whose quality is equal to that of the blast furnace can be produced with high carburization and high desulfurization. (3) The fuel rate of 240-290 kg/t and productivity of 14.7 t/d/m^3 were obtained. (4) The fuel rate can be decreased and productivity can be increased by post combustion with air injection from the shaft wall. Based on the above mentioned results, the comparison of energy

consumption of scrap melting process such as this process, was the least among them. Therefore, it is concluded that this process can be one of the attractive scrap melting methods when the scrap utilization is required in large quantities. Graphs. 10 ref. (Kamei, Y.; Miyazaki, T.; Yamaoka, H.; Tetsu-to-Hagane (Journal of the Iron and Steel Institute of Japan), (Feb. 1993), 79, (2), pp. 139-146 [in Japanese]. ISSN 0021-1575)

0192 ENERGY SAVINGS IN METALLURGICAL FURNACES: REGENERATIVE BURNERS AND OXYGEN-ENRICHED COMBUSTION. (AHORRO ENERGETICO EN HORNOS METALURGICOS: QUEMADORES REGENERATIVOS Y OXICOMBUSTION.) [BIB-199308-45-0839]

Regenerative burners and O-enriched combustion produce more efficient use of fuel in metallurgical (steel making) furnaces. British Gas has used regenerative burners preheated to 500 °C to increase combustion efficiency by up to 65%. GAZ de France has developed a double regeneration burner which, when preheated to 600 °C , increased combustion efficiency by up to 70%. Oxygen-enriched combustion produces higher temperatures with less exhaust and quicker processing time. Applications for O-enriched combustion are limited by elevated cost and overall increased heat loss. Graphs. (Banyeras, L.J.; Lopez, M.V.; Metalurgia y Electricidad, (Dec. 1991), 55, (639), pp. 41-49 [in Spanish]. ISSN 0026-0991)

0193 INFLUENCE OF INNER PROFILE AND SMELTING OPERATION ON COKE RATE AND LINING LIFE OF BLAST FURNACE. [BIB-199308-45-0844]

The inner profile is one of the key factors which influence the productivity and fuel rate of BF. High productivity must be accompanied with reducing the fuel rate and keeping the furnace body in good condition as long as possible. The first important measure for prolonging the furnace life is correct operating principle. Simple rise of smelting intensity may lead to wasting energy and fast lining damage. 5 ref. (Zhang, S.M.; Iron and Steel (China), (Dec. 1992), 27, (12), pp. 6-10 [in Chinese]. ISSN 0449-749X)

0194 RECONSTRUCTION OF EAF STEELWORKS WITH EXPERIENCES OF COMPACT MINI-MILL. [BIB-199308-45-0846]

The conditions to develop mini-mill in China are investigated. The result shows that the use of the practical experiences of the compact mini-mill to increase the production capacity of some EAF steelworks to 20-25 x 10^5 t/year is possible. The application of single or twin furnace is compared. 5 ref. (Yang, J.Y.; Iron and Steel (China), (Dec. 1992), 27, (12), pp. 16-19, 10 [in Chinese]. ISSN 0449-749X)

0195 APPLICATION OF BOTTOM BLOWING TO EAF FOR STAINLESS STEEL MAKING. [BIB-199308-45-0850]

The bottom bubbling technology has been applied to the production of stainless steels by the electric arc furnace with the capacity of 42 tons in Naoetsu Works of Nippon Stainless Steel. In the early days, there existed a problem in the life of refractories at the hearth because of high temperature nd the intermittent operation. However, by the improvement of structures of hearth and refractories, the successful operation became possible. The application of the new technology reduced the consumption of Fe—Si, oxygen, refractories, and other repair materials and raised chromium yield. Graphs. 4 ref. (Uemura, M.; Tetsu-to-Hagane (Journal of the Iron and Steel Institute of Japan), (Oct. 1992), 78, (10), pp. T189-T192 [in Japanese]. ISSN 0021-1575)

0196 QUALITY OF ELECTROSLAG METAL. I. [BIB-199308-45-0866]

A quality up-date on electroslag remelting (ESR) casts between 1987-1990 is reviewed. An investigation on the increasing non-metallic inclusions in ESR billets due to intensive mixing shows that inclusions in ESR billets due to intensive mixing shows that inclusions with a density 4 x 10^3 kg/m^3 and length 2 x 10^{-6}m are displaced to the boundary between the slag and metal, whereas inclusions with lower density concentrate closer to the axis. The composition and morphology of non-metallic inclusions (aluminium nitride or calcium-bearing type) affect defect formation in the metal. The controlling methods for solidification of ESR metal are outlined which used magnetic field or helium for additional cooling of the billet to optimize and intensify the solidification process with improved quality. The productivity of alloy steels by ESR using shavings is approx 1.8 times smaller than that by remelting of electrode. The efficient use of ESR under fluxes of CaF_2—Ca system is highlighted along with the complication from antimony in ESR. The development of ESR methods to save energy and materials is outlined. 26 ref. (Medovar, B.I.; Tsykulenko, A.K.; Dyachenko, D.M.; Problemy Spetsial'noi Elektrometallurgii, (1991), (3), pp. 44-49 [in Russian]. ISSN 0233-7681)

0197 QUALITY OF ELECTROSLAG METAL. I. [BIB-199308-45-0867]

See adjacent abstract. A quality up-date on electroslag remelting (ESR) casts between 1987-1990 is reviewed. An investigation on the increasing non-metallic inclusions in ESR billets due to intensive mixing shows that inclusions in ESR billets due to intensive mixing shows that inclusions with a density 4 x 10^3 kg/m^3 and length 2 x 10^{-6}m are displaced to the boundary between the slag and metal, whereas inclusions with lower density concentrate closer to the axis. The composition and morphology of non-metallic inclusions (aluminium nitride or calcium-bearing type) affect defect formation in the metal. The controlling methods for solidification of ESR metal are outlined which used magnetic field or helium for additional cooling of the billet to optimize and intensify the solidification process with improved quality. The productivity of alloy steels by ESR using shavings is approx 1.8 times smaller than that by remelting of electrode. The efficient use of ESR under fluxes of CaF_2—Ca system is highlighted along with the complication from antimony in ESR. The development of ESR methods to save energy and materials is outlined. (Medovar, B.I.; Tsykulenko, A.K.; Dyachenko, D.M.; Advances in Special Electrometallurgy (USSR), (July-Sept. 1991), 7, (3), pp. 182-185 [in English]. ISSN 0267-4009)

0198 PRODUCTION OF FERROTITANIUM BY ELECTROSLAG REMELTING TITANIUM AND STEEL SHAVINGS. [BIB-199308-45-0868]

The laboratory equipment for electroslag melting of ferrotitanium of two grades (70Fe—30Ti and 30Fe—70Ti) is described using titanium and steel shavings at 1800 plus/minus 50 °C . The current was supplied to the slag pool via two non-consumable water-cooled metallic electrodes to produce ferrotitanium billets with a homogeneous composition. The slag forming components were ANF-1P flux (CaF_2) with addition of titanium oxide, and also AN-295 flux (CaF_2, CaO; Al_2O_3). The use of unprepared shavings in twisted form and/or with lubricating cooling fluid on the surface caused a problem in mechanised loading and stabilizing the electroslag process. The difficulty was overcome by using crushed and annealed shavings. The quality of ferrotitanium billets was affected by the purity of initial charge. The electroslag melting process for ferrotitanium with high consumption of electricity is less advantageous than the induction melting technique. 3 ref. (Latash, Yu.V.; Yakovenko, V.A.; Kravtsov, S.V.; Reida, N.V.; Al'tman, P.S.; Bychkov, A.P.; Problemy Spetsial'noi Elektrometallurgii, (1991), (3), pp. 50-54 [in Russian]. ISSN 0233-7681)

0199 PRODUCTION OF FERROTITANIUM BY ELECTROSLAG REMELTING TITANIUM AND STEEL SHAVINGS. [BIB-199308-45-0869]

See adjacent abstract. The laboratory equipment for electroslag melting of ferrotitanium of two grades (70Fe—30Ti and 30Fe—70Ti) is described using titanium and steel shavings at 1800 plus/minus 50 °C. The current was supplied to the slag pool via two non-consumable water-cooled metallic electrodes to produce ferrotitanium billets with a homogeneous composition. The slag forming components were ANF-1P flux (CaF_2) with addition of titanium oxide, and also AN-295 flux (CaF_2, CaO; Al_2O_3). The use of unprepared shavings in twisted form and/or with lubricating cooling fluid on the surface caused a problem in mechanised loading and stabilizing the electroslag process. The difficulty was overcome by using crushed and annealed shavings. The quality of ferrotitanium billets was affected by the purity of initial charge. The electroslag melting process for ferrotitanium with high consumption of electricity is less advantageous than the induction melting technique. (Latash, Yu.V.; Yakovenko, V.A.; Kravtsov, S.V.; Reida, N.V.; Al'tman, P.S.; Bychkov, A.P.;

Advances in Special Electrometallurgy (USSR), (July-Sept. 1991), 7, (3), pp. 186-189 [in English]. ISSN 0267-4009)

0200 PROSPECTS FOR USING PLASMA HEAT SOURCES IN SYSTEMS OF LADLE TREATMENT OF STEEL. II. [BIB-199308-45-0872]

Based on the distribution of thermal energy in the ladle/furnace technology and the electrical parameters for the plasma torch at 3780 and 5112 kW, the energy parameters of heating 70 t of steel in plasma heating system (PHS) are evaluated. The total power transferred to the metal is estimated to be 50%, while the rest is lost through nozzles, electrodes, plasma torch, ladle walls and roof. The efficiency of heating the metal can be enhanced by 6-8% with an increase in arc current of the plasma torch by a factor of 1.3. The importance of the design of plasma torches and their effective positioning in the melting space during ladle/furnace treatment is highlighted. The use of PHS reduces wear of furnace lining and improves ecological parameters. The requirements on the power source for the plasma torches include stable arcing in the range 100-420 V, smooth regulation of current, suppression of oscillations of volt—ampere characteristics in the plasma torch, and absence of voltage of high harmonics in the high-voltage primary circuit of the power source. Heating rates up to 2 °C /min can be attained in PHS with an arc current of 6 kA. Graphs. 7 ref. (Mel'nik, G.A.; Zabarylo, O.S.; Zhdanovskii, A.A.; Prikhod'ko, M.S.; Reida, N.V.; Problemy Spetsial'noi Elektrometallurgii, (1991), (3), pp. 86-92 [in Russian]. ISSN 0233-7681)

0201 PROSPECTS FOR USING PLASMA HEAT SOURCES IN SYSTEMS OF LADLE TREATMENT OF STEEL. II. [BIB-199308-45-0873]

See adjacent abstract. Based on the distribution of thermal energy in the ladle/furnace technology and the electrical parameters for the plasma torch at 3780 and 5112 kW, the energy parameters of heating 70 t of steel in plasma heating system (PHS) are evaluated. The total power transferred to the metal is estimated to be 50%, while the rest is lost through nozzles, electrodes, plasma torch, ladle walls and roof. The efficiency of heating the metal can be enhanced by 6-8% with an increase in arc current of the plasma torch by a factor of 1.3. The importance of the design of plasma torches and their effective positioning in the melting space during ladle/furnace treatment is highlighted. The use of PHS reduces wear of furnace lining and improves ecological parameters. The requirements on the power source for the plasma torches include stable arcing in the range 100-420 V, smooth regulation of current, suppression of oscillations of volt—ampere characteristics in the plasma torch, and absence of voltage of high harmonics in the high-voltage primary circuit of the power source. Heating rates up to 2 °C /min can be attained in PHS with an arc current of 6 kA. Graphs. (Mel'nik, G.A.; Zabarylo, O.S.; Zhdanovskii, A.A.; Prikhod'ko, M.S.; Reida, N.V.; Advances in Special Electrometallurgy (USSR), (July-Sept. 1991), 7, (3), pp. 217-221 [in English]. ISSN 0267-4009)

0202 PRODUCTION APPLICATION OF INTENSIFYING MELTING TECHNIQUE WITH OXYGEN—COAL POWDER. [BIB-199308-45-0883]

The intensifying melting technique by using fuel and O is an effective way to save energy and increase efficiency in respect to electric arc furnace melting today. The technical processes and economic benefits in Shanghai No. 5 Steel Works due to the adoption of intensifying melting technique with oxygen—coal powder are introduced. Steel making of alloy steels and carbon structural steels is discussed. Graphs. (Zhang, R.; Jiang, H.; Shanghai Jinshu (Shanghai Metals), (Feb. 1993), 15, (2), pp. 16-20 [in Chinese]. ISSN 1001-7208)

0203 YEARLY OVERVIEW OF COMPLETE CASTING FACILITIES. XVIII. (JAHRESUBERSICHT DIE GIESSEREI ALS GESAMTANLAGE (18 FOLGE).) [BIB-199308-51-1155]

This review includes 125 papers from six continents discussing the status and progress of production, organization, and research and development. Some subjects are: comparison of electricity prices and their effect on production costs; capacity for primary aluminum production; market structure in various countries; production numbers and forecasts for steel, iron, and Al castings; competitive factors (price decides in only 32% of the cases); raw materials and products availability on the market; and management and personnel policies. Graphs. 125 ref. (Steinbauer, G.; Giesserei, (23 Nov. 1992), 79, (23), pp. 980-991 [in German]. ISSN 0016-9765)

0204 AUTOMATION OF THE THIONVILLE STEELPLANT. (AUTOMATISATION DE L'ACIERIE DE THIONVILLE.) [BIB-199308-51-1204]

Automation of the Thionville UHP furnace and its environment has made a source of economy of 15 F/ton appear. The particularities of this product, realized between December 1989-March 1991, are found in electrode regularization, dynamic operation, measurement means and information processing. As a result, there was a gain in productivity of 13%, a decrease in electric consumption of 8%, in electrodes of 18% and a rate of scrapping of more than one-half. Graphs. (Bourge, M.; Weber, D.; ATS STEEKMAKING CONFERENCE, Paris, France, 4-5 Dec. 1991, Cahiers d'Informations Techniques de la Revue de Metallurgie, (Dec. 1992), 89, (12), pp. 1075-1082 [in French].)

0205 INCREASING THE ENERGETIC EFFECTIVENESS OF THE PRODUCTION PROCESS IN OCEL VSZ KOSICE. [BIB-199308-51-1207]

Metallurgical and energetic systems of Ocel VSZ Kosice are described with hope of increasing effectiveness of the integrated production process in the plant. The fuel- and energy consumption during flat product production are analyzed and schematically introduced. Methods of energetic system modernization are mentioned, including increasing the portion of continuous casting and introduction of powder coal blowing into the blast furnace. Graphs. (Kiraly, S.; Novotny, K.; Hutnicke Listy, (Dec. 1992), 47, (12), pp. 2-6 [in Slovak]. ISSN 0018-8069)

0206 NATURAL GAS IN THE ALUMINIUM INDUSTRY. (ERDGAS IN DER ALUMINIUMINDUSTRIE.) [BIB-199308-51-1211]

The technical meeting on Natural Gas Applications in the Aluminium Industry focussed an economic, technical, and ecological aspects of aluminium melting engineering. Subjects were: natural gas in the aluminium industry; investigation of furnaces of the Al industry from the energy and environmental point of view; construction of new melting and foundry furnaces in the course of modernisation of an Al foundry; performance of regenerative burners in Al melting and foundry furnaces; performance after modernisation of an Al foundry; and Europe's most modern foundry for ingot Al. (Lindow, R.; Holle, T.; Gov. Res. Announc. Index, (1992), TIB/B93-00515/XAB, Pp 84 [in German]. ISSN 0097-9007)

0207 ENERGY CONSERVATION IN FORMING MACHINES AND FORMING PROCESSES. [BIB-199308-52-1240]

The forming route ensures minimal wastage of material and considerable energy saving, but forming machines have poor efficiency when the operating conditions are not optimised and then significant losses could be present in the deformation processes. Based on many experimental investigations on the forming machines, interconnected with forming process, the approaches to minimise the losses have been identified. The major trends in the concept of conservation of energy in forming are systematically analysed in terms of the efficiency of processes, the temperature of working and the force needed in a process. Graphs. 14 ref. (Venugopal, P.; Padmanabhan, K.A.; Publisher: HEMISPHERE PUBLISHING CORP., 79 Madison Ave., New York, New York 10016-7892, USA, Thermomechanical Aspects of Manufacturing and Materials Processing, (1992), (Met. A., 9308-72-0388), pp. 233-243 [in English].)

0208 THE USE OF DUAL-MILL PLANTS FOR PRODUCING THINNER STRIPS STRAIGHT FROM THE MELT. (EINSATZ VON ZWEIWALZENANLAGEN ZUR HERSTELLUNG DUENNER BAENDER DIREKT AUS DER SCHMELZE.) [BIB-199308-52-1245]

The number of processing steps is considerably by using dual-mill plants. Data values for a plant with mills of 45 kW each are given. Remote thickness control and effective cooling are relevant features. Problems still exist with the finish of the sides of the strip. The method is described whereby deformations are kept to a minimum. Notes are given on surface grinding of the strip. The strip is claimed to be superior as regards further processing. 2 ref. (Wystup, W.; Neue Hutte, (Mar. 1992), 37, (3), pp. 107-111 [in English]. ISSN 0028-3207)

0209 APPLICATION OF THE MAGNETIZED HEAVY-OIL COMBUSTION TECHNIQUE TO THE BONDING MILL'S REHEATING FURNACE. [BIB-199308-52-1370]

The achievements of lowering the viscosity of heavy-oil, improving combustion conditions, and speeding up reheating rate are introduced by applying oil magnetizing economizes to dispose heavy- and slag-oil in the reheating furnaces in blooming mill for steels of Shanghai No. 1 Iron and Steel Works. The experiences to obtain better economic benefits are also discussed. (Zhuang, W.Q.; Shanghai Jinshu (Shanghai Metals), (Feb. 1993), 15, (2), pp. 53-54 [in Chinese]. ISSN 1001-7208)

0210 METHODS OF REDUCED-ENERGY HEAT APPLICATION IN CAST STEEL WELDING. [BIB-199308-55-1683]

Due to limited availability of raw materials and energy sources, improved efficiency in material use has become a necessity in the metal working industry. Cast metals and fabrication procedures which make use of metal casting technology have become indispensable options during the selection of materials and processes for use in component fabrication. Consequently, the number of cast metal products damaged by wear has also risen. Presently, welding is the only method of compensating for wear damage. Welding is also the preferred method for repairing casting irregularities which occur during the fabrication process, and for joining components made from different steels. Welding simulation technology has achieved international recognition as a method of evaluating weldability and of specifying heat application methods. In addition to allowing the evaluation of transformation kinetics and mechanical properties, this technology allows conclusions to be drawn regarding the selection of optimal welding parameters. Graphs. 13 ref. (Scharff, A.; SIXTH INTERNATIONAL CONFERENCE ON THE JOINING OF MATERIALS (JOM-6), Helsingor, Denmark, 5-7 Apr. 1993, Publisher: JOM-INSTITUTE, INGENIORHOJSKOLEN HELSINGOR TEKNIKUM, Rasmus Knudsens Vej 50, DK-3000 Helsingor, Denmark, (1993), (Met. A., 9308-72-0423), pp. 425-437 [in English].)

0211 IMPROVEMENT OF SPHEROIDIZING ANNEALING PROCESS OF STEEL 65MN WIRE IN COLD DRAWING. [BIB-199308-56-1147]

A process is developed to improve the intermediate spheroidizing annealing for cold drawing wire made of 65Mn eutectoid steel (composition in %: 0.62-0.70 carbon, 0.9-1.2 manganese, 0.17-0.37 silicon, (Qian, L.; Guo, Y.X.; Heat Treatment of Metals (China), (Nov. 1992), (11), pp. 43-51 [in Chinese]. ISSN 0254-6051)

0212 APPLICATION OF REDUCING FLAME ATMOSPHERE IN FUKUYAMA NO. 2 CONTINUOUS GALVANIZING LINE. [BIB-199308-58-0981]

The equipments and operations of the direct fired reducing furnace installed in No. 2 continuous galvanizing line for steels which started operations in April 1990 are reported. Outlines of equipments are: the enlarged heating zone with reducing atmosphere, the application of a new NKK troidal burner, adequate arrangements of non-oxidizing heating burners, and the operation controlling system. The effect is evident in the improvement of surface quality of sheets, uniform heating, efficiency, and fuel consumption. Graphs. 5 ref. (Kurihara, M.; Tetsu-to-Hagane (Journal of the Iron and Steel Institute of Japan), (Feb. 1993), 79, (2), pp. T25-T28 [in Japanese]. ISSN 0021-1575)

0213 TRENDS IN WEIGHT REDUCTION TECHNOLOGY. [BIB-199308-61-0930]

To meet various requirements concerning environmental protection and the reduction of energy consumption, demands for weight reduction have increased in transportation fields including aircraft, railway vehicles, ships, and in particular, automobiles. Recent trends in weight reduction technology with special emphasis on the field of transportation, in which further weight reduction is expected to be required in the future, are discussed. Aluminum-, titanium-, magnesium-, and ferrous alloys are discussed (Al—Li alloys and Ti—Al intermetallics are cited.). (Nagai, C.; Kobelco Technology Review, (Apr. 1993), (16), pp. 1-3 [in English]. ISSN 0913-4794)

0214 AUTOMOTIVE APPLICATIONS OF TITANIUM AND ITS ALLOYS. [BIB-199308-61-0936]

Recently, higher performance engines are becoming more desirable as drivers demand both high performance and fuel efficiency from their automobiles. Applications of titanium and its alloys in automotive engine components are described. These components improve the power and fuel efficiency of high-performance engines by reducing surging in the valve system, inertia, and engine friction loss. Also introduced are high tensile strength titanium alloy wire for valve springs, new beta-Ti alloys with high cold forgeability, and electro Ni—P plating technology, all developed by Kobe Steel for automotive applications. Graphs. 5 ref. (Abumiya, T.; Yasui, K.-I.; Suzuki, K.; Ohyama, H.; Nishimoto, H.; Kobelco Technology Review, (Apr. 1993), (16), pp. 43-47 [in English]. ISSN 0913-4794)

0215 A STUDY ON THE BAKING CONDITION OF SODERBERG ELECTRODE. [BIB-199308-61-1003]

In order to maintain a good performance of Soderberg electrode data obtained from a numerical model has been used to analyse the effects of various factors on the baking process of the electrode comprised of A3 steel and copper, and improvements on the baking condition have been put forward. 3 ref. (Zhou, J.-M.; Mei, C.; Zhao, T.-C.; Journal of Central-South Institute of Mining and Metallurgy (China), (Feb. 1993), 24, (1), pp. 58-63 [in Chinese]. ISSN 0253-4347)

0216 ROCK ABRASIVES IN IMPACT DRILLING. [BIB-199308-62-1249]

It was indicated that drill bit made of hard metals is worn off owing to various wearing mechanisms, but that due to abrasive is the predominant. Main influencing factors on rock abrasiveness are the sturdiness of rock mass and content of hard minerals, and the coefficient of rock abrasiveness is a function of the specific energy consumption in drilling and the content of hard minerals. This conclusion has been verified through simulating tests and rock drilling practices. Graphs. 5 ref. (Tu, X.L.; Fei, S.L.; Journal of Northeast University of Technology (China), (1992), 13, (4), pp. 319-324 [in Chinese]. ISSN 0253-4258)

0217 HEATED METAL CONVERTERS FOR LOW EMISSION VEHICLES. [BIB-199308-71-0254]

Electrically heated catalysts (EHC) are being considered for low emission vehicles (LEV) and ultra-low emission vehicles (ULEV). As a result of recent test data, these devices (although they have a higher cost and are more cumbersome to install) have been taken more seriously. The EHC considered is a monolithic catalyzed preheater made from extruded and sintered metallic honeycomb. The preheater is insulated with a high temperature ceramic fiber and assembled into a stainless can. The study investigated emissions with and without preheat, as a function of EHC location and system configuration. The study ascertained that ULEV standards can be achieved with an EHC. Emissions and energy usage are minimized when the EHC is close coupled to the main converter and the engine. Lowering the EHC mass would reduce energy requirements. Use of a preheater is not required but results in lower emission and energy consumption. Graphs. (Socha, L.S.; Thompson, D.F.; Automotive Engineering, (July 1992), 100, (7), pp. 21-25 [in English]. ISSN 0098-2571)

0218 STUDY ON DISSOLUTION OF GOLD BY THE METHOD OF VAPOR PHASE-MICROWAVE HEATING UNDER PRESSURE. [BIB-199309-23-0537]

The dissolution of gold by the method of vapor phase-microwave heating under pressure is reported. High purity Au was weighed out and placed into a small quartz dish. In a PTFE high pressure vessel, a triangle support, on which the small quartz dish was placed, was mounted. The cover of the vessel was screwed fast after adding concentrated HCl-fuming HNO_3 (14:1). The vessel was put in the microwave oven and heated with 200 W microwave power instantly to make the Au dissolved by the ascending acid vapor. The analysis by ICP-AES of 26 impurity elements such as platinum, palladium, iron, nickel, calcium, aluminum, lead, bismuth, copper, antimony, etc. contained in the dissolved product has shown that the latter has not been contaminated by the impurities in the mixed acids. This method has the advantages of instantaneous heating, quick decomposition, energy saving, no loss of volatile components, and no contamination.

It can be used to prepare samples in high purity Au analysis or to prepare uncontaminated Au compounds. Graphs. 37 ref. (Wu, R.L.; Xian, C.Y.; Yu, C.Z.; Fenxi Shiyanshi (Analytical Laboratory), (Mar. 1993), 12, (2), pp. 68-71 [in Chinese].)

0219 USE OF TITANIUM AND ITS ALLOYS IN SEA-WATER SERVICE. [BIB-199309-35-1555]

Titanium and its alloys are being increasingly used in power generation as well as a host of marine-based industries and operations due to their unique corrosion resistance in a chloride environment. An overview is presented of the corrosion resistant properties of Ti in a sea-water environment and their industrial applications particularly in power generation, desalination plants, offshore oil exploration, production and refinery operations, as well as in a large number of ship-based installations. Energy and materials will be of major concern to mankind during the next century. Energy efficient materials like Ti will, therefore, receive greater attention. Development of a cheaper extraction process for commercial use will play a key role in making Ti one of the future materials of the 21st century. Graphs, Phase diagrams. 38 ref. (De, C.P.; High Temperature Materials and Processes, (Jan. 1993), 11, (1-4), pp. 61-95 [in English]. ISSN 0334-1704)

0220 IMPROVEMENT OF PYD2200 SHORT HEAD CONE CRUSHER. [BIB-199309-41-0280]

Some factors affecting the efficiency of PYD 2200 short head cone crusher have been analysed. An improved program is given to consider the key parameter of crushing cavity with accommodating uniform and automatic feeding, etc. The parts of crushing cavity and uniform feeding have been studied in a production experiment, which demonstrates the advantages of less cost and better profit. Crushing of iron ore is discussed. ZGMn13Cr2 liner for crushers is described. (Wei, S.Y.; Qiu, X.R.; Metallurgical Equipment (China), (Apr. 1992), (2), pp. 22-26 [in Chinese]. ISSN 1001-1269)

0221 LEAK DETECTION OF CLOSED COOLING SYSTEM WITH SOFT WATER FOR BF. [BIB-199309-42-0996]

Ways of leak detection, equipment for a closed cooling system with soft water for BF, and the flow characteristics of the cooling systems are introduced. If a cycle inspection by computer is used, this method not only detects leakage, but also has the function of avoiding it. Graphs. (Zhang, J.Z.; Zhuang, S.X.; Gao, G.C.; Yang, Z.G.; Fang, Y.M.; Zhang, L.F.; Iron and Steel (China), (Jan. 1993), 28, (1), pp. 6-10 [in Chinese]. ISSN 0449-749X)

0222 CONSTRUCTION OF NO. 2 BLAST FURNACE AND DESIGN OF NO. 3 BLAST FURNACE AT SHANGHAI BAOSHAN IRON AND STEEL COMPLEX. [BIB-199309-42-0997]

No. 2 BF is the first 4000 m^3 scale FB designed and constructed by engineers in China and a lot of experience has been obtained. Now, No. 3 BF is under construction and 30 new techniques have been adopted. The design work of the new BF has been completed within one year. (Xiang, S.Y.; Iron and Steel (China), (Mar. 1993), 28, (3), pp. 1-5 [in Chinese]. ISSN 0449-749X)

0223 IMPROVEMENT OF FSFE OPERATION WITH SUBSTITUTE FUEL TECHNOLOGY AT TAMANO SMELTER. [BIB-199309-42-1013]

Tamano Smelter initially started its operation in 1972 at the anode production capacity of 101 000 tons/year and through production capacity expansion by oxygen enrichment, which was executed twice, its present capacity reached 196 000 tons/year. During this period, the operation of the flash smelting furnace with electrodes (FSFE) was changed greatly. Of such changes, the operation technologies which are specific to the FSFE are described in this paper. Such operation technologies are carbonaceous material combustion control by CO gas concentration control established by fuel substitution after the oil crisis and subsequent energy saving technology. Graphs. 7 ref. (Shibata, T.; Abe, Y.; Uekawa, M.; COPPER 91 (COBRE 91), Ottawa, Ontario, Canada, 18-21 Aug. 1991, Publisher: PERGAMON PRESS INC., Maxwell House, Fairview Park, Elmsford, New York 10523, USA, (1992), (Met. A., 9309-72-0468), pp. (Vol. IV), 125-139 [in English].)

0224 EL TENIENTE CONVERTER: A LEADING PYROMETALLURGICAL TECHNOLOGY. [BIB-199309-42-1030]

The Teniente Converter technology for the autogenous smelting of Cu concentrate has experienced an important and successful development during the past 5 years at the Caletones Smelter of Codelco-Chile, El Teniente Division. Two new larger sizes reactors (5 m diameter by 22 m long) have replaced two units in operation since 1977 and 1978, respectively. The most important technical improvement introduced is the so-called submerged smelting of concentrate for feeding bone-dry concentrate into the reactors, being used since June 1988. The "bath smelting" as well as the "submerged smelting of concentrate" technologies, are being applied. Over 55% of the overall concentrate charged to the reactors is pneumatically injected. As a result of this technical improvement, the autogenous smelting capacity has been increased and operating costs reduced. The Teniente Converter heat balance shows that it is possible for certain concentrates (according to their chemical compositions) to reach a continuous smelting state, making matte additions unnecessary. This operating scheme places the Teniente Converter as one of the most efficient smelting and converting processes for Cu concentrates. This paper refers to recent improvements and projections on the smelting capacity and subsequently on energy consumption of the Teniente Converter process as a result of the "Submerged Smelting of Concentrate" technology. Graphs. 4 ref. (Campos, R.J.; Achurra, J.O.; Rojas, O.C.; COPPER 91 (COBRE 91), Ottawa, Ontario, Canada, 18-21 Aug. 1991, Publisher: PERGAMON PRESS INC., Maxwell House, Fairview Park, Elmsford, New York 10523, USA, (1992), (Met. A., 9309-72-0468), pp. (Vol. IV), 229-246 [in English].)

0225 PRODUCTIVITY INCREASE AND ENERGY CONSERVATION IN COPPER ELECTROWINNING. [BIB-199309-42-1047]

The space—time—yield of hydrometallurgical and electrometallurgical Cu production processes is extraordinary low. This applies for all production steps: mining, comminution, leaching, solvent extraction and electrowinning. Coincidentally, the specific energy consumption for 1 t of final Cu is surprisingly high. A detailed survey and comparison of Cu pyrometallurgy and other non-ferrous metals is given with space—time—yield and specific energy consumptions. About one quarter of the total energy need for Cu from mining to casting by the hydrometallurgical route is for winning electrolysis. Theoretical considerations are given concerning the influence of various parameters on decomposition voltage, voltage drop, cell voltage and overvoltage. The reasons for current efficiency losses are discussed. Laboratory test work results are reported on the effects of temperature, electrode spacing, current efficiency and electrolyte circulation related to current density, specific energy consumption and space—time—yield. These results show good comparison with industrial practice and the reasons for this are discussed, together with proposals for better technical performance. Graphs. 20 ref. (Paschen, P.; Langfellner, M.; Mori, G.; COPPER 91 (COBRE 91), Ottawa, Ontario, Canada, 18-21 Aug. 1991, Publisher: PERGAMON PRESS INC., Maxwell House, Fairview Park, Elmsford, New York 10523, USA, (1992), (Met. A., 9309-72-0468), pp. (Vol. III), 575-591 [in English].)

0226 AN ODS MATERIAL WITH OUTSTANDING CREEP AND OXIDATION PROPERTIES ABOVE 1100 °C . [BIB-199309-45-0927]

The temperature capability of iron-base ODM materials is far superior to the one of conventional materials. It offers new opportunities for the engineering of high temperature heat exchangers and other advanced energy conversion system. Graphs. 1 ref. (Kazimierzak, B.; Prignon, J.M.; Fromont, R.I.; SYNTHESIS, PROCESSING, AND MODELLING OF ADVANCED MATERIALS, Paris, France, 11-13 Sept. 1991, Publisher: TRANS TECH PUBLICATIONS LTD., Hardstr. 13, CH-4714 Aedermannsdorf, Switzerland, (1993), (Met. A., 9309-72-0458), pp. 363-372 [in English].)

0227 DEVELOPMENT OF OXYGEN UTILIZATION IN STEEL INDUSTRY. [BIB-199309-45-0958]

The development of utilization technologies of oxygen in the main areas of steel industry, such as sintering of iron ore, ironmaking, steelmaking, and rolling of steels is described. Its influences on the yield, quality, consumption of raw

materials and fuels, energy consumption, investment, the energy structure of state, and environmental protection are also included. 19 ref. (Jin, G.F.; Iron and Steel (China), (Mar. 1993), 28, (3), pp. 62-68 [in Chinese]. ISSN 0449-749X)

0228 A STUDY ON MELTING TECHNOLOGY OF STAINLESS STEEL BY EAF PROCESS. [BIB-199309-45-0965]

The scrap melting technology for POSCO's 90 ton EAF (electric arc furnace) was investigated by analyzing operational data. The TAP control for melting was optimized in terms of total energy consumption. In order to increase chrome yield in melt, the slag control practice was analyzed. The optimum slag basicity was in the range of 1.8-2.0 to have minimum chrome oxide content (10 wt.%) in EAF slag. Graphs. 4 ref. (Kim, J.W.; Huh, W.W.; Cho, J.H.; Research Institute of Industrial Science and Technology (Pohang City) Technical Research Report, (Mar. 1993), 7, (10, pp. 34-40 [in Korean].)

0229 ENERGY SAVING IN ELECTRIC ARC FURNACES (EAFS). (MITS BISI: 28418). [BIB-199309-45-0991]

Previously abstracted from original as item 8905-45-0594. Starting with the technical balance in the electric arc furnace, the equation of such technical balance is set up to help determine either power time or power consumption during melting. According to these formulas, the steelmaker's modus operandi is established, aimed at improving energy saving, which must be globally based on the increased efficiency of the arc, on the growing use of other thermal energies and on the reduction of thermal losses. Productivity increase is appraised which, in some cases, can also be of interest to improve thermal savings. Heat recovery and metallurgical processes, electrical efficiency in the arc and new modern operation techniques are examined. Also, attention is given to efficiency in furnace operation, with emphasis on an adequate personnel training plan. (Reparaz, J.M.; Munoz, J.; ELECTRIC STEELMAKING '87 (ACERIA ELECTRICA '87), Puerto Ordaz, Venezuela, 14-17 June 1987, Publisher: INSTITUTO LATINOAMERICANO DEL FIERRO Y EL ACERO, Dario Urzua 1994, Santiago 9, Chile, (1987), pp. N1-N6 [in English].)

0230 THE K-ES PROCESS: IMPROVEMENT OF THE PRODUCTIVITY AND REDUCTION OF THE CONSUMPTION OF ELECTRICITY BY USING FOSSIL FUELS. (MITS BISI: 28359). [BIB-199309-45-0992]

The K-ES process is an attempt to combine coal injection and bottom blowing; its use in the electric furnace leading to a reduction in the consumption of esectric energy, alloying elements and esectrodes and reducing the melting and tap-to-tap times, is described. Improvements in productivity and additional advantages such as scrap preheating and recycling of steelworks dust are also discussed. Original article in French. (Fritz, E.; Pawliska, V.; Strohmeyer, G.; Yamagi, I.; Rev. Metall., Cah. Inf. Tech., (1989), 86, (1), pp. 43-46 [in English]. ISSN 0035-1563)

0231 OPPORTUNITIES AND LIMITATIONS OF ENERGY EFFICIENCY TECHNIQUES FOR EAF MELTSHOPS. [BIB-199309-51-1309]

Energy reduction measures in electric arc furnace (EAF) meltshops have been directed towards control of total energy required to produce a tonne of steel at minimum conversion costs consistent with the steel quality requirements. Energy performance of the existing EAF units is being raised markedly as a number of new technologies are developed and implemented. But they still incur disadvantages of poor furnace time utilisation, heavy electrode use, and excessive electrical power consumption. Some of the best available approaches to good energy use in the EAF practice, typical limitations that have prevented their wide acceptance, several alternative-fuel steelmaking processes and the future prospects of the technology are discussed. Graphs. 62 ref. (Teoh, L.L.; SEAISI Quarterly, (Jan. 1993), 21, (1), pp. 38-53 [in English]. ISSN 0129-5721)

0232 ADVANCED ELECTROSLAG CASTING TECHNOLOGIES—AN EFFORT TOWARD INDIGENISATION. [BIB-199309-51-1335]

Defence Metallurgical Research Laboratory, India, has built up, over the past 15 years, rich expertise in electroslag refining and electroslag casting (ESC) of rings, thick walled tubes, high aspect ratio slabs, etc. Materials covered a wide range including high strength steels, stainless steels, superalloys, copper, and alloys containing highly reactive elements like lithium, cerium, zirconium, titanium, etc. Now with the technical assistance from Paton Welding Institute, Kiev, USSR, two advanced facilities have been indigenously established comprising ESC hollows up to 1 tonne and electroslag crucible melting for intricate shaped castings of approx 150 kg each. The latter technology is not available in many parts of the world except USSR and Austria. Now India can expect to use this enabling and energy-saving technology with high potential for small scale industries in the rural sector as well. Photomicrographs, Graphs. 8 ref. (Rao, V.V.V.N.S.R.; Baligidad, R.G.; Balachandran, G.; Satyaprasad, V.V.; Transactions of the Indian Institute of Metals, (Aug. 1992), 45, (4), pp. 261-273 [in English]. ISSN 0019-493X)

0233 QUANTITATIVE ANALYSIS OF TEMPERATURE CHANGE OF INGOT DURING CONVEYING. [BIB-199309-51-1393]

The heat losses during conveying and the thermal state before charging for ingot are analysed quantitatively by calculating ingot solidification of rimmed and killed steels. The results provide a foundation for reducing conveying time, increasing charging temperature, and adopting the optimum soaking process of ingot. Graphs. 1 ref. (Cao, C.J.; Iron and Steel (China), (Feb. 1993), 28, (2), pp. 60-63, 82 [in Chinese]. ISSN 0449-749X)

0234 ELECTROSLAG MELTING OF CAST IRON FOR MOULDING. (MITS BISI: 28446). [BIB-199309-51-1417]

Previously abstracted from original as item 8605-51-0641. Electroslag Fe melting (EIM) has been studied using 100 kg of Fe consisting of (%) 3.2-3.3 carbon, 1.9-2.0 Si, 0.7-0.8 Mn, 0.10-0.12 sulfur, and 0.12-0.14 phosphorus. Ten different compositions of fluxes have been utilized. The effect of the slag—metal contact area, flux composition and the temperature of metal and slag on the chemistry change and properties of Fe has been analyzed. The study showed that EIM under slags with oxides of Si, Mn and C allowed recovering these elements. Based on this study, the design parameters for production furnaces with capacities from 0.5-10.0 t have been recommended. The working voltage at EIM process should be more than that for electroslag steel melting (80-110 V for Fe opposed to 32-40 V for steel). By using EIM, the Fe had improved mechanical properties and lower content of S and nonmetallic inclusions. (Gorelov, N.A.; Khudaibergenov, A.A.; Kovalev, O.M.; Liteinoe Proizvodstvo, (1985), (8), pp. 21-22 [in English]. ISSN 0024-449X)

0235 MATHEMATICAL MODELLING AND INFRARED THERMOVISION MEASUREMENT OF THERMAL PROCESS OF INGOT. [BIB-199309-52-1484]

The mathematical model of cooling and heating process of ingot (e.g. BY2F, BY3F) has been established and the computation results and figures have been given directly by computer. Some coinclusions are useful for production practice. In the meantime, the dynamic temperature fields from the beginning of pouring to the end of rolling were traced and measured by means of Infrared Thermovision Model AGA 782. The correctness of the mathematical modelling has been verified by the color graphs of the computer. By the method of combining theoretical computation with practical measurement, accurate results and conclusions have been obtained and applied to guiding production practice, so that the goal has been achieved in reducing fuel consumption, increasing productivity, and decreasing scale loss. Graphs. 13 ref. (Yang, Z.K.; Xu, C.H.; Wu, J.G.; Wang, H.; Song, L.M.; Iron and Steel (China), (Feb. 1993), 28, (2), pp. 64-68, 44 [in Chinese]. ISSN 0449-749X)

0236 ROLE OF P/M IN MACHINERY AND ELECTRONICS INDUSTRIES AND ADVANCED TECHNIQUE. [BIB-199309-54-0944]

Numerous information has been cited and it has been explained that P/M is a kind of advanced technology for manufacturing machinery parts and especially suitable for producing precision machinery parts in large batches with material and energy savings, low costs, and high productivity. The superior properties of P/M products are advantageous for improving the performance of main machinery. P/M tool materials meet the necessity for developing machinery working with high efficiency and accuracy. P/M technology is an effective way to improve the properties of metal materials and develop new materials. P/M wil play an important role in vitalizing machinery and electronics industries. The new types of P/M structural and functional materials will occupy an important position in advanced technique. Steel, cermets, superconductors, metallic

glasses, and metal powders; aluminum, titanium, magnesium, beryllium, and tungsten base alloys; nitrides, carbides, oxides, and borides, and composite materials are discussed. 60 ref. (Li, Z.D.; Powder Metallurgy Technology (China), (1992), 10, (Suppl.), pp. 9-18 [in Chinese]. ISSN 1001-3784)

0237 RATIONAL USE OF ENERGY IN INDUSTRY: AN EXAMPLE FROM PLASMA-COATING TECHNOLOGY. (RATIONELLER ENERGIEEINSATZ IN DER INDUSTRIE: EIN BEISPIEL AUS DER PLASMA-BESCHICHTUNGSTECHNIK) [BIB-199309-57-1129]

The use of energy is one of the main preconditions for the functioning of a modern industrial society. In many cases, however, the utilization of energy has detrimental effects on our environment. This is the reason energy must be used as rationally as possible. Among the final energy forms, electrical energy occupies a key position. Using electricity, modern computer systems, intelligent control systems and innovative electrical process-heat methods can often make it possible to achieve significant economies even in the use of other energy sources. A plasma CVD (chemical vapour deposition) process up to now unique around the world for the coating of metal carbides is described as a highly topical example of the rational use of electrical energy. Photomicrographs, Graphs. 7 ref. (Klockner, R.; Tabersky, R.; Elektrowarme Int., (Mar. 1993), 51, (B1), pp. B13-B16 [in German].)

0238 NEW HIGH PRODUCTIVITY PLANT FOR CHEMICAL-HEAT TREATMENT OF COMPONENTS IN POWDERED MEDIUM. [BIB-199309-57-1212]

An installation and automatic control system, designed to reduce the time cycle for the production of Zn diffusion coatings, are described. Typical operating conditions are indicated. The installation can handle large components. A two-fold increase in productivity and a reduction in the energy consumption were achieved. Numeric Data. 6 ref. (Galin, R.G.; Lunegov, B.N.; Derevyannykh, A.A.; Iliev, S.A.; Pudov, E.A.; Dzhikhvashvili, T.G.; METAL SCIENCE AND HEAT TREATMENT NATIONAL CONGRESS, Sofia, Bulgaria, 3-5 Oct. 1991, Publisher: FEDERATION OF SCIENTIFIC AND TECHNICAL ORGANISATIONS IN BULGARIA, P.O. Box 431, 108 Rakovski St., 1000 Sofia, Bulgaria, (1991), (Met. A., 9309-72-0469), pp. 373-377 [in Russian].)

0239 STABILITY OF TITANIUM-BASED MNO_X DSA IN ACIDIC MEDIUM. [BIB-199309-61-1180]

A newly developed energy-saving anode, i.e. $Ti|SnO_2$ —MnO_x—RuO_2 $|MnO_x$, was studied concerning its mechanical and soluble stabilities of anodic active layer in 150 g/l H_2SO_4 in oxygen evolution process. The results showed that this anode is still very stable in such a strong acidic medium. Anode lifetime was estimated to be up to 1700 days through intensive life test under conditions of zinc electrodeposition using aluminum as cathode, and so superior to other types of MnO_x DSA. The decavitation mechanism was also discussed. Graphs. 8 ref. (Liu, R.X.; Zhang, Y.S.; Journal of Northeast University of Technology (China), (Feb. 1993), 14, (1), pp. 94-98 [in Chinese]. ISSN 0253-4258)

0240 PUSH-PULL INJECTION MOULDING OF INDUSTRIAL PRODUCTS MOVING TOWARDS INJECTION MOULDED COMPOSITES. [BIB-199309-61-1197]

Push-pull injection moulding is becoming a state of the art process after a three year long development. Today it is possible to demonstrate trends and limitations in the production of LCP and high performance thermoplastic-fiber composite parts with the desired orientation without weld lines. In English p. 16-19. Photomicrographs. 12 ref. (Becker, H.; Fischer, G.; Muller, U.; Kunststoffe German Plastics, (Mar. 1993), 83, (3), pp. 195-200 [in English, German]. ISSN 0723-0192)

0241 DESIGN AND ANALYSIS OF A HIGH SPEED ENERGY STORED FLYWHEEL. [BIB-199309-61-1209]

Problems of selection of radius, material and dimensions design of a high speed energy stored flywheel used in vehicle transmission system for saving energy and pursuing energy density as high as possible are analyzed and solved. An example of dimensions design of such flywheel is given. As a result, a basis for design and analysis of such flywheel is provided. The flywheels made of steel and carbon-fiber reinforced plastics are discussed. Graphs. 4 ref. (Zhang, T.Z.; Luo, B.J.; Wu, S.R.; Xin, D.J.; Jixie Gongcheng Xuebao (Chinese Journal of Mechanical Engineering), (Feb. 1993), 29, (1), pp. 24-30 [in Chinese].)

0242 DEVELOPING A COMPREHENSIVE BALANCE OF AN AUTOMOBILE INTAKE PIPE. [BIB-199309-61-1226]

An automobile manufacturer, a raw materials producer, an academic institution, and other suppliers cooperated to develop a comprehensive balance for an automobile intake pipe targeted for a new generation of engines. This approach involves the entire history of a product in the assessment of its ecological impact. Products made of aluminum-base alloy Al—Si—10Cu—2Fe and those made of glass fibre reinforced polyamide were compared in this manner. In English p. 16-19. Graphs. 8 ref. (Schuckert, M.; Dekorsy, Th.; Pfleiderer, I.; Eyerer, P.; Kunststoffe German Plastics, (Mar. 1993), 83, (3), pp. 195-200 [in English, German]. ISSN 0723-0192)

0243 ON SCIENTIFIC SUPPORT OF ENVIRONMENT CONTROL AND ENERGY-SAVING ACTIVITIES IN MINING AND STEEL MAKING REGIONS. [BIB-199310-41-0348]

The ecological problems require a comprehensive, systematic approach to the judicious use of nature. Among different approaches to the solution of problems of technological processes ecology (designing, economical, toxicological, geographical, and the other), the energy approach is of great importance. When developing a strategy for the environmental control in a mining—metallurgy region, a concept of material—energy balance and its optimization is recommended as a working one. That will require the participation of different specialists in establishing intercomection between expenditures and the type of energy being consumed, releases into the environment, the quality and quality of metal. Graphs. 10 ref. (Kustov, B.A.; Rekhtin, N.E.; Yankovskii, A.S.; Borodulin, A.V.; Stepanov, V.S.; Stal', (Dec. 1992), (12), pp. 75-79 [in Russian]. ISSN 0038-920X)

0244 THE MODIFICATION OF TOBATA NO.3DL SINTER PLANT AND THE METHOD OF THE POWER SAVING AFTER MODIFICATION. [BIB-199310-42-1057]

In accordance with the rearrangement plan of Yawata Steel Works, Nippon Steel Corp., the capacity of Tobata sinter plant was increased for 9800-14 000T/D. The measures for the capacity increase and the manpower saving technology introduced after the modification are outlined. Modifications such as the extension of length of a sintering machine from 80-120 m, improvements in charging and treating facilities for raw materials, and introduction of developed ignition burners were done for the capacity increase. In future, further improvements of the process for environmental and energy saving problems might become important. Graphs. 4 ref. (Sakuragi, J.; Tetsu-to-Hagane (Journal of the Iron and Steel Institute of Japan), (May 1993), 79, (5), pp. T53-T56 [in Japanese]. ISSN 0021-1575)

0245 ALUMINUM SMELTER TECHNOLOGY FOR THE NINETIES. [BIB-199310-42-1079]

The review of aluminum smelter technology includes energy efficiency, carbon anode preparation, refractory brick, pot lines, process controls, pot tending machines, gas treatment, holding furnaces, casting, thin slab casting, sheet casting, sawing, and quality control. The latest technology results in an energy consumption of 13 kWh/kg of Al. 7 ref. (Nussbaum, A.I.; Light Metal Age, (Feb. 1993), 51, (1-2), pp. 8-52 even, 54-56, 58-62 even, 64-68, 70-72, 74, 76-77 [in English]. ISSN 0024-3345)

0246 STUDIES ON FABRICATION AND CORROSION OF INERT ANODE IN FLUORIDE MELT FOR ALUMINUM ELECTROLYSIS. [BIB-199310-42-1101]

A number of inert anode materials including NiO—Fe_2O_3 -based cermets and ceramics of SnO_2 were fabricated for aluminum electrolysis. Their properties were measured separately. The corrosion resistance of these materials was tested during electrolysis in two systems, NaF—AlF_3 (high-temperature) and NaF—KF—AlF_3 (low-temperature), and the rates of corrosion approximate 0.0015 and 0.0005 cm/h, respectively, i.e. the corrosion in the high temperature system is two to three times that in the low temperature system. Graphs, Photomicrographs, Phase diagrams. 5 ref. (Li, G.X.; Wang, C.F.; Qu, S.L.; Huang, A.Q.; Li, G.B.; Nonferrous Metals (China), (May 1993), 45, (2), pp. 53-57 [in Chinese]. ISSN 1001-0211)

0247 DEVELOPMENT OF IGNITION TECHNOLOGY FOR IRON ORE SINTERING IN CHINA. [BIB-199310-42-1104]

The development of ignition technology for sintering in China is introduced. Many kinds of new burners have been developed. As a result, the ignition energy consumption has been reduced significantly, and the best record of 0.0502 GJ/t was reached in September 1990. 6 ref. (Xie, L.X.; Iron and Steel (China), (May 1993), 28, (5), pp. 64-69 [in Chinese]. ISSN 0449-749X)

0248 DEVELOPMENT OF SECONDARY REFINING IN JAPAN. [BIB-199310-45-1010]

In order to meet the needs of high quality clean steel for modern industry, the secondary refining technology has been advanced remarkably in Japan. The energy and cost savings, especially the developments of UHP and continuous casting, are promoting its further development. Graphs. 24 ref. (Wang, P.; Ma, T.W.; Zhang, J.; Iron and Steel (China), (1993), 4, pp. 68-72 [in Chinese]. ISSN 0449-749X)

0249 ENERGY MANAGEMENT: TATA STEEL'S APPROACH. [BIB-199310-45-1052]

The reserves of fossil fuels in India are generally meagre, particularly good quality coking coal and oil, so the steel companies have taken major steps aimed at reducing their energy consumption by as much as 30% by the turn of the century. Tata Steel has a comprehensive plan to reduce energy use at every stage of production including iron making, steel making, primary rolling, and finishing. Steps are being taken to improve refractories and insulation and to upgrade combustion systems and instrumentation. The expanded use of automation should result in increased productivity and energy savings. In the last ten years, the use of coking coal per tonne of hot metal has been reduced by 25% and the energy usage for steel making in general has been reduced 50% since 1973. Efforts are also being made to reduce the use of petroleum fuels and to reduce the company's dependence on purchased power. Graphs. (Dhillon, A.S.; Ahmad, A.; Tata Tech, (June 1991), (11), pp. 19-30 [in English].)

0250 STEEL AND ALUMINUM ENERGY CONSERVATION AND TECHNOLOGY COMPETITIVENESS ACT OF 1988. FISCAL YEAR 1992 ANNUAL REPORT. [BIB-199310-45-1056]

Purposes of this act are to increase the energy efficiency and enhance the competitiveness of American steel, aluminum, and copper industries, and to continue the R and D efforts begun under DOE's Steel Initiative. The following projects were continued during FY 1992: superplastic steel processing; direct steelmaking; wettable cathodes for alumina reduction cells; electrochemical dezincing of steel scrap; rapid analysis of molten metals using laser produced plasmas; and direct strip casting using a single wheel caster. A seventh project, advanced process control for the steel industry, was selected for inclusion in the Metals Initiative program. Activities relating to these seven projects are presented in this annual report, together with financial data. (Gov. Res. Announc. Index, (1992), DE93009461/XAB, Pp 33 [in English]. ISSN 0097-9007)

0251 NEW STEELMAKING PROCESSES. [BIB-199310-45-1073]

In 1990, the world's consumption of raw materials for steelmaking was approx 970 Mt: pig iron 59%, metal scrap 39%, and DRI (direct reduction iron) 2%, the average rate being 1.16 t/1 t crude steel. The 1989 DRI output was 16 Mt, with more units to appear in South America and the Middle East. Metal scrap stocks were growing steadily, and scrap quality is expected to deteriorate, affecting both recycling costs and environmental aspects. A new raw material, iron carbide, developed by Hazen Research of USA had emerged, with the world's first 350 kt/year commercial plant to be brought into production in 1991 (USA). In the oxygen steelmaking, Kloeckner (Germany) and Voest Alpine (Austria) were developing KVA-process with scrap as the main raw material and the possibility of using hot metal and natural gas injection to increase the proportion of metal scrap. DC electric furnaces had been developed by ASEA-Brown Boverie, Switzerland, IRSID-CECIM, France, and MAN-GHH-BBC, Germany. Energy optimizing furnaces (EOF) were supplied by Korf, Germany to Brazil and USA (Ocean State Steel). An extrapolation of EOF for the 2000's is MECOF (multi-energy combined furnace) featuring DC arc, carbonaceous fuel/oxygen injection, flue gas after burning, scrap preheating etc. On the energy side, together with chemical metallurgy advances like intensive bath stirring, injection metallurgy, vacuum slag cleaning, and linear magnetic pump for oxygen-free teeming. Graphs. (Kobayashi, S.; Met. Tech. (Jpn.), (1991), 61, (1), pp. 3-7 [in Japanese].)

0252 EFFECT OF SLAG'S PHYSICAL PROPERTIES ON POWER CONSUMPTION IN ESR PROCESS. [BIB-199310-51-1460]

Effects of the specific conductance, thermal conductivity, and viscosity of slags, such as ANF-6 and A_1, on the powder consumption in electroslag remelting process were investigated. The results show that at 1500-1900 °C the specific conductance of ANF-6 is 4-11 times higher than that of A_1, whereas the electrical efficiency of A_1 is 10.2% higher than that of ANF-6. With respect to the total thermal resistance, A_1 is double what ANF-6 is, thus reducing the heat loss with thermal efficiency enhanced. At 1600 °C , furthermore, the viscosity of ANF-6 is approx 11 times less that of A_1 so A_1 will enhance thermal efficiency since high viscosity will result in slow heat-transfer. It is thus concluded that slags with low specific conductance and thermal conductivity and high viscosity are advantageous to the improvement of electrical efficiency and the reduction of power consumption. Graphs. 6 ref. (Liang, L.K.; Yang, H.; Guo, Z.W.; Journal of Northeast University of Technology (China), (Apr. 1993), 14, (2), pp. 171-175 [in Chinese]. ISSN 0253-4258)

0253 EFFICIENT MELTING AND HOLDING OF ALUMINUM ALLOYS. [BIB-199310-51-1526]

Energy-optimized methods for melting and holding aluminum alloys are examined with particular reference to gas and electrical furnaces. The principal requirements that must be met by modern melting and holding furnaces are examined, with attention given to high thermal efficiency/fast melting performance with low energy consumption for melting and for the holding cycle, low melting losses, high metal quality, safe working conditions, conformity with current and foreseeable environmental requirements, automatic controls, low maintenance costs, long refractory life, and easy operation. It is emphasized that quality must not be sacrificed at the expense of energy costs. The discussion covers noncrucible gas furnaces, crucible furnaces, electric heated transfer ladles, electric induction furnaces, and combined gas/electric furnaces. (Paterson, T.; Foundryman, (June 1993), 86,(5), pp. 194-195 [in English]. ISSN 0007-0718)

0254 SYSTEMATIC APPROACH TO SUCCESSFUL ENERGY MANAGEMENT IN A FOUNDRY. (DER SYSTEMATISCHE WEG ZUM ERFOLGREICHEN ENERGIEMANAGEMENT IN EINER GIESSEREI) [BIB-199310-51-1561]

Important economies in foundries can result from leveling peak energy consumption. This requires an optimization system which can be readily installed without affecting existing production. In the case reviewed, a complete return on investment was realized in ten months. (Dress, G.; Giesserei-Praxis, (15 July 1992), (13-14), pp. 201-203 [in German]. ISSN 0016-9781)

0255 DEVELOPMENT AND APPLICATION OF NEW PRODUCT MADE FROM LOW CARBON HALF HARD COLD STRIP. [BIB-199310-52-1553]

Low C half-hard cold strip is a new product which is unannealed and delivered in a half-hard state. It is made from C steel (Q215BF) and high quality C steel (08Al) and obtained through optimization of carbon and manganese content and proper match of reduction ratio to control the hardness. This product has the surface feature of cold strip, higher hardness, and strength. It can be used to make cold-bending shaped products, rolling products, and stamping products. The problems of function excess and hardness deficiency in using annealed cold strip have been deleted. At the same time, this new product can save energy for rolling mill, and can reduce the cost for the user. Graphs. (Zhao, R.G.; Wang, L.H.; Su, D.L.; Gu, K.Q.; Iron and Steel (China), (1993), 4, pp. 26-30 [in Chinese]. ISSN 0449-749X)

0256 RESEARCH AND PRACTICE OF PULL-SEPARATED ROLLING BY ROLL WEDGE. [BIB-199310-52-1554]

By means of simulation test, the plastic flow pattern of parallel-connected hexagonal bars by pull-separated rolling was studied and analysed. Simple regression equations applicable to calculate pull-separated deformation are given. The high accuracy of these regression equations has been proven in productive practice. Rolling of steels is discussed. Graphs. 1 ref. (Ma, Y.; Shi,

C.H.; Liu, H.C.; Iron and Steel (China), (1993), 4, pp. 31-34 [in Chinese]. ISSN 0449-749X)

0257 MANAGEMENT SYSTEM FOR HOT CHARGING—ROLLING TECHNOLOGY OF CONTINUOUSLY CAST SLAB IN SHANGHAI BAOSHAN IRON AND STEEL COMPLEX. [BIB-199310-52-1635]

The hot charging and rolling technology of continuously cast slab is a great improvement over the present steel making—hot rolling process and may bring remarkable benefit. It is necessary for adoption of the technology not only to have relevant equipment, but also to realize integrated management. Dealing with a hot charging—rolling experiment, an analysis of test data and economical benefit is conducted. The main problems and solutions existing in the adoption are also pointed out. (Wang, W.R.; Iron and Steel (China), (May 1993), 28, (5), pp. 75-81 [in Chinese]. ISSN 0449-749X)

0258 MACHINES FOR TRACTION LEVELING OF BANDS IN FERROUS AND NON-FERROUS METALS. (MACCHINE PER SPIANATURA A TRAZIONE DI NASTRI IN METALLI FERROSI E NON FERROSI.) [BIB-199310-52-1711]

The French company Redex produces traction levelers made up essentially of two groups of tension rollers between which is a leveling mechanism consisting of two or more groups of small rollers. These machines combine traction on the bands as well as flexure due to the passage of the bands over the two or more small-diameter rolls; this results in a contraction of the internal portion of the metal which is in contact with the rollers together with an elongation of the external portion of the metal. The operator of such a leveler can regulate the difference in velocity of the two groups of rollers by means of a simple + or — adjustment. This mechanism comprises a closed kinematic chain, controlled by a single motor, which provides the advantages of simplicity of the electrical equipment, ease of adjustment and maintenance, and limited energy consumption. (Lamiera, (Apr.1992), 4, (29), pp. 108-114 [in Italian]. ISSN 0391-5891)

0259 STATUS QUO AND FUTURE DEVELOPMENT OF THERMAL CUTTING IN CHINA. [BIB-199310-53-0653]

The important role of thermal cutting in modern industry is stated. The development of thermal cutting in China is reviewed. The status quo and achievement are presented. On the basis of the analysis, the future development, aim and practicable ways of China in thermal cutting are proposed. Thermal cutting of steels is discussed. (Cui, S.; China Welding, (15 May 1993), 2, (1), pp. 7-10 [in English]. ISSN 1004-5341)

0260 THE FABRICATION AND CHARACTERISTICS OF METAL POWDER BY RAPID SOLIDIFICATION PROCESS. (RETROACTIVE COVERAGE). [BIB-199310-54-1000]

Metal powder made by the rapid solidification process is primarily used to manufacture small parts for the automotive industry. Benefits include energy saving and reduced material cost required to satisfy increased demand and productivity. Interest in and motivation for developing this technology is prompted by a desire to create substitutes for imported product and Korean self-sufficiency. At the present time, atomization is the most economical method for fabricating good quality metal powder. Generally, water, gas, and centrifugal atomization are the three methods used to fabricate metal powder. Water atomization is used to create steel or stainless steel (e.g. 303L, 304ULC, 304L, 316L, and 310L) irregularly shaped powder. In general, gas atomization will produce more regular, spherical metal or alloy powder with a lower melting point. Centrifugal atomization is a more expensive process, but it can produce very pure, spherical metal powder. Copper and 7075 aluminum are also discussed. Photomicrographs, Graphs. 16 ref. (Chun, B.S.; Bull. Korean Inst. Met., (Mar. 1990), 3, (1), pp. 3-11 [in Korean].)

0261 RECONSTRUCTION OF SINTERING FURNACE FOR ENERGY SAVING. [BIB-199310-54-1058]

The RJT-84-13 pusher type sintering furnace for sintering of ferrous alloys is rebuilt to save energy. After rebuilt, the length of the preheating section is 2160 mm; sintering section, 2800 mm; pre-cooling section, 1140 mm; and cooling jacket, 6000 mm. The box (dimension: 250 x 250 x 140 mm) to hold the workpieces is increased by 1.7 times. The furnace wall temperature is reduced from 50 to 30 °C by using high alumina brick and alumina silicate fiber for wall construction. The temperature of the extruded ends of the silicon carbide heating elements is reduced from 300 to 50 °C by using aluminum silicate insulation. The continuous welded case eliminates all possible heat leakage. After the modification, electricity consumption for the same amount of production is decreased by 54%. (Chen, G.P.; Powder Metallurgy Technology (China), (1992), 10,(3), pp. 234-236 [in Chinese]. ISSN 1001-3784)

0262 APPLICATION OF HEAT PIPE EXCHANGER TO REHEATING FURNACE OF STEEL ROLLING PLANT. [BIB-199310-56-1439]

The exchanger composed of heat pipes has advantages of high efficiency of heat exchange, compact structure, and easy installation. It is very suitable for the recovery of the waste heat at middle and low temperatures and plays a great role in energy saving. The principle and application of the exchanger to the reheating furnace of steel rolling plant are introduced. 3 ref. (Wang, L.Q.; Iron and Steel (China), (May 1993), 28, (5), pp. 49-53 [in Chinese]. ISSN 0449-749X)

0263 LOCALIZATION ENERGETIC CHARACTERISTICS OF PLASTIC DEFORMATION UNDER QUASIBRITTLE FRACTURE OF STRUCTURAL STEEL. [BIB-199312-31-5081]

There is shown a possibility to apply the energetic characteristics of structure material fracture (steel 20) to estimation of limit carrying capacity of structure elements. The transfer to deformation parameters is conducted, the mentioned parameters are responsible for structure limit state occurrence. Amount of energy necessary for plastic deformation with notch zone location at test low temperatures has been estimated. Ultimate strengths of steel 20 estimated from mechanical tests and measurements of specific strain and failure energies fall in the range of reaching the ductility limit which was detected by X-ray diffraction analysis. Graphs., Numeric Data. 6 ref. (Gulyaev, V.P.; Noev, I.I.; Petrov, P.P.; Fiziko-Khimicheskaya Mekhanika Materialov, (Jan.-Feb. 1992), 28, (1), pp. 33-37 [in Russian]. ISSN 0430-6252)

0264 THE INTELLIGENT METERING DEVICE FOR DIRECT CURRENT POWER CONSUMPTION. [BIB-199312-42-1212]

The intelligent metering device for direct current power consumption is a practical metering and managing device for direct current power consumption in electrolytic aluminium plant. The principle, functions, and practical results for the device are introduced. (Lin, Y.L.; Fu, D.M.; Wang, X.G.; Metallurgical Industry Automation (China), (Nov. 1991), 15, (6), pp. 37-39 [in Chinese]. ISSN 1000-7059)

0265 CURRENT YIELD IN ZINC ELECTROWINNING. (STROMAUSBEUTE IN DER ZINKELEKTROLYSE.) [BIB-199312-42-1229]

The electrical energy consumption in zinc production was evaluated in a laboratory scale electrolytic cell and compared to industrial units. Influence of three major impurities—copper, nickel, and cobalt—were measured at three curent densities (1000, 700, and 400 A/m2) individually and synergistically. Impurity contents of six smelters from five nations are tabulated and their process parameters discussed. Graphs. 20 ref. (Mori, G.; Paschen, P.; Berg- und Huttenmannische Monatshefte, (1992), 137, (1), pp. 19-26 [in German]. ISSN 0005-8912)

0266 MELTING OF SCRAP WITH PRIMARY ENERGY. [BIB-199312-43-0422]

The possibilities of applying fossil energy to metal scrap are shown. By using alternative fuels and raw materials in electric arc furnaces, it is possible to partly replace the scarce and expensive electric energy and enhance the furnaces' productivity further. In converter steelmaking, an increased scrap ratio is geared to reducing the dependency on expensive hot metal and increasing flexibility. By combining elements from the various spheres of modern metallurgy, new processes can be developed which are based on the use of fossil energy. A report on the current status is given, and for the first time the results are published which were achieved in 1992 when melting 100% steel scrap in a 30 t EOF at Companhia Siderurgica Pains, Brazil. Graphs. 19 ref. (Weber, R.; Nose, D.; 1ST EUROPEAN OXYGEN STEELMAKING CONGRESS, Dusseldorf/Neuss, Germany, 21-23 June 1993, Publisher: VEREIN DEUTSCHER EISENHUTTENLEUTE (VDEH), P.O. Box 10 51 45, D-40042 Dusseldorf, Germany, (1993), (Met. A., 9312-72-0550), pp. 262-267 [in English].)

0267 RECYCLING OF ALUMINIUM WITH MODERN MELTING FURNACES. (RETROACTIVE COVERAGE). [BIB-199312-43-0434]

Recycling is, today, regarded both a matter of economic importance and a way of utilizing waste material. Aluminium, recycled, needs, only 4% of the energy needed to obtain it from bauxite. Further energy use reduction is necessary in the melting equipment and this can include various forms of pre- heating. Other cost reductions can be effected by recirculation, elimination of solids and volatile impurities, bearing in mind avoidance of atmospheric pollution, noise troubles and other matters. Metal loss reduction is also important, and can occur in several ways, such as slag. It is also important to design the plant layout with great care, from receipt of scrap to final billets. Graphs. (Jochem, H.O.; Fonderia, (Nov.-Dec. 1989), 38, (11-12), pp. 64-68 [in Italian]. ISSN 0015-6078)

0268 MICROCOMPUTER CONTROL OF 30 T ELECTRIC ARC FURNACE FOR STEEL-MAKING. [BIB-199312-45-1250]

The microcomputer control system for 30 t electric arc furnace is introduced. By use of full floating STD Bus and advanced control algorithms, the control system not only has strong anti-interference ability, but has perfect control performance. 1 ref. (Ye, H.; Chen, W.N.; Jun, W.S.; Nei, H.J.; Tang, J.L.; Yan, D.M.; Metallurgical Industry Automation (China), (Sept. 1992), 16, (5), pp. 11-14 [in Chinese]. ISSN 1000-7059)

0269 THE COMPUTER CONTROL OF ORE FURNACE. [BIB-199312-45-1254]

The computer control system of the electrode positioning on an ore furnace for making ferrous alloys is presented. It is realized on the basis of the original equipment of the ore furnace of Da Guanshan Mine, Taiyuan Iron and Steel Company, by means of adding a microelectronic device and introducing artificial intelligence. The structure and principle of the system are expounded. This system has been put into operation in Da Guanshan Mine and has already achieved better economic benefit. Graphs. (Hao, J.Y.; Lii, X.Y.; Liu, H.C.; Metallurgical Industry Automation (China), (Nov. 1992), 16, (6), pp. 34-38 [in Chinese]. ISSN 1000-7059)

0270 DETERMINATION OF THE STATE OF THE AUSTRIAN STEEL INDUSTRY AND FUTURE PROSPECTS. (STANDORTBESTIMMUNG DER OSTERREICHISCHEN STAHLINDUSTRIE UND ZUKUNFTSAUSBLICK.) [BIB-199312-45-1315]

The steel industry consumes approx 10% of the total Austrian energy output, principally in the form of coke. The industry plans to reduce this volume, and has achieved some success. Improved melting and casting procedures have been instituted. Environmental protection measures continue to expand on reducing discharges into the atmosphere, the rivers, and landfills. Graphs. (Schmidt, G.; Schroer, U.; Berg- und Huttenmannische Monatshefte, (1991), 136, (9), pp. 313-323 [in German]. ISSN 0005-8912)

0271 SPRAY COOLING CONTROL OF SECONDARY COOLING ZONE FOR BILLET CONTINUOUS CASTING. [BIB-199312-51-1778]

Based upon the theoretical mathematical model of solidification process in continuous casting, a lot of calculations under the condition of different casting temperatures and withdrawal speeds are made, the calculated results with the binary regression method are processed, and a control model for spraying water volume of each section in the secondary cooling zone is presented. Provided that the spraying water volume of each section in the secondary cooling zone is controlled by computer with this control model, it is possible to process casting stably and coordinately, to save water and energy, to reduce leakage and to improve quality of casting products. A3 and 16Mn steels are discussed. Graphs. 3 ref. (Zhou, J.Q.; Metallurgical Industry Automation (China), (Sept. 1991), 15, (5), pp. 45-48 [in Chinese]. ISSN 1000-7059)

0272 EXPERIMENTAL RESEARCH FOR DETERMINING THE MAIN OPERATION PARAMETERS OF THE REGENERATION BURNERS. [BIB-199312-51-1781]

The paper presents the experimental method and the main results of a test on an ART16 regenerator burner on a trial stand. The fuel consumption is reduced in furnaces equipped with this burner, and other recovery equipment is eliminated. Graphs. 3 ref. (Ioana, A.; Semenescu, A.; Metalurgia (Bucharest), (May 1993), (5), pp. 19-22 [in Romanian]. ISSN 0461-9579)

0273 EFFECTIVE PRODUCTION IN THE EHRHARDT PUSH BENCH PIPE MANUFACTURING. [BIB-199312-52-1902]

Effective steel seamless pipe production by Ehrhardt Push Bench Method is described. The Steel Tube Works at Sumitomo Metal Industries produced seamless steel pipes having 165.2-952.5 mm outside diameters for power plants, nuclear power plants, chemical plants, and construction purposes for machine structures. Subtopics covered are: (1) production flow-sheet for the seamless pipe manufacturing process; (2) improvement of energy saving and production increase; (3) maintenance wherein (a) uneven thickness prevention and (b) improvement of precise refinement of pipes are discussed; and (4) heat-treatment furnaces wherein (a) pit furnace and (b) moving-type furnace are briefed. Graphs. 3 ref. (Koichiro, N.; Tawara, M.; Hayase, Y.; Katsube, T.; Kyoda, M.; Nakagawa, H.; Tetsu-to-Hagane (Journal of the Iron and Steel Institute of Japan), (Nov. 1992), 78, (11), pp. T209-T212 [in Japanese]. ISSN 0021-1575)

0274 PRESENT SITUATION OF COMPUTER CONTROL ON ROLLING MILL FURNACE AND SOME PROBLEMS IN THE SPREADING APPLICATION. [BIB-199312-52-1909]

The result and economic benefit of computer control on rolling mill furnace for steel rolling, the present situation of control on furnace, the key technique used, and some problems which must be noticed in the spreading application at present and in the future are introduced. 5 ref. (Fan, Z.Z.; Shi, H.; Metallurgical Industry Automation (China), (Nov. 1991), 15, (6), pp. 3-9 [in Chinese]. ISSN 1000-7059)

0275 DEVELOPMENT AND APPLICATION OF PNEUMO-HYDRAULIC FORGING HAMMER. [BIB-199312-52-1936]

A brief introduction to motion mechanisms of each type of hydraulic hammer, a detailed description of features of Czech KHZ series pneumo-hydraulic hammers, and the forging process of pneumo-hydraulic forging hammer KHZ8 imported into Chengdu Forging Factory are presented. 4 ref. (Li, C.T.; Metal-forming Machinery (China), (June 1991), 26, (3), pp. 9-14 [in Chinese]. ISSN 1001-1951)

0276 STUDIES OF SUBSIDIARY ENERGY CONSUMPTION OF METALLURGICAL PLANT AGGREGATES SUCH AS MELTING FURNACES, HEATING FURNACES AND METAL WORKING EQUIPMENT. (UNTERSUCHUNGEN ZUM ENERGIENEBENVERBRAUCH AN ANLAGEN (SCHMELZ-, WARMEOFEN, UMFORMAGGREGATE) IN DER METALLURGIE.) [BIB-199312-52-1967]

In the case of some deformation processes, 30% or more of the specific total energy consumption of the plant can be taken up by the operational conditions underlying the particular metal working practice. Since this is not a insignificant part of the overall energy consumption reflecting on the plant operating costs, the authors undertook a study to see whether this deformation process-related energy consumption can be reduced. Based on the results obtained, several possibilities to achieve this objective are discussed. The subsidiary energy consumption can be reduced exclusively by measures directed at the way the metal working operation is organized and performed, thus requiring no additional investment. This is not the case however, if changes in furnace or deformation equipment are required for a reduction of the energy consumption for heating or working the metal. The specific energy consumption of the entire plant operation is determined by the sum of the individual subsidiary consumers and their load per time interval. Idling and auxiliary consumption must be included in any analysis that is to lead to a reduced use of energy. The determination of operationally caused energy consumption is difficult and depends on conditions prevailing in the plant and on available measuring technology. If carried out correctly, the data obtained can serve as plant code numbers or standards. Graphs. 3 ref. (Muller, R.; Pietsch, J.; Blech Rohre Profile, (May 1991), 38, (5), pp. 387-388, 390 [in German]. ISSN 0006-4688)

0277 TWO DEGREE-OF-FREEDOM PID AUTOMATIC COMBUSTION CONTROL SYSTEM OF REHEATING FURNACE IN PLATE MILL. [BIB-199312-56-1580]

The practical application of the two degree-of-freedom PID control in automatic combustion control system of reheating furnace in plate mill introduced. As in using two degree-of-freedom PID control, the temperature control error of the furnace is decreased by one-half. It is obvious that significant economic benefit is achieved and energy and steel are saved. Graphs. 1 ref. (Sun, G.; Liu, G.P.; Li, J.S.; Men, Q.X.; Metallurgical Industry Automation (China), (Sept. 1991), 15, (5), pp. 11-14 [in Chinese]. ISSN 1000-7059)

0278 APPLICATION OF MICROCOMPUTER FUZZY LOGICAL CONTROL SYSTEM FOR PUSHER-TYPE CONTINUOUS REHEATING FURNACE. [BIB-199312-56-1587]

The constitution and functions of microcomputer fuzzy logical control system for pusher-type continuous reheating furnace for heating steels are introduced. The control situation and features of combustion control system of reheating furnace, to which the fuzzy logical control method is applied, are described. Real-time control results show that the control idea is applicable and control effect is satisfactory. Graphs. 4 ref. (Wang, N.; Pan, L.; Wen, B.J.; Chen, S.H.; Metallurgical Industry Automation (China), (Sept. 1992), 16, (5), pp. 35-38, 48 [in Chinese]. ISSN 1000-7059)

0279 STUDY ON OPTIMUM Q-P HEAT SUPPLY CONTROL MODEL FOR BILLET REHEATING FURNACE. [BIB-199312-56-1588]

An optimum Q-P heat supply control model which can directly control heat supply on line upon mill output and is different from the traditional method that controls heat supply by temperature of furnace is developed. Application results at 650 reheating furnace for heating steels in Handan Iron and Steel General Works show that the control model not only ensures heating quality but also decreases fuel consumption in spite of frequent mill output variation. Moreover, the relative energy saving effect has come up to the advanced world standard. (Yang, Z.S.; Lu, Z.W.; Zhao, W.G.; Cai, J.J.; Wang, Q.; Metallurgical Industry Automation (China), (July 1992), 16, (4), pp. 36-40 [in Chinese]. ISSN 1000-7059)

0280 HEAT TREATING INSTALLATIONS FOR SHEET, STRIP AND PIPES IN ROLLER-HEARTH FURNACES WITH PROTECTIVE ATMOSPHERE. (WARMEBEHANDLUNGSANLAGEN FUR BLECHE, BANDER UND ROHRE—ROLLENHERDOFEN MIT SCHUTZGAS.) [BIB-199312-56-1598]

Heat treatment of sheet, strip and pipes may be an intermediate or final operation. It must be carried out to produce the intended changes of the physical characteristics of the workpiece and therefore must fulfill certain distinct criteria. For the treatment, it is common to use roller hearth or shuttle kiln furnaces with continuous or discontinuous charging, whereby the material under heat is treated in a protective atmosphere environment. The article describes construction details and presents operational principles of roller hearth furnaces. This equipment can provide a working temperature of 1200 °C , have an effective width of 3000 mm and can handle a specific load of 2000 kg/m. Modern monitoring, guidance and control schemes based on microprocesses allow fully automatic operation including switching with commensurate optimum energy utilization. Control parameters can be adjusted according to specific load requirements. All essential operational data are automatically recorded and can be followed on video screens at all times. A permanent record of the routine data as well as malfunction indications is logged in printouts. The economic utility of the equipment is emphasized. Photomicrographs, Graphs. (Liekmeier, F.; Blech Rohre Profile, (May 1991), 38, (5), pp. 414-415 [in German]. ISSN 0006-4688)

0281 THE DEVELOPMENT OF 5454 AL—MG ALLOY TUBES FOR CONDENSERS AND HEAT EXCHANGER EQUIPMENT IN OIL-REFINERY. (RETROACTIVE COVERAGE). [BIB-199311-35-1936]

A comprehensive investigation and relevant study on the development of 5454 Al—Mg alloy tubes with high exchanging efficiency, energy-saving, dirt resistant and corrosive resistance, which is used in heat-exchanging equipment in China, are conducted. The results prove that this type of material can be used in heat-exchanging equipment. Its primary application in such equipment has achieved significant economical effect. The application of such material in heat-exchanging equipment has obviously broad prospects. Graphs, Photomicrographs. 2 ref. (Fang, Y.; Xu, Y.; Zhang, W.; ALUMINUM ALLOYS '90. SECOND INTERNATIONAL CONFERENCE ON ALUMINUM ALLOYS—THEIR PHYSICAL AND MECHANICAL PROPERTIES, Beijing, China, 9-13 Oct. 1990, Publisher: INTERNATIONAL ACADEMIC PUBLISHERS, Beijing 100044, Peoples Republic of China, (1990), (Met. A., 9311-72-0518), pp. 698-702 [in English].)

0282 UTILIZATION OF CONVERTER SLURRY IN SINTER PRODUCTION. [BIB-199311-42-1149]

A simple technology, mixing converter slurry with hot gas dust of BF, has been adopted to produce even-grained granules with proper quantity of water. This mix can be used in sinter production and can improve sinter quality, make sinter strength higher, save energy and improve the environment. Graphs. (Li, W.Z.; Iron and Steel (China), (July 1993), 28, (7), pp. 67-70 [in Chinese]. ISSN 0449-749X)

0283 LONG-TIME TEST OF A 30 000 T/YEAR DEMONSTRATION PLANT FOR ENVIRONMENTALLY CLEAN SMELTING OF LEAD-CONCENTRATES AND LEAD-CONTAINING SECONDARY MATERIALS BY THE QSL-PROCESS. (ERPROBUNG EINER 30 000 T/A DEMONSTRATIONSANLAGE ZUR UMWELTFREUNDLICHEN BLEIVERHUETTUNG MIT KONVENTIONELLEN BLEIKONZENTRATEN UND SEKUNDAEREN VOR- UND ABFALLSTOFFEN NACH DEM QSL-VERFAHREN (QSL-PHASEN 2 UND 3). SCHLUSSBERICHT.) [BIB-199311-42-1150]

The QSL-process (Queneau—Schuhmann—Lurgi) is a continuous oxygen-smelting-process. The operation is based on an energy saving and environmentally clean way for the production of lead bullion, high content in SO_2 in off-gas and slag with 3% Pb in a single reaction unit. During the continuous operation of the demonstration plant in second and third phase, the smelting of conventional Pb concentrates as well as several secondary materials could be treated successfully. Besides metallurgical and some technical problems, such as off-gas cooling in a steam cooled vertical shaft, direct measurement of bath temperature and dosing of coal for reduction are solved in time spending tests. The QSL-process is the matured substitute for the traditional Pb smelting operations. (Kola, R.; Schwab, B.; Gov. Res. Announc. Index, (1986), TIB/A93-01476/XAB, Pp 44 [in German]. ISSN 0097-9007)

0284 HOT CLEANING OF OLDER SODERBERG CELLS. [BIB-199311-42-1169]

Until recently, the cleaning of the cathode bottom of older Soderberg cells was a demanding and costly operation entailing production losses of 30 days/cell cleaned. In 1990, a new method was developed allowing the cleaning of a cathode bottom over a few hours using simple tools attached to a hydraulic shovel, while the material to be removed is still in a plastic state. This faster and more efficient method increases the number of cells that can be cleaned over a given period of time. This process restores cell operating conditions on older cells usually aged 2500 days. Therefore, cell voltage is decreased, current distribution improved and overall energy consumed/unit produced is reduced. Production losses are restricted to 24 h, down from 720 h. Graphs. (Bosse, P.; Tremblay, L.; LIGHT METALS PROCESSING AND APPLICATIONS, Quebec City, Quebec, Canada, 29 Aug.-1 Sept. 1993, Publisher: CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM, Xerox Tower, 1210-3400 Maisonneuve Blvd. W., Montreal, Quebec H3Z 3B8, Canada, (1993), (Met. A., 9311-72-0524), pp. 57-70 [in English].)

0285 THE MODEL 80K OREMET TITANIUM MAGNESIUM RECOVERY CELL. [BIB-199311-42-1170]

During 1991, Oremet Titanium began installation of a newly developed 80 kA magnesium electrolytic cell. This new cell is the result of an intense development and testing effort by a multi-discipline team of engineering consultants and in-plant personnel. Over a period of 15 months, two prototype cells were designed, installed and tested; during the same period, the cell house revisions and the production cell were designed. The new cell is capable of twice the production of the older cell, has reduced the specific power consumption

(kwhr/lb Mg) by 30% and fits into the same cell house space as the older cells. Graphs. 1 ref. (Gale, C.; Cork, G.D.; Case, P.; LIGHT METALS PROCESSING AND APPLICATIONS, Quebec City, Quebec, Canada, 29 Aug.-1 Sept. 1993, Publisher: CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM, Xerox Tower, 1210-3400 Maisonneuve Blvd. W., Montreal, Quebec H3Z 3B8, Canada, (1993), (Met. A., 9311-72-0524), pp. 71-80 [in English].)

0286 PROCESSING OF DROSS IN A PLASMA ARC HEATED FURNACE. [BIB-199311-42-1180]

The plasma dross treatment process allows for salt-free, residue-free, aluminum dross treatment. Alcan has operated this process under industrial conditions for about two years. This paper presents the actual performances of the plant. In particular, the energy utilization, the Al recovery efficiency and the utilization of the non-metallic by-products are discussed. Graphs. 2 ref. (Lavoie, S.; Litalien, M.; Robitaille, A.; LIGHT METALS PROCESSING AND APPLICATIONS, Quebec City, Quebec, Canada, 29 Aug.-1 Sept. 1993, Publisher: CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM, Xerox Tower, 1210-3400 Maisonneuve Blvd. W., Montreal, Quebec H3Z 3B8, Canada, (1993), (Met. A., 9311-72-0524), pp. 225-232 [in English].)

0287 MEASUREMENT DATA ANALYSES APPLIED TO IMPROVING FESI AND SILICON FURNACE OPERATION AND CONTROL. [BIB-199311-42-1181]

The paper deals with the experience from the Elkem research project FeSi 8000 1990-1992 on increased productivity in FeSi production. The project focused on both improvements in furnace operations and on theoretical studies of the process. It has lead to increased knowledge about the FeSi and Si processes, and major progress has been realized in furnace production. An important activity in this project was analysis of furnace measurement data to increase the process understanding and find methods of estimating furnace conditions. This analysis especially focused on the measurement of the silica fume content in the furnace waste gas, and it has resulted in new knowledge about how this measurement should be applied in furnace operation and control and in the development of systems for estimating the carbon content of the furnace. The paper also describes the present development of an expert system for FeSi and Si furnace operation that is based on the results from the FeSi 8000 project. Graphs. 6 ref. (Tveit, H.; Valderhaug, A.; Leidal, T.; LIGHT METALS PROCESSING AND APPLICATIONS, Quebec City, Quebec, Canada, 29 Aug.-1 Sept. 1993, Publisher: CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM, Xerox Tower, 1210-3400 Maisonneuve Blvd. W., Montreal, Quebec H3Z 3B8, Canada, (1993), (Met. A., 9311-72-0524), pp. 895-906 [in English].)

0288 INFLUENCE OF VARIOUS FACTORS ON BEHAVIOUR OF ZINC IN BLAST FURNACE. [BIB-199311-42-1197]

Previously abstracted from original as item 9111-42-1005. In spite of withdrawing from circulation Zn-bearing slurries from the blast furnace gas cleaning and the converter shops, the problem of Zn remained acute with an intake of 1.9-2.1 kg/t of Fe. Zinc was deposited in the gas outlets. Factors were investigated which reduced the negative effect of Zn and a distinct connection was found between the behaviour of Zn in the blast furnace and the stack thermodynamics, particularly at the throat. Condensation of Zn vapours on the relatively cool burden is especially important as it affects the structure of the circulating Zn and the coke consumption for the direct reduction of the secondary Zn. The results of thermodynamic calculations relating to throat temperature are discussed in relation to several plants. The best way to reduce the harmful effect of the liquid phase of Zn is to eliminate conditions for the condensation of its vapours on the surface of lumps of the burden and of the furnace lining and to reduce the evacuation of metallic Zn formed directly from vapours 419 °C into the free space of the throat and gas outlets. Graphs. 11 ref. (Shchukin, Yu.P.; Kaporulin, V.V.; Novikov, V.S.; Marsuverskii, B.A.; Chernavin, A.Yu.; Ivonina, I.E.; Steel USSR, (May 1991), 21, (5), pp. 189-194 [in English]. ISSN 0038-9218)

0289 A NEW MODEL OF MINI MILL FOR STRIP PRODUCTION. [BIB-199311-45-1168]

The new process model of mini mills for producing steel strips through smelting-reduction—converter—continuous casting—hot-rolling—cold-rolling is described. Detailed data were used to compare smelting-reduction with direct reduction and the new process with conventional ones (direct reduction—EF—continuous casting—hot and cold-rolling), which demonstrates that the new process has many advantages in respect of varieties, energy-consumption, cost, and benefits. (Wu, Z.H.; Shanghai Jinshu (Shanghai Metals), (July 1993), 15, (4), pp. 7-10 [in Chinese]. ISSN 1001-7208)

0290 LOWERING ENERGY COSTS IN LIQUID PHASE REDUCTION PROCESS DURING REDUCTION SMELTING OF OXIDISED RAW MATERIAL. [BIB-199311-45-1187]

Previously abstracted from original as item 9111-45-1481. The Novolipetsk Iron and Steel Combine is developing a new practice for the direct production of iron using a liquid phase reduction. This includes a furnace for reduction melting oxidised ferruginous raw material in a bubbling slag bath and a boiler condenser. Details of the equipment and practice are given and the heat balances when melting basic oxygen furnace slurries are stated for oxygas and oxyair bottom blowing. The most promising practice is the use of O-free blast for bubbling the slag bath. Graphs. 4 ref. (Karpushin, V.K.; Timin, E.I.; Romenets, V.A.; Valavin, V.S.; Beremblyum, G.B.; Shkatov, N.M.; Steel USSR, (May 1991), 21, (5), pp. 199-200 [in English]. ISSN 0038-9218)

0291 MICROCOMPUTER NETWORK SYSTEM FOR PRODUCTION AND MANAGEMENT OF STEEL MAKING. [BIB-199311-45-1207]

A good steel producing and managing computer system with local network is shown. This system can accommodate a lot of good application groups for steel producing and managing. It is very apparent that the system affects the quality and quantity of steel production. This system has been applied in a steel shop of Baoshan Iron and Steel Works. Since being brought into service, the system has controlled 812 heats and 60 steel varieties and achieved economical benefit of approx 1 000 000 yuan. (Ma, Y.P.; Metallurgical Industry Automation (China), (July 1991), 15, (4), pp. 22-24 [in Chinese]. ISSN 1000-7059)

0292 PROSPECTS FOR SEMICONTINUOUS INGOT CASTING PROCESS. [BIB-199311-51-1655]

Previously abstracted from original as item 9111-51-1979. The possibility of using semicontinuously cast slabs instead of mould-cast ingots is shown. The use of semicontinuous casting makes it possible to mechanise the casting of large cross-section strands, reduce metal losses, lower energy costs, and improve working conditions in the steelmaking and foundry shops. The process can be used for producing semiproducts for rolling and forging and consumable electrodes. Graphs. 3 ref. (Marchenko, I.K.; Brovman, M.Ya.; Anikeev, V.V.; Steel USSR, (Apr. 1991), 21, (4), pp. 164-166 [in English]. ISSN 0038-9218)

0293 TRANSFERRED ARC REMELTING OF ALUMINUM ALLOYS. [BIB-199311-51-1706]

A study has been undertaken to apply transferred plasma arc "fluxless" remelting to aluminium alloys, to determine the efficiencies of energy use, materials recovery, gas consumption, etc. associated with the melting of representative Al alloy material at the approx 200 kg furnace scale. A specially designed unit was constructed for the planned program, with sufficient instrumentation to permit collection of data on arc performance, energy efficiency and disbursement and durability of components. The particular feature of this furnace was the use of the "rotary" plasma torch, to effectively distribute the arc heat widely over the burden, without incurring excessive localised heating. Operating at power levels of 50-60 kW, specific melting energy requirements, at the quoted scale, as low as 465 kWh/t for an Al—4.5% magnesium alloy, were achieved for an energy efficiency of 65%. The achieved performance was at least equal to that quoted for induction furnace melting, being several times that commonly achieved for combustion heated melting units. Results are presented for preliminary melting tests with both Mg and lithium aluminium alloys, demonstrating net metal recovery on remelting of 99% (inclusive of the metallic Al recovered from dross). Graphs. 7 ref. (Jurewicz, J.; Lanigan, P.; Lemire, C.; Boulos, M.; Stevens, W.; Dube, G.; LIGHT METALS PROCESSING AND APPLICATIONS, Quebec City, Quebec, Canada, 29 Aug.-1 Sept. 1993, Publisher: CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM, Xerox Tower, 1210-3400 Maisonneuve Blvd. W., Montreal, Quebec H3Z 3B8, Canada, (1993), (Met. A., 9311-72-0524), pp. 295-304 [in English].)

0294 UTILIZATION OF CONVERTER SLURRY IN SINTER PRODUCTION. [BIB-199311-51-1743]

A simple technology, mixing converter slurry with hot gas dust of BF, has been adopted to produce even-grained granules with proper quantity of water. This mix can be used in sinter production and can improve sinter quality, make sinter strength higher, save energy and improve the environment. Graphs. (Li, W.Z.; Iron and Steel (China), (July 1993), 28, (7), pp. 67-70 [in Chinese]. ISSN 0449-749X)

0295 OPTIMISATING ROLL PASS DESIGN FOR ROLLING STEEL ANGLES ON 320/150 MILL. [BIB-199311-52-1825]

Previously abstracted from original as item 9109-52-1589. The continuous light section and rod mill at the Amurstal' works was commissioned in 1987. The mill was built in eastern Germany and details are given of the suggested pass design. The shortcomings of the suggested practice are outlined and the new pass design was developed for rolling angles. Details are given of the energy force parameters in the intermediate and finishing stands when rolling St3 steel angles at optimum speeds. The influence of the number of passes on power consumption is tabulated. 4 ref. (Smirnov, V.K.; Yatsenko, V.F.; Limankin, V.V.; Shilov, V.A.; Inatovich, Yu.V.; Steel USSR, (Feb. 1991), 21, (2), pp. 73-75 [in English]. ISSN 0038-9218)

0296 THEORY AND PRACTICE OF PRELIMINARY HEAT TREATMENT OF LARGE PRODUCTS AND SEMIPRODUCTS (FORGINGS). [BIB-199311-56-1534]

Previously abstracted from original as item 9207-56-0930. The scientific base for developing an energy-saving practice for the preliminary heat treatment of large parts involves a knowledge of the hydrogen saturation of the metal, the kinetics of phase transformations under isothermal conditions and with continuous cooling and the kinetics of the formation of temporal and residual stresses throughout the entire heat treatment cycle. Details are given of the following: variation in the temperature of the melting chamber, of the surface of the forging at a distance of one-third of the radius from the surface and at the centre of a 1300 mm diameter CrNi steel forging during normalising and high tempering, the preliminary heat treatment of heavy forgings with and without recrystallization and anti-flake heat treatment. Graphs. 5 ref. (Bashnin, Yu.A.; Steel USSR, (Aug. 1991), 21, (8), pp. 373-376 [in English]. ISSN 0038-9218)

0297 FIBRE COMPOSITES. I. (FASERVERBUNDWERKSTOFFE. I.) [BIB-199301-C1-D-0058]

Fibre composites manufacture combines energy savings and ecological advantage, e.g. in the replacement of asbestos by aramid fibres in friction coatings and seals. Glass and, in particular, ceramic fibres give very good heat resistance. High-melting metal fibres, on the other hand, substantially increase ductility, while carbon fibres maintain their high density to up to 600 °C. Composite boron or SiC coated tungsten fibres withstand 650 °C and have a relatively high specific gravity, and C and SiC whiskers offer elastic moduli of 720 and approx 500 GPa, respectively. Graphs. (Steffens, H.-D.; Lauterbach, R.; DUNNE SCHICHTEN, (JUNE 1992), 3, (2), pp. 24-27 [in German].)

0298 NEW POLYOL FOR HOT MOLDED POLYURETHANE FOAM BY HIGH MOLD TEMPERATURE PROCESS WITHOUT USING CFCS AS BLOWING AGENTS. [BIB-199301-E1-P-0028]

In the manufacturing industry of flexible hot molded polyurethane foams, especially with low density, the reduction of R-11 used as a blowing agent has become an urgent subject in Japan. The water blowing method to form the hot molded foams was investigated from a viewpoint of the reduction of R-11. When the mold temperature was raised from a conventional temperature of 35-60 °C at a urethane liquid pouring stage in the process, it was found that the reduction of R-11 was possible. However, several structural defects of the foams were observed. The cause of these defects was investigated to gather valuable suggestions for the modification of polyols. A new type of polyol not to show such defects (XF-2001) has been developed, which has several advantages as follows: reduction of R-11 by using water as blowing agent, lowering of the compression set value of the foam; energy saving when producing the foam, etc. (Hayashida, S.; Horie, A.; Yamaguchi, Y.; Morita, H.; GOVERNMENT RESEARCH ANNOUNCEMENTS AND INDEX, (1990), PB92-194240/XAB, Pp 11 [in English]. ISSN 0097-9007)

0299 THE AUTOMOTIVE INDUSTRY CHALLENGES IN VIEW OF THE YEAR 2000: ENVIRONMENT PROTECTION, ENERGY SAVING, QUALITY ASSURANCE, THE CONTRIBUTION OF PLASTIC MATERIALS. [BIB-199301-F1-P-0045]

Regulations concerning environment protection are promoting energy conservation and weight reduction in automobiles. This has created a trend toward the use of lighter-weight materials such as plastics in automotive applications. Materials used in car construction are discussed as a percentage of overall weight. Graphs. (Raveglia, M.; NEW ALTERNATIVE MATERIALS FOR THE AUTOMOTIVE INDUSTRIES, FLORENCE, ITALY, 1-5 JUNE 1992, Publisher: AUTOMOTIVE AUTOMATION LIMITED, 42 Lloyd Park Ave., Croydon CR0 5SB, UK, (1992), (Eng. Mat., 9301-G2-Z-0019), pp. 165-176 [in English].)

0300 MICROWAVE SINTERING OF BORON CARBIDE. (RETROACTIVE COVERAGE). [BIB-199307-E4-C-0298]

Boron carbide has been sintered to 95% of theoretical density in 12 min without the use of sintering aids by heating to 2000 °C with 2.45 GHz microwave radiation. An average grain size of approx 20 μm resulted. Twins and microcracking were present in the microstructure. Energy usage for microwave sintering was found to be 18% less than for inductive hot-pressing. Graphs, Photomicrographs, Phase diagrams. 7 ref. (Katz, J.D.; Blake, R.D.; Petrovic, J.J.; Sheinberg, H.; MICROWAVE PROCESSING OF MATERIALS, RENO, NEVADA, USA, 5-8 APR. 1988, Publisher: MATERIALS RESEARCH SOCIETY, 9800 McKnight Rd., Pittsburgh, Pennsylvania 15237, USA, (1988), (Eng. Mat., 9307-G2-Z-0207), pp. 219-226 [in English].)

0301 1,1,1,4,4,4, HEXAFLUOROBUTANE, A NEW NON-OZONE-DEPLETING BLOWING AGENT FOR RIGID PUR FOAMS. [BIB-199305-D1-P-0881]

HCFCs are widely accepted to be technically promising replacement for CFCs in rigid PUR foams, especially for appliance applications. Despite this, political pressure is rising to limit their use to a transition period. One of the reasons is their residual ozone depletion potential. In the search for long term substitutes for both CFCs and HCFCs, a new blowing agent and insulation gas: 1,1,1,4,4,4 hexafluorobutane (HFC-356) has been identified and developed. Important properties of hexafluorobutane are: chlorine-free/non-ozone-depleting; very short atmospheric lifetime; minor greenhouse activity; non-flammable; no explosion limits; suitable boiling point; low gas phase thermal conductivity; and compatibility with appliance inner liner plastics. These properties allow the use of established appliance construction and foaming technology. Nevertheless, reformulation of the PUR components was necessary to design the first PUR appliance system with hexafluorobutane. Extensive laboratory scale testing including foaming of cabinets has been conducted with good results. In comparison with 50% CFC-reduced systems, it fulfills the technical standards of the European appliance industry concerning cell size/cell structure, flow properties/foam density, thermal conductivity/energy consumption, aging behaviour, demould properties, dimensional stability/compressive strength, and compatibility with SB and ABS inner liners. According to the regulations on chemical substances worldwide, hexafluorobutane is a new chemical substance which requires notification before commercialization. Ecological and toxicological testing of hexafluorobutane is in progress, but not yet completed. Results from acute and subacute inhalation toxicity testing are acceptable and encourage further development of this product. Graphs. 5 ref. (Lamberts, W.M.; POLYURETHANES WORLD CONGRESS 1991, Nice, France, 24-26 Sept. 1991, Journal of Cellular Plastics, (Nov.-Dec. 1992), 28, (6), pp. 584-595 [in English]. ISSN 0021-955X)

0302 BATCH PROCESS FOR MICROWAVE SINTERING OF SI_3N_4. [BIB-199305-E4-C-0199]

A method for sintering silicon nitride using microwave energy at 2.45 GHz is described. Sintering takes place in air, in times of between 30-120 min and has been scaled up to give isothermal conditions over a batch size of 150 mm diameter by 200 mm in ehgith and weights approx 1.0 kg. Additions of 5% alumina and 5% yttria result in a sintered product density of approx 97% of theoretical, with a density variation better than plus/minus 0.5% throughout the batch. It has been estimated that a load of 7.0 kg can be conventionally sintered using a 12 h cycle and an energy consumption of 19.7 kWh/kg. In contrast with microwave energy, a batch of 540 g can be sintered in 120 min with an energy consumption of approx 3.1 kWh/kg. This results in a possible energy savings of up to 78% for microwave heating. Graphs. 15 ref. (Patterson, M.C.L.; Apte, P.S.; Kimber, R.M.; Roy, R.; MICROWAVE PROCESSING OF MATERIALS III, San Francisco, California, USA, 27 Apr.-1 May 1992, Publisher: MATERIALS RESEARCH SOCIETY, 9800 McKnight Rd., Pittsburgh, Pennsylvania 15237, USA, (1992), (Eng. Mat., 9305-G2-Z-0151), pp. 291-300 [in English].)

0303 DEVELOPING A COMPREHENSIVE BALANCE OF AN AUTOMOBILE INTAKE PIPE. [BIB-199309-F1-D-0532]

An automobile manufacturer, a raw materials producer, an academic institution, and other suppliers cooperated to develop a comprehensive balance for an automobile intake pipe targeted for a new generation of engines. This approach involves the entire history of a product in the assessment of its ecological impact. Products made of aluminum-base alloy Al—Si—10Cu—2Fe and those made of glass fibre reinforced polyamide were compared in this manner. In English p. 16-19 . Graphs. 8 ref. (Schuckert, M.; Dekorsy, Th.; Pfleiderer, I.; Eyerer, P.; Kunststoffe German Plastics, (Mar. 1993), 83, (3), pp. 195-200 [in English, German]. ISSN 0723-0192)

0304 MAIN DEVELOPMENT TRENDS OF ALUMINA PRODUCTION PROCESS IN CHINA. [BIB-199310-D1-C-1787]

The main trends of the future development of alumina production processes in China are described on the basis of the present production processes to improve the competitiveness of its alumina industry in the world. The product restructuring of the sintering process, the application of the indirect heating intensive digestion in the Bayer process, the transformation of the Bayer-sintering-mixed combination process to the series combined process, and the development of the "Bayer-hydrothermal" combined process are included. 10 ref. (Chen, W.H.; Nonferrous Metals (China), (May 1993), 45, (2), pp. 77-82 [in Chinese]. ISSN 1001-0211)

0305 COMBUSTION SYNTHESIS AND POWDER METALLURGY. [BIB-199311-D1-C-1913]

Combustion synthesis is a new process with many advantages and has immense application prospects for manufacturing materials. The process of combustion synthesis is similar to the process of powder metallurgy in every way. The process, characteristics, and applications of combustion synthesis are provided

along with a discussion about coordination and difference between combustion synthesis and powder metallurgy. Engineers and scientists in the field of powder metallurgy are fit for the job to research and develop combustion synthesis, taking note of the close coordination between combustion and powder metallurgy. Combustion synthesis can be used for producing shape memory alloys (e.g. Ti—Ni alloys), high temperature structural alloys (e.g. Ni—Al alloys), ceramic powders (e.g. Si_3N_4, TiB_2, TiC), high temperature heating elements (e.g. $MoSi_2$). The steel pipe with combustion synthesized layer is discussed. Graphs. 17 ref. (Zhang, S.G.; Powder Metallurgy Technology (China), (1992), 10, (4), pp. 301-310 [in Chinese]. ISSN 1001-3784)

0306 POWER CONSUMPTION IN THE ACHESON PROCESS FOR PRODUCING SIC. [BIB-199311-D1-C-1919]

A thermodynamic model has been developed to assess electrical energy consumption in the Acheson process. The thermodynamic power consumption is dependent on silica, carbon, and silicon carbide contents in a furnace charge as well as on the temperatures of reaction zone and off-gas. Industrial tests were also carried out using 2 MW commercial furnaces (95 t charge) with various charging models and compositions. A mathematical procedure was formulated to calculate power consumption for newly produced SiC in an individual heat. Power consumption was as low as 7.0 kWh/m of newly produced SiC, when the initial charges having a carbon factor between 0.38-0.41 and containing 23-28% SiC were heated without exceeding 2310K. Graphs. 9 ref. (Nagamori, M.; Leblanc, R.; Courtemanche, R.; DEVELOPMENTS AND APPLICATIONS OF CERAMICS AND NEW METAL ALLOYS., Quebec City, Quebec, Canada, 29 Aug.-2 Sept. 1993, Publisher: CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM, Xerox Tower, 1210-3400 de Maisonneuve Blvd. W., Montreal, Quebec H3Z 3B8, Canada, (1993), (Eng. Mat., 9311-G2-Z-0280), pp. 301-312 [in English].)

0307 GRINDING OF CERAMIC MATERIALS: A MODEL FOR ENERGY CONSUMPTION AND FORCE TRANSFORMATION. [BIB-199311-E3-C-0092]

A simple model is introduced for relating grinding forces to operational equipment parameters: the normal force on the wheel is assumed proportional to the normal component of the velocity of the workpiece relative to the wheel, and the tangential force on the wheel is assumed essentially frictional and, thus, proportional to the normal force. Both force components are shown to be proportional to the product of the workpiece velocity and the depth of cut. Comparably simple expressions are derived for average normal and tangential stress at the grinding interface and for specific grinding energy. The normal and tangential forces are related to measured horizontal and vertical force components via the effective locus of application of these forces on the wheel, i.e. by an angle phi from the vertical which is shown to be closely represented by 2 beta /3, where beta is the angle subtended by the grinding interface. Experiments on silicon carbide using an instrumented surface grinder with a resin-bonded diamond wheel and a synthetic coolant showed excellent correspondence to this model over a wide range of table feed rates and grinding depths. Graphs. 7 ref. (Liang, S.X.; Devereux, O.F.; MACHINING OF ADVANCED MATERIALS, Gaithersburg, Maryland, USA, 20-22 July 1993, NIST Special Publication, (1993), (847), pp. 21-32 [in English].)

0308 CONDITIONS AND LIMITATIONS OF MATERIAL RECYCLING. (VORAUSSETZUNGEN UND GRENZEN DES STOFFLICHEN RECYCLINGS.) [BIB-199312-F1-Z-0778]

Closing the circle with regard to recycling materials is quite often seen as a positive aspect. Therefore a great deal of faith is being put into saving resources, reducing the environmental burden and consideration toward new deposit areas. Recycling is only one of the possibilities for getting rid of waste, a process which also requires the use of resources and creates waste and emissions. The condition required, to take recycling as the most ecologically efficient method to get rid of waste in an ecologically sensible manner, is that the difference of the necessary primary resources for recycling and manufacture of secondary raw materials must be lower than the primary resources required for alternative waste disposal methods. Bearing this in mind, the sensible limitations for recycling are automatically set. Not in every case is the recycling of materials ecologically orientated. Conditions and limitations stipulate each other. The ecological limits are given a lot of consideration where recycling is concerned. Graphs. 7 ref. (Fleischer, G.; Radex Rundschau, (1993), (1-2), pp. 274-278 [in German]. ISSN 0370-3657)

0309 THE POSSIBILITIES AND LIMITS OF THE SHREADING TECHNOLOGY WHEN RECYCLING CONSUMER MATERIALS. (MOGLICHKEITEN UND GRENZEN DER SHREDDER-TECHNOLOGIE BEIM STOFFLICHEN RECYCLEN VON KONSUMGUTERN.) [BIB-199312-F1-Z-0779]

Shreading means reducing goods in size so that all scrap pieces comprised of one material can be fed to a separate recycling process. The shreading technology today is of a high standard and well developed. Efficient scrap preparation for the steel industry is necessary due to the increasing number of old cars and used consumer items. Various handling methods in the shreader enable almost 100% separation efficiency. Man-made fibres, rubber items, and glass can only be recycled to a certain extent. In this case they are sorted manually. In this way many metals, fibres polyester materials, and glass can be recycled many times and will not be a burden to nature. Our resources will be spared, energy saved, and the environment relieved. Graphs. (Schmieg, F.; Radex Rundschau, (1993), (1-2), pp. 279-288 [in German]. ISSN 0370-3657)

0310 AUTOMOBILE RECYCLING—TODAY AND TOMORROW. (AUTOMOBIL-RECYCLING—HEUTE UND MORGEN.) [BIB-199312-F1-Z-0780]

The problems with depositing waste together with the environmental problems are slowly coming to a head. This situation urges a policy toward cutting back on, and more efficient use of, natural resources. In this case there is a need to concentrate, and try harder, to eliminate, and when possible, recycle materials appropriately. With this and the product life cycle in mind, a concept covering the recycling of old vehicles has been proposed by the German automobile industry together with the representatives of other industrial branches involved. The second dimension of automobile recycling has led to the development and manufacture of new automobiles which are environment friendly and safe to recycle. The key tasks are to design an easily strippable construction and select economic recyclable materials. 5 ref. (Franze, H.A.; Radex Rundschau, (1993), (1-2), pp. 289-295 [in German]. ISSN 0370-3657)

0311 "TOTAL RECYCLING OF SCRAP CARS". CONCEPT OF THE STUDY COMMITTEE FOR THE DISPOSAL OF SCRAP CARS (EVA). (DAS "TOTALRECYCLING VON ALTFAHRZEUGEN". DAS KONZEPT DER STUDIENGESELLSCHAFT ZUR ENTSORGUNG VON ALTFAHRZEUGEN MBH (EVA).) [BIB-199312-F1-Z-0781]

The combination of development measures, dismantling concepts, utilization of components and downstream metallurgical recycling allows for an applicable continuous future-oriented concept for the disposal of scrap cars. In this overall process an optimum combination of metallurgical values with lowest possible energy consumption is achieved by an ecologically and economically oriented sequence of procedures. The utilization of the chemically bound energy content of the organic substances in the scrap bale will reduce the amount of required primary energy. The use of natural gas as melting energy (i.e. secondary energy source) instead of electrical energy also contributes considerably to minimize CO_2 emissions. This process sequence ensures an environment-friendly disposal of scrap cars with saleable by-products and lowest emissions. Graphs. 4 ref. (Nieder, W.; Radex Rundschau, (1993), (1-2), pp. 308-314 [in German]. ISSN 0370-3657)

0312 LARGE SCALE ENERGY RECOVERY TRIALS ON POLYURETHANE, PET, ACRYLIC AND NYLON. [BIB-199402-D1-P-0264]

The use of plastics as an energy source has been demonstrated on a commercial scale at a plastics manufacturing site. This paper covers the preparation and use of pre- and post-consumer plastics as supplementary fuels within a circulating fluidised bed boiler specially designed for co-combustion with coal. Full emissions data on the 15% mixtures of individual plastics with coal are presented together with calculations of thermal efficiencies. Measurements by an independent body confirm that the co-combustion of coal and plastic reduces some emissions relative to coal alone. Thermal efficiencies of approx 80% were achieved during operation, and this heat was used effectively during the produc-

tion of plastics. 7 ref. (Soderberg, D.J.; Lenton, R.A.; Boylett, A.R.; Hicks, D.A.; RECYCLE '93, Davos, Switzerland, 23-26 Mar. 1993, Cellular Polymers, (1993), 12, (6), pp. 421-432 [in English]. ISSN 0262-4893)

0313 APPLICATION OF CERAMIC FIBRE IN SAIL PLANT FURNACES FOR ENERGY CONSERVATION. (RETROACTIVE COVERAGE). [BIB-199402-F1-D-0085]

The use of ceramic fibers in the steel industry is discussed. For the hot face temperature up to 1400 °C , alumino-silicate, alumina—silica—zirconia fibres and for temperature up to 1600 °C , alumina fibres are utilised in the forms of veneering, wall paper lining, modular lining and sealant in different furnaces to conserve energy. This ability is derived because of the unique property of ceramic fibre of low thermal mass, easier and quicker to install and light weight. The studies in the plants have shown that a fuel saving of 5-25% has been achieved with the use of ceramic fibres as insulant, along with other benefits like lighter furnace weight, faster cycle time, etc. (Bhattachrya, A.K.; Das, P.; Mahadeo, —.; Dasgupta, A.K.; Chatterjee, K.C.; ADVANCES IN COMPOSITE MATERIALS, Bombay, India, 15-18 Jan. 1990, Publisher: OXFORD & IBH PUBLISHING CO. PVT. LTD., New Delhi 110 001, India, (1991), (Eng. Mat., 9402-G2-Z-0052), pp. 67-79 [in English].)

0314 MECHANOCHEMICAL SYNTHESIS OF BINDERS IN TECHNOLOGY OF ALUMINA PRODUCTS FOR HIGH-TEMPERATURE PROCESSES. [BIB-199403-D1-C-0357]

Mechanochemical treatment and synthesis of gel-like binders make it possible to simplify the composition of alumina mouldings, e.g. catalyst, carriers, and their preparation process. Alumina, calcium monoaluminate ($CaO.Al_2O_3$) and calcium dialuminate ($CaO.2Al_2O_3$) were comminuted in various laboratory mills (of ball, vibratory ball, vibratory roll-ring, vapart and impact types). The increases of hydration rates and hydration degrees are ascribed to mechanical activation. Ball-milled and vibratory-roll-ring-milled powders exhibit the highest hydration degree and the largest quantities of mechanosynthesized gel-like binder. The treatment in such mills is characterized by the largest energy efficiency calculated from the kinetic curves of mechanical activation. The presence of gel-like binders permits the regular development of structural—mechanical properties of alumina-containing moulding pastes, increases the plasticity of molding compositions and increases the extrudate strength. Graphs, Maps. 6 ref. (Trofimov, A.N.; Il'yin, A.P.; Shirokov, Yu.G.; 3rd Soviet-Japan Seminar on Mechanochemistry, Novosibirsk and Irkutsk, Siberia, USSR, 26 July-3 Aug. 1990, Sibirskii Khimicheskii Zhurnal, (Sept.-Oct. 1991), (5), pp. 150-155 [in English]. ISSN 0002-3426)

0315 HOT ISOSTATIC PRESSING. [BIB-199403-E4-C-0114]

Two types of production systems that have been developed for sintering and hot isostatic pressing (HIP) of oxide, carbide, nitride and special high temperature ceramic materials are described. For oxides, a special platinum furnace which can operate with 20% oxygen in argon up to 1400 degrees celsius and 200MPa was developed. The furnace for nitrides is a graphite furnace with nitrogen atmosphere. For special high temperature materials, a sinter HIP system capable of 2000 degrees celsius in vacuum and 3000 degrees celsius under pressure was developed. The systems are said to be reliable and safe with low cost per part processed due to it short processing times and dependable measuring and control systems. The possibility to optimize sintering cycles with dilatometers and to calculate required cooling rates and capsule shapes offers additional scope for cost savings. (Traff, A.; Publisher: Sterling Publications Limited, P.O. Box 799, Brunel House, 57 North Wharf Rd., London W2 1XR, UK, Ceramic Technology International 1994, (1993), (Eng. Mat., 9403-G2-Z-7016), pp. 168-170 [in English].)

0316 FIRING HEAVY CLAY PRODUCTS MORE EFFICIENTLY. [BIB-199403-E6-C-0038]

The potential for using time-temperature-transformation (TTT) diagrams to reduce the firing times for heavy clay products was investigated. The research involved examination of 245 sample materials drawn from 14 different geological horizons. The sample selection represented the main sources of brick and tile clay used in the United Kingdom. Twenty-five raw material samples from this initial range of materials were subjected to detailed firing tests. About 100 briquettes were extruded from each sample raw material and were fired at a range of temperatures and soak times. The results were used to prepare TTT diagrams for each constituent mineral, for the background and amorphous content and for levels of water absorption and fired shrinkage. The TTT diagrams constructed indicated that it should be possible to reduce soak times in all but a few instances. Graphs. (Furnival, J.; Publisher: Sterling Publications Limited, P.O. Box 799, Brunel House, 57 North Wharf Rd., London W2 1XR, UK, Ceramic Technology International 1994, (1993), (Eng. Mat., 9403-G2-Z-7016), pp. 165-167 [in English].)

0317 IMPACT OF ENERGY CODES ON THE GLASS INDUSTRY. [BIB-199403-G1-C-0024]

The glass industry, both flat glass and fiberglass, will be positively impacted by recent changes in energy codes. Increased thermal and energy requirements have been adopted via recent changes in energy codes for the construction of new buildings. These changes are presented in the 1992 Council of American Building Officials Model Energy Code for residences and in the ASHRAE Standard 90.1-1989 for commercial building. Each of these energy codes was identified in the Energy Policy Act of 1992, signed into law on 24 October 1992, which requires all states to either meet or exceed these codes within two years. Details of the requirements are reviewed along with their impact. Graphs. 8 ref. (McBride, M.F.; Bulger, M.L.; 54th Conference on Glass Problems, Urbana, Illinois, 26-27 Oct. 1993, Ceramic Engineering and Science Proceedings, (Mar.-Apr. 1994), 15, (2), pp. 50-61 [in English]. ISSN 0196-6219)

0318 THE DEPARTMENT OF ENERGY'S RESEARCH AND DEVELOPMENT PROGRAM FOR THE GLASS MANUFACTURING INDUSTRY. [BIB-199403-G1-C-0025]

The US Department of Energy's Office of Industrial Processes is supporting a cost-shared research and development program for the glass manufacturing industry. This paper reviews DOE's program planning and its ongoing R & D projects. It is the first step in opening a dialogue between DOE and industry to help DOE develop an effective research program designed to increase the industry's energy efficiency and competitiveness. 3 ref. (Obenchain, W.A.; 54th Conference on Glass Problems, Urbana, Illinois, 26-27 Oct. 1993, Ceramic Engineering and Science Proceedings, (Mar.-Apr. 1994), 15, (2), pp. 90-98 [in English]. ISSN 0196-6219)

0319 POWER COSTS ACHILLE'S HEEL FOR KENTUCKY BASIN SMELTERS. [BIB-199301-G1-0021]

Power costs have long been the Achille's heel for Alcan and Southwire Al smelters in western Kentucky, USA, located approx 50 miles apart in a region whose once bustling high-sulfur coalfield has almost gone bust, a victim of the Clean Air Act Amendments of 1990. They've had to cut costs wherever possible because the companies represent the major load factor for the financially distressed utility that serves them, Big Rivers Electric Corp., Henderson, Kentucky, USA. (METALS WEEK FOCUS, (NOV.-DEC. 1992), 1, (14), pp. 8, 10, 24 [in English].)

0320 ELECTRICAL USES ARE BIG GROWTH AREA FOR COPPER. [BIB-199301-G8-0045]

Some of the major areas to watch for Cu growth during the next several years include electrical transformers and motors, along with building wire and busbar; sheet and coil for architectural applications; tubing for fire sprinklers; and Cu alloys for screw machine parts and automotive electrical systems. The Copper Development Association's new Electrical Energy Efficiency program illustrates how a simple upsizing of Cu conductors used for electrical distribution can earn significant paybacks to building owners, usually within one to two years. (Payne, R. M.; AMERICAN METAL MARKET, (23 NOV. 1992), 100, (227), (Suppl. Copper), pp. 10A [in English]. ISSN 0002-9998)

0321 LOW NO_X BURNERS FOR THE STEEL INDUSTRY. [BIB-199301-S4-0001]

Energy efficiency in furnace burners is not always green technology. While preheating combustion air saves fuel and hence CO_2 emissions, early burners resulted in higher NO_X emissions. How this problem was overcome is described. (STEEL TIMES, (NOV. 1992), 220, (11), pp. 508, 510 [in English]. ISSN 0039-095X)

0322 BPA'S CURBS TO TRIM RECORD METAL OUTPUT. [BIB-199302-G8-0131]

US primary Al production, running at a 13-month high coming into 1993, is heading lower under a looming power cut in the Pacific Northwest. Alumax, Columbia Aluminum, and Columbia Falls Aluminum have trimmed output or set plans to cut back production after the Bonneville Power Administration (BPA) reversed field on 11 January 1993, and in effect canceled a restoration of a 25% power curb effected in August 1992. Alcoa and Kaiser Aluminum & Chemical are weighing options on trimming output at their respective Washington-State-based smelters. Reynolds Metals is unaffected. (Regan, B.; AMERICAN METAL MARKET, (13 JAN. 1993), 101, (8), pp. 2, 8 [in English]. ISSN 0002-9998)

0323 REHEAT COSTS SPOTLIGHTED. [BIB-199302-S1-0012]

Reheating cold stock consumes 85-90% of the total energy used in hot rolling. In theory, based on the heat capacity of steel, the energy requirement should be 0.5-0.7 GJ/t, depending on the steel grade and temperature reached. In practice, the results of a survey published by the Energy Technology Support Unit (ETSU), UK, reveal that, in the worst case, energy consumption was 2.65 GJ/t (23% efficiency), and even in the best case, 1.20 GJ/t (50% efficiency). The mean for 70 furnaces surveyed was approx 1.91 GJ/t. Methods of improving efficiency will be the theme of a one day conference and exhibition to be held in Solihull, West Midlands, UK, on 17 March 1993. Topics covered will include furnace design, burner technology, furnace operational aspects and control. (METALS INDUSTRY NEWS, (DEC. 1992), 9, (4), pp. 16 [in English]. ISSN 0265-8321)

0324 THE GAS INJECTION SOLUTION FOR BLAST FURNACES. [BIB-199302-S1-0013]

In theory, high rate natural gas injection in blast furnaces can reduce coke consumption and increase blast furnace productivity at minimum capital cost to the steel industry. Confirming this theory on a production-scale operating furnace and generating verification data to support the technology were the goals of some recent field tests by the Gas Research Institute (GRI) and its contractor Charles River Associates at Armco Steel Company, Middletown, Ohio, USA. (PLANT ENGINEERING, (10 DEC. 1992), 46, (19), pp. A8-A9 [in English]. ISSN 0032-082X)

0325 ENERGY CUTS BLOOM AT BRITISH STEEL. [BIB-199302-S1-0014]

Enough energy to keep the largest mill at British Steel Scunthorpe running for one whole week can be saved in 1992 due to a bank of Control Techniques frequency inverters. Twenty-five Commander CDV digital inverters were installed on air fans at the Scunthorpe site's Bloom and Billet Mill following the success of a trial inverter at the plant in December 1991. The frequency inverters enable the speed of the combustion air fans on the soaking pits to be varied between 360-2400 rpm. Previously the fans worked on a damper system running at a constant 3000 rpm. (STEEL TIMES, (DEC. 1992), 220, (12), pp. 575 [in English]. ISSN 0039-095X)

0326 FURTHER ENERGY ECONOMY REQUIRES TECHNOLOGICAL BREAKTHROUGH. [BIB-199302-S1-0016]

Hoogovens IJmuiden is no longer letting off any steam. Recently, the company has put three systems into use with which the steam, released during certain processes, is re-applied for other processes. This leads to an annual energy saving of approx 245 000 GJ, or the annual quantity of natural gas for 3000 households. The steam re-application systems have required an investment of Dfl.3.9 million. The EC and the Ministry of Economic Affairs, supported the project as it fell within the Multi-Year Energy Saving Agreement which was signed in 1992 by the Ministry and the Dutch iron and steel producing industry. (STARVISION (ENGLISH EDITION), (NOV. 1992), 1, (1), pp. 22-23 [in English].)

0327 ECONOMICS ADD UP FOR BOOSTING GAS INJECTION. [BIB-199302-S1-0017]

In the second half of their review of the experiments at Armco Steel's No. 3 blast furnace at Middletown, Ohio, USA, researchers discuss the productivity gains that resulted from increasing the natural gas injection rate. (Agarwal, J.C.; Brown, F.C.; Lingras, A.P.; IRON AGE, (JAN. 1993), 9, (1), pp. 30-32 [in English]. ISSN 0897-4365)

0328 SCALING DOWN SLAB CONVERSION COSTS. [BIB-199302-S9-0106]

Steel producers are looking at new ways to hot roll carbon sheet. The aim is to scale down the size and cost of equipment needed to convert slabs into strip. With companies scrambling to build the next minimill, the search for new technology has taken on the character of a race. One concept being studied calls for feeding slabs directly and continously into a high reduction mill. Deep bites would be taken at relatively slow speeds. A second approach makes hot reduction an integral part of the continuous casting process. Slabs are reduced while still soft or even with molten centers. A third method employs hot reversing mills instead of continuous trains. Steckel mills have been around for years on a limited basis but are attracting new interest. (McManus, G.J.; IRON AGE, (JAN. 1993), 9, (1), pp. 12-14 [in English]. ISSN 0897-4365)

0329 EUROPE'S MOST RATIONAL SMELTING WORKS. [BIB-199303-G2-0044]

The main products of the Tinfos Jernverk, Kvinesdal, Oye smelting works are SiMn and high-C ferromanganese. The works exhaust heat is used in fish breeding in the clean fjord water. A large proportion of the furnace gas energy has also been recuperated since 1981 with 15% decrease in energy expenditure. (Bergh, S.; BERGSMANNEN, (1992), (6), pp. 12-14 [in Swedish]. ISSN 0284-0448)

0330 ZERO POLLUTION AND QUICKER PLATING WITH YRPS. [BIB-199303-G4-0013]

The Yamaha Rapid Plating System (YRPS) supplied by Thyssen is claimed to be unique in the world. The fully automatic equipment is suitable for hardchroming, Ni or Cu plating for mass production of components. According to the company the system is up to 100 times faster than previous traditional methods and is compact, non-polluting and able to be fully integrated into existing mechanical production processes. It is also cost-reductive in respect of energy consumption. Up until now it was only thought possible in theory to develop a non-pollution plating system. This was because it was extremely difficult to improve the adhesion property, to develop anodes with a relative long durability, to master leakages and fumes as well as numerous other hurdles. It has taken Yamaha five years to produce a production mature system after solving all the

problems one by one. (FINISHING, (JAN. 1993), 17, (1), pp. 37 [in English]. ISSN 0309-3109)

0331 CAPTURES SOLAR ENERGY—SAVES ELECTRICITY. [BIB-199303-G6-0053]

Solar energy captured by an Al roof can reduce energy consumption for an average Norwegian family by approx 30-40%. After having been a research project of the University of Oslo and Hydro Aluminium Vekst since about the middle of the 1970s, the Norwegian solar energy roof is now on the market. The Solnor roof traps solar energy in the water that runs over an Al roof. To get the extra effect from the sun's rays, the Al roof is covered with plastic sheets made of polycarbonate. The plastic covering produces a greenhouse effect, making the water that runs over the Al roof even hotter. (Mustvedt, S.; ALUNEWS, (DEC. 1992), 4, pp. 11 [in English].)

0332 VARIABLES INFLUENCING ELECTRIC ENERGY AND ELECTRODE CONSUMPTION IN ELECTRIC ARC FURNACES. [BIB-199303-S1-0021]

From the evaluation of average values from 14 ac electric arc furnaces with tap weights from 64-147 t, a formula has been derived for the calculation of the specific electric energy demand as a function of the specific weight of the scrap, alloys and fluxes, specific consumption of burner gas and blowing oxygen, tapping temperature and heating time as well as specific electric power and power-off time. This calculation agrees with the actual consumption values ranging between 380-600 kWh/t with a standard deviation of 5 kWh/t. Influencing factors for the specific electrode consumption have also been calculated from the given formula by using Bowman's formulae for tip and side consumption rates. For a fictitious model furnace an electric energy consumption of 330 kWh/t and electrode consumption of 1.37 kg/t with a power-on time of 32 min have been calculated. (Kohle, S.; METALLURGICAL PLANT AND TECHNOLOGY INTERNATIONAL, (DEC. 1992), 15, (6), pp. 48-50, 52, 55 [in English]. ISSN 0935-7254)

0333 THE FUCHS SHAFT FURNACE AT CO-STEEL SHEERNESS. [BIB-199303-S2-0083]

The need to save energy as well as to meet future environmental, ergonomic and economic demands caused Co-Steel Sheerness, which is a subsidiary of the Co-Steel Group, to replace its outdated conventional EAF with a new concept—the shaft furnace developed by Fuchs Systemtechnik. A single shaft furnace went into operation at Co-Steel Sheerness in April 1992. (IRON AND STEELMAKER, (FEB. 1993), 20, (2), pp. 21-24 [in English]. ISSN 0097-8388)

0334 AGING ZINC SMELTER REPLACED AT MITSUI [BIB-199304-G2-0060]

Mitsui Mining & Smelting has replaced the 50 year old Zn smelter at Kamioka, Gifu Prefecture, Japan, with a new one that is 10% more efficient. The production capacity remains unchanged at 72 000 mt/year. The newly completed Zn electrolyzing mill is able to operate with an electric current density 30% less than the old plant. Computer controls set optimum operating conditions, which saves 300 kwh/t produced. (Furukawa, T.; American Metal Market, (15 Mar. 1993), 101, (49), pp. 6 [in English]. ISSN 0002-9998)

0335 US BTU TAX HIT HARD BY INDUSTRY. NAM CHIEF SAYS EFFECT WILL BE 30% WORSE THAN ON GDP. [BIB-199304-G7-0158]

The Clinton administration's proposed BTU energy tax would have a particularly adverse affect on the primary metals and Al industry and it should be replaced by a value added tax, the National Association of Manufacturers testified before the US Senate Committee on Energy and Natural Resources. The BTU tax could cause a loss in industrial production that would be 30% higher than the loss in the gross domestic product, and could harm the competitiveness of US-produced goods in foreign markets by significantly reducing exports, which have accounted for 30-40% of US economic growth. (Viani, L.; American Metal Market, (25 Feb. 1993), 101, (37), pp. 2, 16 [in English]. ISSN 0002-9998)

0336 CRP BEATS ALUMINUM OVER A LIFETIME. [BIB-199304-D6-0057]

Thermosetting composite materials are inherently less capable of being recycled than thermoplastics, and when proposed as replacements for recyclable metals can seem positively disadvantageous. However, the recyclability of the material is by no means the only factor, and when a lifetime energy equation is drawn up the balance can be very much in favour of composites. Ciba-Geigy makes this argument in the context of a carbon fibre-reinforced epoxy Airbus tail fin box. The alternative is to make the fin box in Al, which can be recycled. However, the production of a fin box in Al takes seven times more energy than using CRP. In use an Airbus with a CRP fin box consumes approximately 1% less fuel than one with an aluminum fin box. During a 20 year lifespan this gives an energy saving of approximately ten million MJ for the production and use of CRP for the fin box compared with Al. In addition, there is a reduction of approx 800 tonnes of CO_2 emission. (British Plastics and Rubber, (Feb. 1993), pp. 33 [in English]. ISSN 0307-6164)

0337 ENERGY SAVINGS WITH CATALYTIC HEATERS. [BIB-199304-P3-0122]

In the last year, a dozen thermoforming plants have replaced their conventional electric and gas-flame heaters with catalytic units, which are marketed by Vulcan Catalytic Systems, Portsmouth, Rhode Island, USA. Though the catalytics offer some unique processing benefits, their obvious selling point is energy savings. One Midwest US thermoformer who processes 60 000 lb of sheet/month on four machines reported that, after converting his ovens from electric to gas catalytic heaters, his monthly electricity bill dropped from $25 000 to $9300. The gas bill was $1300, producing a net saving of $17 000. (Miller, B.; Plastics World, (Mar. 1993), 51, (3), pp. 17 [in English]. ISSN 0032-1273)

0338 EUROPE LAUNCHES PLASTICS INITIATIVE, SEEKS STANDARD APPROACH. [BIB-199304-P4-0018]

European plastics producers have achieved a common approach to life cycle analysis (LCA) and are now looking to promote the technique in downstream industries at an international level. Inventories of raw materials, energy consumption, and emissions will be published shortly for hydrocarbon feed-stocks and a number of polymers, eg. polyethylene, polypropylene, polystyrene, polyvinyl chloride, polyethylene terephenalate, acrylics, poly-carbonates, nylons, and unsaturated polyesters) says the European Centre for Plastics in the Environment (PWMI), an arm of the Association of Plastics Manufacturers in Europe (APME), Brussels, Belgium. Last week the PWMI published common methodology for collecting data devised by four independent LCA experts led by a professor at the UK's Open University. PWMI has just initiated a program with the European Union of Plastics Convertors, Brussels, and LCA experts to address conversion. LCA efforts are under way in the US, and the Society of the Plastics Industry, Washington, D.C., has asked Chem Systems, Tarrytown, New York, to create a data base for LCA. The Environmental Protection Agency, Washington, D.C., concerned about misleading studies, published guidelines for compiling LCA inventories last December. The Society of Environmental Toxicology and Chemistry (SETAC), Brussels and Washington, will meet in Lisbon in March to develop codes of practice for LCA generators. (Chynoweeh, E.; Kirschnes, E.; Chemical Week, (10 Mar. 1993), 152, (9), pp. 17 [in English]. ISSN 0009-272X)

0339 PROCESSORS WILL PAY IF ENERGY TAX PASSES. [BIB-199304-P7-0126]

US Plastics processors can expect their cost of doing business to rise next year if Congress passes President Clinton's energy tax proposal. Processors avoided a double hit to their balance sheets, however, as the use of oil and natural gas as a feedstock material for making resins apparently would be exempted under Clinton's proposed plan. The energy tax was one among several money-raising moves Clinton presented as he outlined a plan on 17 February to reduce the federal government's debt and stimulate both long-term and short-term growth. He wants to levy $0.257/million BTUs produced by coal, natural gas and nuclear power and $0.599/million BTUs produced by oil. Plastics industry reaction to the energy tax and Clinton's overall plan was mixed, partly because it was not immediately clear how the feedstock exemption would be administered. (Gardner, J.; Plastics News (Detroit), (1 Mar. 1993), 5, (1), pp. 5 [in English]. ISSN 1042-802X)

0340 STEELMAKERS MULL SWITCH TO DC FURNACE. [BIB-199304-S1-0034]

Steelmakers, always eager to find new ways to save money, are looking increasingly at direct-current (dc) arc furnaces rather than the conventional

alternating-current furnaces. The reason? Lower operating cost. According to ABB Metallurgy, of 30 North American projects for arc furnaces that the company is currently working on, only two are for ac furnaces. To date between 36-40 dc furnaces have been sold worldwide, 27 of which are from ABB, and 18 or 19 of these are now on stream. (Pinkham, M.; American Metal Market, (18 Feb. 1993), 101, (32), (Suppl. Electric Furnace Steel), pp. 5A [in English]. ISSN 0002-9998)

0341 EUROPE'S EF DEMAND FIRES UP AS PRODUCERS LOOK TO REDUCE COSTS. [BIB-199304-S1-0035]

China, the US, and Western Europe are the hottest markets for electric furnaces in the steel industry, according to Germany's MAN Gutehoffnungshutte GmbH, also known as MAN GHH. MAN GHH currently has six projects in Western Europe—three in Germany (including one in former East Germany), one in Spain, one in France and one in Luxembourg. Other European orders are expected later in 1993, inspite of the recession. (Erlick, J.C.; American Metal Market, (18 Feb. 1993), 101, (32), (Suppl. Electric Furnace Steel), pp. 4A [in English]. ISSN 0002-9998)

0342 EXPANSION OF PAIR CROSS (PC) MILL APPLICATIONS TO HOT AND COLD ROLLING MILLS. [BIB-199304-S2-0122]

Mitsubishi Heavy Industries, Hiroshima, Japan, has developed a pair cross mill (PC mill) equipped with on-line roll grinders to obtain both curve-free rolling and strip width-free rolling conditions simultaneously. Adoption of in-plate rolling has led to improved product quality and reduced the number of rolling passes, increasing productivity and, by reducing the slab dropout temperature, reducing energy consumption. Anticipated benefits in cold rolling include higher reductions and improved strip profile (less edge drop). (Aratani, H.; Ozono, R.; Nakano, T.; Iron and Steel Engineer, (Mar. 1993), 70, (3), pp. 32-37 [in English]. ISSN 0021-1559)

0343 COMPUTER SYSTEM AIDS ENERGY SAVINGS AT BS LLANWERN. [BIB-199304-S3-0111]

British Steel Llanwern has installed a comprehensive, centralised energy monitoring and control system to optimise energy use. Initial results show significant savings, particularly on gas consumption. The Eurotherm Network 6000 system collects information from 2000 points, divided between the main sections of plant. The Energy Centre supervisory package running on a Dec Vax 3400 computer, collects data over dedicated serial links from the turbines, the fuel control system, its associated pump-houses and the BOS gas recovery system. A Decnet network links the centre to a further Maxi-Vis supervisory package also running on a Vax, in the main electricity sub-station. (Steel Times, (Feb. 1993), 221, (2), pp. 89, 92 [in English]. ISSN 0039-095X)

0344 SECONDARY ALUMINIUM FURNACE BURNS ITSELF CLEAN. [BIB-199306-G4-0043]

A new, patented, smelting furnace technology guarantees the use of secondary recycled aluminum in new product design. It should reverse the rapidly reducing profitability for material processors and suppliers caused by environmental legislation. This new type of furnace designated RILEE (recycled incineration low exhaust emission system) was developed by Brock Metal and Industrial Gas Applications. Primary energy consumption is reduced to approx 3 GJ/t of Al ingot, a saving of 70%. (Titley, J.; Eureka, (Feb. 1993), 13, (2), pp. 17 [in English]. ISSN 0261-2097)

0345 US ALUMINUM OUTPUT OFF 7.4% IN FIRST QUARTER 1993. [BIB-199306-G8-0575]

Regional drought and spawning salmon did what the Russian bear couldn't: force primary aluminum production down sharply in the US. The nations 22 active smelters reported a 7.4% drop in new metal poured from the last quarter of 1992. Primary Al production totaled 949 687 mt during the first quarter of 1993, as average daily production slipped to 10 552 t/day in March 1993—91.7% of the industry's nameplate capacity. A 25% power curb that affects a cluster of Pacific smelters was extended in mid- January 1993 due to continued low water levels and salmon fishing. (Regan, B.; American Metal Market, (15 Apr. 1993), 101, (72), pp. 5 [in English]. ISSN 0002-9998)

0346 RECYCLED PS, CEMENT USED TO BUILD HOUSE. [BIB-199306-P6-0116]

Recycled polystyrene is featured in a model home designed to be affordable and energy efficient. The project, in Templeton, California, USA, was developed by the San Luis Obispo Non-Profit Housing Corp. The home is built mainly from a material called Rastra, which is made of recycled PS pellets molded with cement. The home also has vinyl window and door framing produced from profiles supplied by Veka Inc. of Fombell, Pennsylvania. Likit Windows of San Leandro, California, supplied sliding- and single-hung windows and patio doors, while Radco Windows of Santa Maria, California, supplied picture windows and some single-hung windows. (Plastics News (Detroit), (19 Apr. 1993), 5, (8), pp. 5 [in English]. ISSN 1042-802X)

0347 KALTEK INSULATING LINING SYSTEM FOR DISAMATIC POURING BOXES YIELDS QUALITY, AND PROCESS BENEFITS. [BIB-199306-S3-0158]

The KALTEK ladle lining system combines the features of high insulation with refractory stability when used in iron and steel foundry metal transfer applications. While benefits in molten steel applications have been known for some time, it is just recently that KALTEK has gained wide acceptance in iron casting facilities. This is especially true for ductile iron treatment ladles, transfer ladles, and fixed station pouring boxes such as those associated with DISAMATIC molding systems. The reasons are clear—lower costs associated with energy, labor, and operations as well as higher quality in the form of both finished product and consistency of process. The results have been documented in the case study, where a production iron foundry was able to quantify savings of $244 000/year after converting to the KALTEK system. (Karson, J.A.; Foundry Practice, (Mar. 1993), (224), pp. 16-17 [in English]. ISSN 0266-9994)

0348 JAPAN HELPS ROMANIA CLEAN UP ITS STEEL INDUSTRY. [BIB-199306-S4-0056]

Japan is taking an active role in helping the steel industry in Romania reduce its energy consumption and cut back on pollution. The Japan International Cooperation Agency (JICA) has already surveyed the Galati Steel Plant, which is responsible for extensive pollution of the Danube River and suffers frequent raw material and power shortages. (Japan Metal Bulletin, (12 Apr. 1993), 41-15, (5745), pp. 1 [in English]. ISSN 0021-4523)

0349 SUMITOMO METAL MAKES STRONGER EFFORT TO SAVE ENERGY. [BIB-199306-S4-0057]

Sumitomo Metal Industries plans to reduce its energy consumption by 10% during the 1990s, and will invest 25 billion yen in energy conservation. Energysaving work groups have already been established at Sumitomo's three plants, apparently with good results. The 1992 energy reductions goal of 1% was met, resulting in a 1 billion yen savings. (Japan Metal Bulletin, (12 Apr. 1993), 41-15, (5745), pp. 3 [in English]. ISSN 0021-4523)

0350 CLINTON TAX PLAN OFFERS COKE BREAK: LOBBYISTS SEEK OTHER BTU TAX AIDS FOR 'NON-FUEL USES'. [BIB-199306-S7-0390]

Coke used in steel making in the US would get a partial break from the proposed Btu tax on energy. The Clinton administration's massive tax plan currently promises a partial refund when the energy tax is levied on coal that is used in producing coke for steelmaking. The full Btu tax would be paid initially on the coal, but the refund would cover only the reduced Btu content of the coke produced, approx 60% of the original content. Integrated steel companies would still be hit with additional energy-tax related costs of approx 4.80/t of steel produced. (Schmitt, B.; American Metal Market, (7 May 1993), 101, (88), pp. 8 [in English]. ISSN 0002-9998)

0351 STEEL TELLS SENATE POSITIONS US. [BIB-199306-S9-0271]

Steel industry executives went to Capitol Hill to voice suggestions about a multilateral steel agreement, reservations about President Clinton's proposed energy tax and support for a value-added tax that would replace other business levies. The American Iron and Steel Institute presented to the US Senate Steel Caucus position papers on the MSA and on Clinton's Btu tax on energy.

(Schmitt, B.; American Metal Market, (26 Apr. 1993), 101, (79), pp. 2 [in English]. ISSN 0002-9998)

0352 EFFICIANT USE OF ELECTRIC FURNACES IN THE NON- FERROUS FOUNDRY. [BIB-199307-G3-0127]

Electric-furnace melting and holding are commonplace in copper and aluminum foundries, and have proven to be a highly effective means of providing molten metal. Stewing and superheating can increase power costs, adversly affect metal quality, and lead to more scrap. Recovery flexibility, and environmental impact must also be considered as well. (Smith, L.; Foundryman, (May 1993), 86, (4), pp. 131-136 [in English]. ISSN 0007-0718)

0353 GAS TECHNOLOGIES FOR NONFERROUS MELTING EFFICIENCY. OVERALL ROLLED COPPER DEMAND EXPECTED TO DECREASE IN FY 1993. [BIB-199307-G3-0128199307-G3-0128]

Energy efficiency continues to be a driving force behind British Gas' involvement in the development of new nonferrous metal melting technologies. High velocity burners are effective for processes which rely on forced convective heat transfer, i.e. zinc melting in top-heated galvanizing baths. Recuperative burners are well established for metal reheating and aluminum melting in crucible furnaces. Regenrative burners are finding their niche in secondary Al processing, while oxy-gas burners are being used in rotary-furnace melting of Al.

The Japan Rolled Copper Association is expecting Japanese demand for rolled copper products to be 1 107 000 t for fiscal 1993, down 2.2% from the previous year. Demand for Cu rolled in fiscal 1992 was down 11.1% from fiscal 1991, but government and housing investments are expected to boost domestic demand and result in a slight recovery for 1993. (Japan Metal Bulletin, (17 May 1993), 41-19, (5750), pp. 6 [in English, English]. ISSN 0007-0718, ISSN 0021-4523)

0354 EURO TRADE GROUP REVEALS FIRST BATCH OF POLYOLEFINS LIFE CYCLE DATA. [BIB-199307-P1-0146]

The first results of a landmark European study of plastics' lifecycles are in. The Association of Plastics manufacturers in Europe (APME), Brussels presented its first batch of data on polyolefins at a late May meeting, and expects to have data on PVC and PET to show in coming months. The life cycle inventory (LCI) studies have been in the pipeline for three years, and have cost $4.5M so far. A similar study program is underway in the US, sponsored by the Society of the Plastics Industry, but may not produce any numbers until sometime next year. The initial APME information presents detailed industry average data on energy and raw material inputs, plus solid, liquid and air emissions, all stated on the basis of "per kg of product" made. (Plastics Week, (7 June 1993), pp. 1, 3 [in English]. ISSN 1044-9663)

0355 HATCH FINISHES STUDY ON POWER FOR NEW ELECTRIC FURNACE. [BIB-199307-S1-0068]

Hatch Associates, Dallas, Texas, USA, has completed a power compensation study for a new direct-current electric furnace melt shop under construction at Nucor's Darlington, South Carolina, USA, plant. The existing static VAR compensator will be retrofitted to compensate for the new furnace load, avoiding the cost of purchasing and installing new equipment. (American Metal Market, (27 May 1993), 101, (102), pp. 3 [in English]. ISSN 0002-9998)

0356 EVOLUTION OF AN ELECTRICAL POWER DEMAND CONTROL SYSTEM. [BIB-199307-S3-0228]

Canton, Ohio, USA-based Timken Steel has conserved energy and substantially reduced power costs through shorter power shedding times with the use of a computer- controlled electrical power demand system. The upgraded system is flexible to changes in steel melting practice, with control moved to levels closest to the process, and allows for easy maintenance and furure enhancement. (Effinger, J.R.; Iron and Steel Engineer, (June 1993), 70, (6), pp. 36-40 [in English]. ISSN 0021-1559)

0357 WHO IS "GREENER"? STEEL AND ALUMINUM CANS IN A BITTER CONTEST. (WER IST "GRUNER"? STAHL- UND ALU-DOSE IN ERBITTERTEM WETTSTREIT.) [BIB-199307-S6-0077]

The British steel industry promotes "Ecotop", a steel can for carbonated drinks which opens by pressure on a button without the need for aluminum, as used for ring pulls. The steel cans present a price advantage over Al, which is easier to recycle. However, steel cans have lower total energy consumption, and even more so as the weight of steel cans can be reduced. (Stahlmarkt, (Dec. 1992), 42, (12), pp. 22 [in German]. ISSN 0178-6571)

0358 14% POWER RATE HIKE SLATED BY BPA FOR PACIFIC NORTHWEST. [BIB-199308-G1-0209]

The Bonneville Power Administration (BPA) has proposed a 14% hike in electric power bills for its aluminum-producing customers in the Pacific Northwest. BPA, which also proposed a priority rate increase for prefernece customers (public utility districts, municipalities), anticipates rate approval from the Federal Regulatory Commission on an interim basis starting 2 October 1993. Production cutbacks in the region are expected. (Regan, B.; American Metal Market, (5 July 1993), 101, (128), pp. 2 [in English]. ISSN 0002-9998)

0359 ADJUSTABLE SPEED DRIVES BENEFIT INJECTION MOULDING. [BIB-199308-P3-0236]

Many of the 89 000 injection moulding machines used by plastics manufacturers are not equipped with the newest energy-efficient technologies, says the Electric Power Research Institute (EPRI) Center for Materials Fabrication (CMF), Columbus, Ohio, USA. Saving energy is just one of the benefits of adjustable speed drives that the research organization hopes to promote by publishing a manual on the subject. The CMF, Commonwealth Edison, Wise-Hamlin Plastics, consultants, and equipment sellers conducted a test programmed to evaluate the potential benefits of retrofitting a large injection moulding machine with an adjustable speed drive instead of a fixed volume system. The adjustable speed drive reduced the energy consumption of the motor by an average of 41%. It also provided improved process control, greater hydraulic efficiency, decreased maintenance, and lower capital investment. (High Performance Plastics, (July 1993), pp. 10 [in English]. ISSN 0264-7753)

0360 FOAM-PANEL HOUSE EXCELS IN FIRST ENERGY TEST. [BIB-199308-P6-0153]

A foam-core panel house beat an identical stick-built house in lower heating costs, according to tests conducted in Louisville, Kentucky, USA. Conducted by the Florida Solar Energy Center, the research is believed to be the first time two such houses have been tested, side-by-side, for energy consumption. Using gas heat, the panel house used 15% less heating energy than the conventional frame house. The panel house used 12% less energy with electric heating. In other foamed-plastic panel news, university researchers plan to build a test house in Oregon this summer to demonstrate energy efficiency and reduced construction cost. (Bregar, B.; Plastics News (Detroit), (5 July 1993), 5, (19), pp. 7 [in English]. ISSN 1042-802X)

0361 ELECTRICITY COST SHOCK. [BIB-199308-P7-0235]

UK polymer processors must be vigilant if they want to get the best deal possible from their suppliers, is the message from a recently launched electricity cost analysis. Although privatising electricity supply has reduced costs in real terms for some users, buyers should be aware of the difference in prices between contracts with suppliers and the pool which rounds up the price of electricity, warns Croydon-based National Utility Services. This is confirmed by a report from the Energy Efficiency Office which showed the price paid by rubber firms varied between 4-7 p/kWh for the same day-tariff electricity to vulcanise rubber (PRW 29 May p1). The situation will become more complex next year, when companies that use 100 kW of electricity/year will be able to negotiate supply contracts with generators outside their electricity region. (Plastics and Rubber Weekly, (19 June 1993), (1490), pp. 2 [in English]. ISSN 0032-1168)

0362 MINIMILL BURNS FLUFF TO PREHEAT SCRAP. [BIB-199308-S1-0076]

Fiat SpA, Turin, Italy, has found a productive use for shredder fluff, burning it to preheat ferrous scrap at a minimill in Montello, Italy. The fluff, which reportedly has a thermal value comparable to conventional fuels, heats the scrap by pyrolysis to 400 °C before the metal is charged into the electric-arc furnace, a process that yields a 30% energy savings. This project is part of the automaker's larger Fiat Auto Recycling program, which aims to recover 100% of Fiat auto components through recycling and energy recovery. (Scrap Processing and Recycling, (July-Aug.), 50, (4), pp. 23-24 [in English]. ISSN 0036-9527)

0363 CONTROLLING MELT COMPONENTS CAN LOWER GOOD CASTING COSTS. [BIB-199308-S3-0261]

Melting metal can account for up to 50% of energy costs in a typical electric furnace foundry and 30-50% of all processing costs. To calculate the real cost of metal in good castings, one must isolate each component of those costs and devise a strategy to reduce them. (Mullins, J.D.; Warda, R.D.; Modern Casting, (June 1993), 83, (6), pp. 36-38 [in English]. ISSN 0026-7562)

0364 LTV, INLAND IN LINE FOR 'SUPER FRIG'. [BIB-199308-S8-0544]

If steel companies can benfit by virtue of their association with an award-winning custome, LTV Steel, Cleveland, Ohio, USA, and Inland Steel, East Chicago, Indiana, have something to look forward to as the principal suppliers of flat-rolled steel to Whirlpool. The appliance giant claimed a 30 million award from a consortium of 24 power utilities around the country for a refrigerator design which exceeds 1993 federal energy consumption standards by 30-50% and contains no CFCs to harm the ozone layer. The 22 ft^3 super frig will go into production at Whirlpool's Fort Smith, Arkansas, USA, plant for delivery in early 1994. (Wrigley, A.; American Metal Market, (7 July 1993), 101, (129), pp. 3 [in English]. ISSN 0002-9998)

0365 METALS PRODUCTION, ENERGY, AND THE ENVIRONMENT. II. ENVIRONMENTAL IMPACT. [BIB-199309-G4-0079]

The results of the investigation on the production of aluminum, steel, copper, zinc, magnesium, and titanium—from mining to casting of primary ingot and secondary production—provide a useful basis for comparison among the six metals. In terms of lightweight, moderate-temperature applications, Al will continue to have the edge over Mg and Ti, which require energy-intensive processing. Al—Li alloys will also be strong candidates for intermediate- to high-temperature applications. Growth of Zn will be limited due to its increasing dependence on the construction and automobile industries, the latter seeking savings in weight. Further, the close-packed hexagonal crystal structure of Zn and Mg metals, and their positions in the electromotive force series (and consequent ease in forming a galvanic couple), might limit their use as structural materials. Aluminum and Cu will continue to compete in the wire market; however, Al offers lower cost on a volume basis, and growth through new applications. For structural applications, steel will remain the material of choice due to its low cost and reduced energy requirements through ongoing process technology improvements. (Yoshiki-Gravelsins, K.S.; Toquri, J.M.; Choo, R.T.; JOM, (Aug. 1993), 45, (8), pp. 23-29 [in English]. ISSN 0148-6608)

0366 ENERGY USAGE IN FIRING CERAMICS AND GLASS. [BIB-199309-C1-0003]

Because of the high temperatures required, the energy used in firing ceramics is large and a significant cost factor. The relative cost of firing energy as part of total cost is probably the greatest in structural clay products. However, efficiency can be improved by redesigning existing kilns. By incorporating sealed burners in a side fired tunnel kiln, efficiency was improved by 10%. Use of better insulation has also helped to improve efficiency of periodic kilns, from 15 to 42%. According to a reported based on a paper presented at the 1993 American Ceramic Society Annual Meeting, efficiencies have improved in most areas. In all cases, the energies considered are those delivered to the kilns or furnaces. (American Ceramic Society Bulletin, (Aug. 1993), 72, (8), pp. 56 [in English]. ISSN 0002-7812)

0367 SAVING ENERGY IN CONTINUOUS REHEAT FURNACES. [BIB-199309-S1-0089]

The UK iron and steel industry consumes 5.4% of UK's total energy requirements. Continuous reheat furnaces use about 36PJ (340M BTU) of energy/year, of which 54% is supplied by natural gas, 36% by other gaseous fuels and 10% fuel oils, at a cost of pounds sterling 80M/year. Appropriate energy saving measures described in two new publications can result in a halving of fuel demand. (Steel Times, (June 1993), 221, (6), pp. 267-268 [in English]. ISSN 0039-095X)

0368 ENERGY SAVING IN THREE-ROLL MILLS FOR WIRE ROD AND BAR. [BIB-199309-S1-0090]

A comparison of the deformation efficiency of two-high conventional bar mills with that of three-roll mill blocks shows that the three-roll block uses 30% less energy. Mill economy is further increased as a result of a higher yield and greater mill utilisation. Three-roll blocks also offer a high product tolerance as well as flexibility in product size and range. (Ammerling, W.J.; Steel Times, (June 1993), 221, (6), pp. 256, 259-260 [in English]. ISSN 0039-095X)

0369 HIGH PRODUCTIVITY ALUMINIUM MELTING FURNACE. [BIB-199310-G1-0290]

Thermcon Ovens BV in the Netherlands, specialist in equipment for the aluminium industry, now has a new, high-capacity tiltable melting furnace in operation at AMAG in Ranshofen, Austria. The modern melting furnace is designed to melt mainly rolling mill scrap at the rate of 10 t (22 000 lb)/hr, the maximum bath capacity is 35 t (77 000 lb). The external combination type recuperator provides hot air of max 500 °C to the burners—an energy savings of approx 20%. A heavy-duty charging machine (capacity 15 t or 33 000 lb) allows safe and fast charging, cutting cycle times, further improving the productivity of the furnace. Energy consumption including losses for charging etc., is a consistent low average of 712 kWh/t (1120 Btu/lb), holding a full furnace requires approx 400kWh/hr (1.37 mil Btu/hr). This environmentally sound operation means No_x emissions 200 ppm. (Metallurgia, (July 1993), 60, (7), pp. 233 [in English]. ISSN 0141-8602)

0370 A CONSIDERATION OF ZINC VS. ALUMINUM SHOT IN SHOT BLAST DEBURRING OF DIE CASTINGS. [BIB-199310-G6-0210]

Many die casters are looking for an alternative to the expensive (and often difficult-to-find) small size, stainless steel shot, or cut wire. In those applications where ferrous contamination of steel shot or grit is prohibited, zinc abrasive may be the alternative worth pursuing. Two primary factors for consideration are reduced risk of explosion and density levels. A comparison of explosion risk factors reflects why aluminum shot is not a preferred alternative. When measuring density, Zn is 2.5 times more dense than Al. This gives it the ability to remove burrs that Al can't touch. Also, equal profiles can be achieved with significantly reduced velocities due to the higher density when using Zn. This results in energy savings and quieter operations by using Zn, as compared with Al. (Warren, T.; Die Casting Engineer, (July-Aug. 1993), 37, (4), pp. 57 [in English]. ISSN 0012-253X)

0371 HARMONIC MEASUREMENTS AND ANALYSIS FOR POWER FACTOR CORRECTION AT NORTH STAR STEEL BEAUMONT. [BIB-199310-S3-0312]

A properly designed electrical supply system is necessary for the reliable and efficient operation of steel manufacturing facilities. Deciding to apply capacitors in a harmonic environment can be accomplished with thorough analysis prior to installation. Field measurements are quite useful in the analysis, providing input data and information to validate system models. Harmonic analysis can provide filter parameters that avoid problems and yet allow all of the benefits of a capacitor bank alone. (Andrews, D.; Bishop, M.T.; Witte, J.F.; Iron and Steelmaker, (Sept. 1993), 20, (9), pp. 45-51 [in English]. ISSN 0097-8388)

0372 TUBEMAKER EASES LOAD MANAGEMENT WITH SUBMETERS. [BIB-199310-S3-0330]

Load management is a top priority when peak-demand charges represent 60% of power charges. That's why LTV Steel values its E-Mon D-Mon electronic submeters so highly. Four of them have enabled the steelmaker's Youngstown, Ohio, USA, pipe mill to save $7000/month in energy costs. The submeters are installed on four feeders at LTV. The feeders supply power to the mill, including the big electric resistance welder that converts flat-rolled steel into pipe. (Thirty-Three (33) Metal Producing, (Sept. 1993), 31, (9), pp. 58-59 [in English]. ISSN 0149-1210)

0373 MITI MOVES AHEAD WITH TWO MODEL REFINERIES IN CHINA. [BIB-199310-S8-0699]

Based on MITI's Green Aid Plan (energy and environment international cooperation), MITI—Ministry of International Trade and Industry (Japan)—is in the process of promoting a model environmental and energy conservation business. Two integrated refinery plants will be located in China. The purpose of the model business is to show Japan's first-class environmental and energy conservation technology through technology transfer and cooperation. MITI has appropriated 975 million yen (special allocation) in their 1993 budget to carry out international cooperation with China. The NEDO (New Energy Development Organization) conducted a location survey in July 1993 to lay the groundwork. As a result, both the Chongqing and Baotou iron and steel plant locations have tentatively been chosen for integrated refinery sites. (Japan Metal Bulletin, (23 Aug. 1993), 41-32, (5763), pp. 6 [in English]. ISSN 0021-4523)

0374 ANOTHER MULTI-SLIT CONTRACT. PAKISTAN STEEL TAPS SUMITOMO METALS TECHNOLOGY TO SAVE ENERGY. [BIB-199310-S9-0418]

Sumitomo Metals has won a contract from Pakistan Steel Mills Corporation Limited to construct a new sintering ignition furnace at its Karachi Steel Works which will incorporate multi-slit burner technology. The contract is the latest in a succession of deals under which Sumitomo Metals has enabled counterparts such as Pohang Iron & Steel in South Korea and the Wuhan Steel Works in China to greatly reduce energy consumption sintering. In the case of Wuhan Steel Works, for example, a 75% saving has been achieved. Savings anticipated for Pakistan Steel are even greater. (Business Scope, (Summer 1993), 8, pp. 3 [in English]. ISSN 0916-8303)

0375 AUTOMOTIVE MATERIALS GROUP TO ASSUME ROLE IN STEEL EFFORT. [BIB-199311-S1-0111]

Members of the United States Automotive Materials Partnership (USAMP) will be asked in November 1993 to take over the responsibility from the Auto/Steel Partnership Program (ASPP) for a cradle-to-grave ecological study involving automotive materials. The study would start with the mining of ores or extraction of feedstocks for auto materials and cover the production of the materials, parts made of those materials, production and use of the vehicles, and finally the disassembly and recycling processes. The effects on the environment and energy consumption associated with each material involved in the study would be determined to the highest degree possible so that comparisons between materials can be made. (Wrigley, A.; American Metal Market, (2 Nov. 1993), 101, (212), pp. 7 [in English]. ISSN 0002-9998)

0376 A TECHNICAL COMPARISON OF AC AND DC FURNACES. [BIB-199311-S3-0356]

The important technical features of AC and DC furnaces are compared. The AC furnaces examined will be traditional three-electrode units, while the DC furnaces will have one electrode. In general, we will consider furnaces with sizes ranging from 80-120 metric tons, in which most electric furnace steel is made. Where relevant, data from smaller furnaces also will be included. The technical parameters that will be discussed here include electrical efficiency, thermal efficiency and heat loss, total energy consumption, electrode consumption, flicker, simplicity and maintenance, power input profiles, and magnetic fields. (Bowman, B.; Iron and Steelmaker, (Oct. 1993), 20, (10), pp. 55-59 [in English]. ISSN 0097-8388)

0377 FASTMET FLEXIBILITY TOUTED. ELECTRICS OR BOFS CAN USE IRON UNITS. [BIB-199311-S5-0060]

Fastmet, the latest direct reduction effort being pushed in the steel technology marketplace, can be used by all facets of the iron and steelmaking industry, from iron ore producers to electric furnace steelmakers, an executive of Midrex Direct Reduction Corp. told engineers here. Vice president of technical for the Charlotte, North Carolina, USA, direct reduction technology company, said Fastmet can satisfy the Fe unit needs of both electric furnace and integrated steelmakers and open new markets for ore and pellet producers. A 450 000 metric ton/year plant can be constructed for between $55-75M, with operating costs, including the capital cost of approx $85.00-91.00/ton. One of the chief benefits of Fastmet is that the pellets that are produced can either be briquetted or charged directly into a steelmaking vessel. The pellets, which are discharged from a rotary hearth furnace at a temperature of 1000 °C , also save in steelmaking energy costs. (Scolieri, P.; American Metal Market, (27 Sept. 1993), 101, (186), pp. 3 [in English]. ISSN 0002-9998)

0378 ENERGY USE IN US MINERALS AND PRIMARY METALS INDUSTRY. [BIB-199312-G1-0331]

In the 1970s the energy costs increased fast and many steps were taken to reduce energy consumption in the mineral industry. The trend in energy consumption in the mineral industry including mining and processing of metallic ores (iron, copper, lead and zinc, gold and silver ores) and the primary metals industry (steels, aluminum, Pb, Zn, Cu) for production of selected mineral commodities during the last decades is described. Information about energy consumption in the mineral industry can be found in publications from the Bureau of the Census, US Department of Commerce. Information about the energy consumption in the primary metal industries is nowadays collected and published by the Energy Information Administration, US Department of Energy. The latest study is from 1988. For earlier years, such information can be found in publications from the Bureau of the Census. In some cases, production data has been completed with data published by the US Bureau of Mines. (Nilsson, D.; Raw Materials Report, (1993), 9, (3), pp. 20-26 [in English]. ISSN 0349-6287)

0379 BONNEVILLE POWER MAY REWIRE OPERATIONS. [BIB-199312-G1-0341]

Under intense pressure from aluminum smelters to stabilize electricity rates, Bonneville Power Administration—hydropower provider for approx 40% of the United States' primary Al production capacity—may restructure debt-financing. The Clinton Administration may alloy Bonneville to issue bonds at market rates and repay its low-interest Treasury loans. With debt-restructuring, Bonneville could avoid rate hikes by obtaining favorable interest rates on bonds and by lenghtening its repayment terms. (Schmitt, B.; American Metal Market, (11 Nov. 1993), 101, (219), (Suppl. Aluminum), pp. 8A [in English]. ISSN 0002-9998)

0380 PARAMETERS INFLUENCING STABILITY OF FOAMING SLAG IN THE EAF. [BIB-199312-S3-0390]

Operating electric arc furnaces with a foaming slag, produced by carbon and oxygen injection, lowers specific power consumption. Foaming is improved by the use of petroleum coke as C source and an increase in the FeO content of the slag, this producing carbon monoxide by reaction with C. This endothermic reaction also improves slag stability by increasing its viscosity from increased precipitation of Ca_2SiO_2 on cooling. (Burstrom, E.; Ye, G.; Steel Times, (Nov. 1993), 221, (11), pp. 476-477 [in English]. ISSN 0039-095X)

0381 FROM SCRAP TO AS-CAST BILLETS IN LESS THAN 75 MINUTES. [BIB-199312-S3-0405]

Concast Standard AG and Fuchs Systemtechnik are to supply the EG Metal Celik a very high productivity steel plant. This will take 75 min from loading with scrap to the finished billet of 100 x 100 mm. This will be designed to save 70 kWH/tonne compared with normal plant. The main details of the furnace, ladle metallurgy and continuous casting machines are given. This new technology follows 20 years of development and employs a shaft type furnace. This overcomes the usual loss of 20% of the energy with exhaust gases by continuous scrap flow and heat recovery from the exhaust gases. Details are given of some of the use of an exothermal reaction for heating. (Concast Standard News, (1993), 32, (2), pp. 6-7 [in English].)

0382 HEFTIER COPPER WINDINGS CUT TRANSFORMER ENERGY USE. [BIB-199401-G6-0010]

Doubling the amount of copper used in transformers in local electric power distribution could pay off 1000% over the added cost of the metal, claims te Copper Development Association (CDA), New York, New York, USA. Twice as much Cu in the windings increases costs to the buyer by approx 50%, but the energy savings over the usual 20-30 year life of such transformers could be ten times greater than the added purchase price. That is because coils with larger-diameter Cu windings have less power-wasting electrical resistance. Reduced resistance also results in longer equipment life because operating temperatures are lower. CDA also notes that similar gains can be made in electric motors. Raising the efficiency of a motor by just 2% pays off many times in energy savings over its life. (Advanced Materials & Processes, (Dec. 1993), 144, (6), pp. 10 [in English]. ISSN 0882-7958)

0383 FLUXLESS MELTING WINS COOKSON ALUMINIUM TWO EAST MIDLANDS ELECTRICITY PEP AWARDS. [BIB-199401-G9-0011]

The foundry of Cookson Aluminium Ltd, Trent Alloys, at Willington, Derbyshire, has won two PEP awards from East Midlands Electricity for improved business performance and for technological innovation. Following environmental and productivity studies an investigation of alternative metal melting technologies was undertaken which culminated in trials of the innovative electromagnetic pump developed as part of EA Technology's complete heating stirring (CHAS) project. The trial proved successful resulting in Cookson Aluminium Ltd investing in a new E3 million foundry incorporating two 30 tonne gas-fired melting furnaces, both fitted with electromagnetic pumps. As a result of this investment, the environmental impact of the metal melting process has been much reduced. The energy required to melt each tonne of aluminium has been reduced by E16, which gives a current annual savings of E350 000. (Foundryman, (Dec. 1993), 86, (11), pp. 415 [in English]. ISSN 0007-0718)

0384 INJECTION MOULDER CUTS ENERGY NEEDS BY UP TO 70%. [BIB-199401-P3-0005]

The Ecologica range of injection moulding machines is capable of showing up to 70% energy savings over comparable machines, says MIR UK Ltd, Reading, UK. As well as cutting energy requirements, the medium tonnage machines reduce coolants usage (approx 80% less than a traditional press), require only 10% of the hydraulic oil normally required, are less noisy, have high repeatability of cycle conditions, and require less maintenance of the hydraulic circuit. The machines carry a three-phase electrical motor for the rotation of the plasticizing screw and a servomotor for the movement of the hydraulic pump. The traditional hydraulics have disappeared, been redesigned and are totally renewed. (High Performance Plastics, (Dec. 1993), pp. 13 [in English]. ISSN 0264-7753)

0385 ZIRCONIA FEEDERS FOR CONTINUOUS CASTING. [BIB-199401-S3-0015]

Zirconia feeders for use in steel manufacturing have been developed by the Metallurgy Department of MP RF, Russia. Using the ceramic feeders, it is apparently possible to cast up to 1200 tons of liquid steel while at the same time reducing the energy requirement from 170 to 83 kW/h. The ceramic feeders are manufactured by semi-dry pressing and contain refractory material additions. They are said to feature improved spalling resistance, increased strength, high corrosion resistance and reduced interaction with liquid melts. (Technical Ceramics International, (Jan. 1994), pp. 4 [in English].)

0386 ENERGY COSTS IN UK NONFERROUS FOUNDRIES. [BIB-199402-G2-0018]

The Best Practice programme of the UK's Energy Efficiency Office aims to help businesses use energy more efficiently. In doing so, they can lower their costs, improve their competitive status and at the same time help to improve the environment. One facet of the programme is the production of Energy Consumption Guides to disseminate information on how much energy is being used in particular industrial sectors and what it costs. Figures for individual firms within each industry often vary considerably and it is particularly useful to a company to have an idea of how its energy costs compare with those of like organisations. The recently produced Guide to Energy Consumption in Nonferrous Foundries emphasises total energy costs/tonne of net good castings, a figure which most foundries will find easy to calculate and monitor from their normal accounting and estimating data. The Guide contains estimates of the usage and costs of electricity, gas, oil and propane, based mainly on answers to a postal questionnaire and visits to a large number of foundries. (Foundry Trade Journal, (14 Jan. 1994), 3488, (168), pp. 23, 25 [in English]. ISSN 0015-9042)

0387 THE IMPACT OF UNILATERAL OECD CARBON TAXES ON THE LOCATION OF ALUMINIUM SMELTING. [BIB-199402-G2-0023]

Aluminium smelting is electricity intensive. Within the OECD region, electricity generation is based largely on fossil fuels, and a carbon tax would have a significant impact on the cost of electricity. Outside the OECD, there are large amounts of additional electricity that could be generated through hydro-electricity or flare gas. If carbon limits ere adopted unilaterally by the OECD nations, domestic producers would be at a competitive disadvantage. To quantify these ideas, a global Al trade model constructed at the World Bank during the early 1980s is updated. According to our business-as-usual scenario, there will be a gradual shift toward new sources of production located outside the OECD region. Unilateral OECD C restrictions could dramatically accelerate this process. (Manne, A.S.; Mathiesen, L.; International Journal of Global Energy Issues, (1994), 6, (1-2), pp. 52-61 [in English]. ISSN 0954-7118)

0388 NEW RESEARCH HOUSES TO FEATURE LUMBER ALTERNATIVES. [BIB-199402-D6-0076]

The National Association of Home Builders (NAHB) Research Center, USA, will construct a group of four townhouses in the NAHB National Research Home Park, featuring alternatives to lumber and plywood and innovative approaches to advanced energy efficiency in home construction. Plans call for construction to begin about 1 July 1994. As a major feature of the White House plan released in October 1993 is the implementation of residential energy efficiency strategies, the US Department of Energy (DOE) will help to sponsor the construction. The White House plan includes a joint effort among DOE, NAHB, the NAHB Research Center, and state home builders' associations, to foster residential energy efficiency through the development, testing, and dissemination of advanced energy-saving technology. Alternatives to lumber and plywood that are being considered for the houses include engineered wood products, cementitious materials, steel, laminated fiberboard structural sheathing, composite materials, and foam core structural sandwich panels. (Plastics in Building Construction, (Feb. 1994), 18, (5), pp. 2 [in English].)

0389 THE DC ELECTRIC ARC FURNACE FOR ECONOMICAL MELTING PROCESSES. [BIB-199402-S3-0030]

Among all steelmaking technologies, the process employing the electric arc furnace is the only one showing continuously positive growth rates. The proven three-phase alternating current (ac) EAF has recently been exposed to severe competition from the direct current (dc) EAF. Although the basic idea of using dc dates back nearly as far as the furnace itself (first patented in 1902), the foundation for industrial application was not laid until the 1970s, when semiconductor technology, modern refractories and suitable bottom electrodes were developed. (Muller, H.G.; Patuzzi, A.A.; Nix, E.H.; Metallurgical Plant and Technology International, (Dec. 1993), 16, (6), pp. 44, 46, 48, 50 [in English]. ISSN 0935-7254)

0390 ELECTRICITY RATE BATTLE ESCALATES. HYDRO-QUEBEC DEALS WITH METALS AT STAKE. [BIB-199403-G1-0073]

A new round in the multibillion-dollar electric power rate battle centering around state-owned Hydro-Quebec, Canada, was opened with a call for renegotiation of the utility's contracts with five light metals companies and other industrial clients. It was charged that contracts entered into by province-owned Hydro-Quebec in the 1980s with four aluminum producers, the Oslo, Norway-based magnesium giant Norsk Hydro AS, and certain other firms constitute a subsidy from the people of Quebec to a small handful of foreign firms. The Al operations involved include Aluminerie Alouette (in which the province of Quebec has a 20% stake); Alumax Inc., which owns the Lauralco smelter in Deschambault; consortium-owned Aluminium Becancour; and Reynolds Metals Co., which has a stake in the Becancour smelter (as does the province of Quebec) and a larger smelter of its own in Baie Comeau, Quebec. (Regan, B.; American Metal Market, (16 Mar. 1994), 102, (51), pp. 1, 16 [in English]. ISSN 0002-9998)

0391 ENERGY COSTS STILL BUGGING RUSSIAN ALUMINUM. [BIB-199403-G1-0074]

Rising costs for energy and transport are causing some problems for smelters in the former Soviet Union but are unlikely to stop aluminium exports to the West in 1994. Energy costs are the greatest difficulty and smaller smelters, using coal, may not be able to continue. Efforts are being made to reorganise the Russian electricity supply industry, this may, or may not, ease the problems of the smelters. A prime factor is whether hydroelectric producers will eventually drop their prices sufficiently. (Metal Bulletin, (13 Jan. 1994), (7846), pp. 7 [in English]. ISSN 0026-0533)

0392 A REVIEW OF SMELTERS IN INDIA, THE GULF, ARAB REGIONS AND TURKEY. [BIB-199403-G3-0042]

With their enormous demand for electricity set against a background of chronic power shortage throughout the country, the smelters have proved to be the

bottleneck of the aluminum production network in India. The Dubai Aluminium Company Ltd. was established in 1975 by the late ruler of Dubai, His Highness Sheikh Rashid bin Saeed Al Maktoum. Construction began in 1977, the first hot metal was tapped and poured in November 1979 and sales began early the following year. Installed capacity was 135 000 t/year from three potlines; since that time Dubai has continually increased capacity, focussing initially on increasing amperage in the cells. One Turkish smelter comprises 248 cells averaging 68 5 kg/cell/day. In 1993 current efficiency was rated at 81.7% and power consumption at 16 693 kWh/MT. (Light Metal Age, (Feb. 1994), 52, (1-2), pp. 42, 44, 46, 48, 50, 52-53, 84-86 [in English]. ISSN 0024-3345)

0393 SAVINGS IN ENERGY IN PUSHER-TYPE FURNACES TO REHEAT ALUMINUM INGOTS. [BIB-199403-G3-0043]

This is a report on energy consumption when heating aluminum ingots in pusher-type furnaces. Optimization of internal atmosphere circulation, comparison of recuperative methods, and use of recuperation on furnaces with direct and indirect firing are detailed. CO_2 and NO_x emission levels are reported. Energy cost savings achievable at facilities installed in the USA are also reported. (Moller, K.H.; Light Metal Age, (Feb. 1994), 52, (1-2), pp. 70, 72, 74, 76 [in English]. ISSN 0024-3345)

0394 HEATING FURNACE SYSTEM ENABLING FUEL SAVING OF OVER 15%. [BIB-199403-S1-0014]

Daido Steel Co., Ltd. has developed a heating furnace system Regenerative Furnace System that enables fuel savings of 15%, which will be introduced into the Kawasaki Works continuous billet heating furnace that is the company's main steel product manufacturing base. This furnace system features a low running cost and is designed for the minimal discharge of atmospheric pollutants such as CO_2 and NO_x. The company plans to introduce the new furnace system into other sectors of production, and to make the system available to other steel makers. (New Technology Japan, (Feb. 1994), 21, (11), pp. 33 [in English]. ISSN 0385-6542)

0395 APC REPORT DETAILS IMPORTANCE OF PLASTICS IN APPLIANCES. [BIB-199404-P6-0082]

Improvements made possible by plastic save approx 53 billion kw h of electricity in the US each year, according to a report prepared for the American Plastics Council (APC). The 85 million barrels of oil saved is sufficient to provide the annual energy needs of four million homes. The report states that the use of plastics has also increased productivity and innovation, contained escalating costs, improved performance, extended product life, and enhanced product safety. The report, entitled "Plastics—Key Materials for Innovation and Productivity in Major Appliances", was prepared for the APC by Ralph S. Hagan, formerly a technology laboratories manager at General Electric Appliances, and was peer-reviewed by Frigidaire, Whirlpool, General Electric, and the University of Kentucky's Center for Robotics and Manufacturing Systems. Copies of the report are available by calling (800) 2-HELP-90. The executive summary is free; the full report is $5.00/copy. (Plastics Engineering, (May 1994), 50, (5), pp. 6 [in English]. ISSN 0091-9578)

0396 DIRECT CHARGING AT UES STEELS ALDWARKE WORKS. [BIB-199404-S1-0032]

In 1988, United Engineering Steels, UK's largest producer of engineering steels, commissioned two 175 t/h reheat furnaces, purpose designed for direct charging of bloom. The furnaces are installed at their 1 Mt/year Aldwarke Works, located at Rotherham, which has undergone conversion from an ingot casting route to 100% continuous casting of large section bloom following the installation of two twin strand bloom casters. UES is achieving a savings of pounds sterling 700 000/year with the introduction of direct charging. Although the reduction in the energy bill is a significant contributor to this, pounds sterling 500 000/year is attributed to reduced handling of the bloom. (Steel Times, (Apr. 1994), 222, (4), pp. 152 [in English]. ISSN 0039-095X)

0397 THE CHALLENGE OF IMPROVING ELECTRIC ARC FURNACE EFFICIENCY. [BIB-199404-S1-0033]

Electric arc furnace requirements for electrical energy are increasing more rapidly than generation and distribution capacity. Electric arc furnace technology is reviewed with respect to energy requirements. Although the use of water-cooled panels, increased power levels and higher oxygen inputs, for example, all increase the rate of energy loss, they do not necessarily result in an increase in energy losses/ton. The increase in loss rate (energy/h) may be more than offset by a decrease in cycle time. (McIntyre, E.H.; Goodwill, J.E.; Klesser, D.E.; Iron and Steel Engineer, (May 1994), 71, (5), pp. 28-33 [in English]. ISSN 0021-1559)

0398 THE D-C SHAFT FURNACE. [BIB-199404-S3-0108]

The integration of two state of the art technologies into the dc shaft furnace process is discussed: the direct current arc furnace; and scrap preheating. The dc shaft furnace, with scrap preheating capability, provides the potential for not only major increases in production rate but also significant reductions in energy and electrode consumption in comparison with a conventional dc furnace of similar physical and electrical characteristics. Although the Fuchs shaft furnace offers substantial advantages to the operation of the dc furnace, it is recognized that for any given meltshop there may be other options. (Haissig, M.; Iron and Steel Engineer, (May 1994), 71, (5), pp. 25-27 [in English]. ISSN 0021-1559)

0399 PRESSURE CALCINATION OF ALUMINA PROMISES TO SAVE ENERGY. [BIB-199405-G5-0050]

Aluminum Co. of America is developing a new calcination process, which removes moisture from alumina. To be carried out in what is called the high energy-efficient pressure mineral calciner, the process could reduce the energy requirements of the conventional Bayer process by approx 20%. For the on-shore US alumina-producing industry, this amounts to an annual savings of 9.98 trillion Btu, equivalent of 68 million gallons of gasoline. The maximum temperature in Alcoa's calcination process is 20-25% lower than the 1000-1100 ° F (537.78-593.33 °C) employed in conventional fluid-flash units. Another difference is that the calcination takes place at an elevated pressure of 110 psig. Following further testing of the mechanical design and operation of this process in a three-tube pilot unit, Alcoa expects to demonstrate it in a 10 ton/h commercial unit. The estimated cost of the project is $14M, 70% of which will be provided by the US Department of Energy over five years. (Chemical Engineering (NY), (June 1994), 101, (6), pp. 23 [in English]. ISSN 0009-2460)

0400 NEW YORK FUNDS HIGH-TECH MATERIALS. [BIB-199405-D7-0072]

The New York State Energy Research & Development Authority has announced a program designed to encourage wider use of innovative materials in designing energy-intensive devices that would greatly benefit from their higher performance characteristics. Projects eligible for funding may include but not to be limited to the development, demonstration, and/or comercialization of: advanced and innovative materials (monolithic, composite), reinforcements (fibers, whiskers), or functional coatings (wear resistant, oxidation resistant, thermal barrier); innovative materials processing/manufacturing methods for currently available or advanced materials; and advanced materials application/utilization in the design of components for energy-intensive devices. Multiple awards in the amount of $50 000-250 000, with anticipated starting dates in October 1994, will be made. Contact Gina Wilder, New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, New York 12223-9998, USA; phone: (518) 465-6251, extn. 232, fax (518) 432- 9474. (High Tech Ceramics News, (May 1994), 6, (1), pp. 11 [in English]. ISSN 1045-2397)

0401 BEST PRACTICE ELECTRICITY USE IN STEEL MINIMILLS. [BIB-199405-S1-0053]

Through a series of studies of energy use in the US steelmaking operations, minimills that make the best use of electricity to increase their competitiveness and meet new environmental standards were identified. In addition, it was discovered that minimill improvements to existing electricity-intensive processes coexist with new applications of electricity. It seemed in the mid- to late-1980s that the minimills' share of the steel business had matured at approx 21% of raw steel production (the share from 1984-1988). However, the ability of minimills to improve their electricity use and adopt new steelmaking technologies, combined with their increasing operating experience, indicate that there indeed may be room for expansion into more steel markets. (Bock, M.; Boyd, G.A.; Karlson, S.H.; Ross, M.; Iron and Steelmaker, (May 1994), 21, (5), pp. 63-66 [in English]. ISSN 0097-8388)

0402 THE PRESENT NUCLEAR ENERGY POSITION IN UKRAINE. [BIB-ECEE000001]

Ukraine has five nuclear power plants operating 14 units with a total output of 12,818 MW. These power plants account for up to 30% of the total electricity produced. The management structure for the Ukraine nuclear power complex is outlined. The need for a nuclear fuel cycle in Ukraine is explained. Treatment of nuclear waste, and transport, storage and processing of spent nuclear fuel are discussed. Priority will be given to the problem of nuclear power station safety. This is closely connected with research, design and technological work, and the creation of a modern experimental production and testing sector. Work is in progress to transform the "encasement" to ensure long-term ecological safety. The future of Ukraine's nuclear energy industry will depend on the choice of a new generation, safer type of nuclear reactor, and the nature of the national nuclear fuel cycle adopted. (Nigmatullin, N.R.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (31 January 1994), ENERGY/SEM.13/R.18, pp. (Summary) [in Russian].)

0403 INSTITUTIONAL ASPECT AND COMMERCIAL ASPECTS OF ENERGY EFFICIENCY MANAGEMENT [BIB-ECEE000002]

A review of institutional, legislative and commercial aspects of an energy efficiency policy is presented. Sustainable development and implementation of energy efficiency management in countries with market economys and those with economies in transition (in Eastern and Central Europe) is considered. Western European countries have reached a ceiling of energy efficiency improvement whereas in Eastern and Central European countries there are still huge potential energy savings (up to 50%) to be made. The instruments available for energy efficiency management, in all economies, are listed and include legislation, education, financial incentives and technical and commercial measures. The high energy intensities associated with Eastern and Central European countries arise from their economic structure and their inefficient use of energy. An important instrument in energy efficiency management, for the economies in transition, is the design of development and restructuring policies which take energy efficiency improvements into account. Governments need to set up institutions with authority and financial means to implement energy efficiency policies. (Kogalniceanu, Violeta; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (19940403), ENERGY/SEM.13/R.103, pp. 6 [in English].)

0404 THE EUROPEAN COMMISSION ACTIVITY FOR A MORE EFFICIENT USE OF ELECTRICITY PACE AND SAVE PROGRAMMES. [BIB-ECEE000003]

The European Commission (EEC) is working to improve electricity end-use efficiency. Efforts have been concentrated in the areas of domestic refrigeration appliances, office equipment, commercial lighting and electric motors. The total annual electricity consumption and potential savings are tabulated for each area. For domestic refrigeration appliances, energy consumption labels, to increase consumer awareness of energy efficiency, and minimum efficiency standards are proposed. A voluntary agreement between manufacturers to improve efficiency was suggested but no agreement could be reached due to the highly competitive market. Energy savings in office equipment could be achieved by reducing the stand-by power levels for equipment. Manufacturers in this sector are willing to take part in a voluntary programme. Studies are underway in the areas of commercial lighting and electric motors to examine potential energy savings and their practicability, costs and benefits. (Bertoldi, Paolo; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (31 January 1994), ENERGY/SEM.13/R.29, pp. (Summary) [in English].)

0405 ENERGY EFFICIENT LIGHTING IN SWEDEN [BIB-ECEE000004]

In this paper we discuss and evaluate the effects of mandatory efficiency standards and utility demand-side energy management (DSM) programs on lighting energy consumption in Sweden. We focus on efficiency measures for the services and commercial sector lighting which allows us to examine in detail the dynamics of energy saving technologies for an end-use that represents more than 6 percent of Sweden's electricity consumption. In the Swedish service sector, lighting represents 30 percent of the non-heating electric power consumption. The efficient technologies considered include improved lamps, ballasts, luminaries, controls and system designs that better exploit natural daylight and task lighting. We develop dynamic scenarios of electricity demand and efficiency improvement based on the application of performance standards and utility demand-side management (DSM) programs. In the analysis we use the computer program Compass to study the dynamics of energy efficiency implementation year by year in Swedish lighting over the next 15-20 years. In that way we examine the achievable potential, which over time increases beyond the retrofit potential, as new energy saving opportunities appear in new and renovated buildings and equipment that is replaced by newer models. However, the rate of energy-efficiency implementation is limited by the rate of turnover of existings buildings and equipment. The result of the study indicates that if mandatory standards were implemented in Sweden approximately 25% of the energy in the service and commercial sectors could be saved in year 2010, compared to the energy consumption that would occur in our base-case, "constant efficiency", where the average new equipment in 1990 becomes the average used in 2010. (Christianson, Lena; Swisher, Joel; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (21 December 1993), ENERGY/SEM.13/R.2, pp. (Summary) [in English].)

0406 RESEARCH AND IMPLEMENTATION ACTIVITIES REGARDING ENERGY EFFICIENCY MANAGEMENT IN BOLOGNA: A SPECIAL REFER TO THE PARTICIPATION IN EUROPEAN PROJECTS [BIB-ECEE000005]

For several years A.T.C., with the strong collaboration of Bologna Municipality, has realised some feasibility studies to implement systems and/or plants with the main aims to reach energy saving and environmental effects reduction. The adopted measures intend to realise more rational energy use in existing infrastructures and transport vehicles and to use new technologies and automatic systems to provide the same performances with an energy saving and reaching management optimisation. A.T.C. has been supported with funds from the Italian Government and the European Community (EEC). This funds have allowed the realisation of these new projects. It was always possible to obtain the financial support because of the nature of our projects, always achieving consumption reduction, environmental impact reduction, traffic congestion in urban areas and as a consequence the improvement in life quality level. These new experiences in partnership with other European cities have allowed us to improve our technological and industrial knowhow. The main fields of application are: systems and transport vehicles; traffic and mobility management systems; systems for production and use of energy; automatic control systems for services optimisation; demand management (energy demand) systems; inter modality infrastructures. The effected researches, the developed projects, the obtained funds and the realised plants will be analysed in the demonstration. We would like to stress the obtained and obtainable results and the possibilities of these solutions to be extended, brought out and applied to other European cities. The international and industrial partnerships, both public and private, are described showing a very efficient cooperation. (Coguccioni, Armando; Claroni, Claudion; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (23 December 1993), ENERGY/SEM.13/R.3, pp. (Summary) [in English].)

0407 ECONOMIC AND TECHNICAL DESIGN OF AN ADVANCED COMBINED HEAT AND POWER PLANT [BIB-ECEE000006]

Cogeneration plant installations using small-scale gas turbine have been remarkably increased during recent years in Italy. There are several reasons for this: a favorable economic feature with a payback time limited to 3 to 5 years, a high total efficiency up to 90%, a very low level of emissions, new laws and administrative measures which assure the sale of excess electric power to the National Electricity Board at advantageous prices. If we consider gas turbine plants with electric power less than 5 MWe, there are in Italy 61 plants of a total of 181 MWe, with an increase of 80% only in the last year. A further growth is expected, also in the present crisis period, because small-scale power cogeneration frequently satisfies energy requirements of several establishments as hospitals, sporting centers, industrial and office buildings, greenhouses, university centers. ENEA (Italian Agency for New Technology, Energy and Environment)

installed a combined cycle plant designed to satisfy energy demands of the ENEA Casaccia Center (near Rome) and with the general task of promoting small-scale cogeneration plants using gas turbines. Basic ideas of this project are to prove the economic convenience of a small-scale combined power plant (gas turbine associated with steam turbine), up to electric power greater than 10 MWe, and to establish an experimental and demonstration centre for cogenerating cycles. (Avitabile, M.; Minghetti, E.; Palazzi, G.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (30 December 1993), ENERGY/SEM.13/R.4, pp. (Summary) [in English].)

0408 A SURVEY OF ENERGY TAXATION IN WESTERN EUROPE [BIB-ECEE000007]

Energy taxation differs enormously in the countries of Western Europe - as a result, energy prices in some countries are twice as high as in others. Ecological taxation has been successfully introduced especially in Nordic countries. However, the level and the differences of 'traditional' taxes (aimed at raising revenue) are higher in most cases and they are therefore of more importance from an ecological point of view. These are the main results of this paper which provided an overview of energy taxation in Western Europe. It is almost generally accepted that energy prices play a key role in a policy of sustainable development. The European Union (EEC) and many individual states therefore consider the implementation of taxes on energy and/or carbon dioxide content of fuels. Nevertheless, only Denmark, Sweden and Norway have really introduced such ecological taxes at a substantial level. Experiences from some countries show clearly that environmental taxes combined with various systems of exemptions and rebates can be practical and effective and that it is possible for countries to go it alone, both in the legal and economic sense. From the economic point of view, even quite high taxes can be implemented without harmful effects for the industry when cuts in other taxes, especially income taxes, are realised at the same time. In Sweden for example, this resulted in lower labour costs and a constant total tax burden (fiscal neutrality) for the economy. In the European Union and in many countries, the international competitiveness of industry is still the main argument against the introduction of higher energy/CO_2 taxes. However, the survey of taxation levels shows that differences from country to country are much higher than the level of the additional ecological taxes under consideration. If we are to exploit their potential and achieve the environmental aims set, taxes must be imposed still more widely in Europe and at higher rates. As an important complement to energy taxation, deregulation and unbundling of electric power and gas markets is discussed. (Müller, A.; Suter, S.; Walter, F.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (30 December 1993), ENERGY/SEM.13/R.5, pp. (Summary) [in English].)

0409 APPLIANCE EFFICIENCY STANDARDS IN THE EUROPEAN COMMUNITY A PROMISING TOOL FOR ACHIEVING LARGE SAVINGS [BIB-ECEE000008]

One of the most effective ways to achieve large electricity savings is to introduce minimum energy efficiency standards on electrical equipment. The Group for Efficient Appliances (GEA), gathering experts from different European Energy Agencies, was established in 1991 as a technical working group whose aim is to carry out the technical economic analyses necessary for the definition of minimum efficiency standards. The paper presents the results of a study ordered by the Commission of the European Communities (CEC) to the GEA. The study investigates the economic, energetic and environmental effects due to the introduction of minimum energy efficiency standards for domestic refrigeration appliances in the European Community. Based on a thorough analysis of today's market and technologies, several standard scenarios are proposed. In 1992, the stock of refrigerators and freezers in the whole European Community consumed 111 TWh. Applying efficiency standards starting in 1997 would save 40 TWh annually in 2010 and 384 TWh over a 20 year period. GEA is currently working for the Commission of the European Communities on the definition of minimum efficiency standards for domestic laundry appliances (clothes-washers, dishwashers, clothes dryers). General approach and findings of this new analysis will also be presented. Because minimum efficiency standards guarantee large savings, they appear at the forefront of energy policy measures. (Lebot, B.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (5 January 1994), ENERGY/SEM.13/R.6, pp. (Summary) [in English].)

0410 ENERGY MANAGEMENT FOR HOUSING WITH DISTRICT HEATING [BIB-ECEE000009]

The start of the National Environment Plan in the Netherlands in 1990 gave new impulses to the energy savings activities. The objective is to reduce the energy consumption for households by 25 percent during the time frame from 1990 through 2000. Energy utilities play a vital part in the implementation of this energy saving project. New developments in the area of energy saving are strongly encouraged by both, the Dutch government and utilities in order to achieve the objectives. Energy consumption for heating and hot water is the main topic of this presentation because this is about 75% of the total energy consumption of households. Possibilities to reduce the energy consumption in the existing housing stock are: limiting of heat losses, to increase the efficiency of heat production and measuring/charging the energy consumption per household. Practical experience: by providing energy saving measures in flats the average annual consumption of natural gas was reduced from 2500 m^3 to 800 m^3, these decreases of energy consumption were realised through improvement of the heating installation, insulation and measurement of the energy consumption; in Rotterdam in an area of 23,000 homes, heated by a district heating system, the average energy consumption decreased by 30 percent through the application of energy measurements for the heating and hot water systems per household. In addition, four Hungarian pilot projects running to get experience with the measurement of the heat- and hot water consumption, at one project there are already some results available of the energy savings: the saving on heating is 20 % and the saving on hot water consumption is 60 %. The average reduction of the energy consumption is 30%. It can be held that the introduction of measurement of heat consumption and control of the heating temperature must be the first steps in lowering the energy consumption. But one has to be aware of problems which can occur: moisture and mould, inhabitants who have higher bills instead of lower bills, flats where the temperature remains too low etc. (Vyfwinkel, W.P.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (5 January 1994), ENERGY/SEM.13/R.7, pp. (Summary) [in English].)

0411 IMPLEMENTATION OF POLICY FOR ENERGY DEMAND MANAGEMENT IN LITHUANIA [BIB-ECEE000010]

Implementation of energy conservation policy, as a process without alternative in this period of transition to market economy conditions in Lithuania is going on slowly and painfully. The big distance between theoretical issues and practical activities is characteristic feature of this process. The "National Energy Conservation Programme" was prepared and confirmed-by the Government in 1991. In this Program the main directions for energy conservation were formed and main principles formulated. According them, the regulation of energy prices and controlled transition to world market energy prices could be made using financial and economical means. Real political events left behind the prepared variant of strategy for reorganisation of energy economics. Rapid growth of prices called critical situation in economy. In the presence of these changes, an intensive work was performed to prepare juridical-economical preconditions for the realisation of energy conservation policy. Prepared juridical-economical mechanism can be interpreted as a system for energy demand management including: justification of state energy conservation policy, institutional reforms, creating of energy conservation services, information system (collection), reorganisation of investment policy financial institutions operating according special regime. Large work was performed to realise this system solving main actual problems ensuring financial vitality for centralised district heating systems. More detailed results in this sphere will be given in the report. Also, critical remarks will be presented regarding the formulation of energy conservation policy in Lithuania by Western experts. (Tamonis, M.; Klevas, V.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (5 January 1994), ENERGY/SEM.13/R.8, pp. (Summary) [in English].)

0412 OPTIONS, BARRIERS AND INCENTIVES FOR ENERGY CONSERVATION IN INDUSTRIES OF CZECH AND SLOVAK REPUBLICS AND HUNGARY [BIB-ECEE000011]

The former Centrally Planned Economys fostered a system with insufficient incentives to use energy efficiently. In general energy intensities are three times higher than in Western Countries. Substantial amounts of energy were wasted and energy saving measures such as administrative controls, legislative pro-

grammes were inadequate for monitoring and enforcement of savings. Therefore the transition of the Eastern European economies towards more market economys rose high expectations with respect to improving the efficiency of energy economies and reducing energy demand substantially by economic mechanisms and financial support. However the realities are different so far. Some countries such as Czech Republic and Hungary are already confronted with 2 to 3 % rise in energy intensities. In this paper we will summarise and evaluate the results of two recently finished large industry energy conservation studies conducted by ECN Policy Studies in Hungary and the Czech and Slovak Republics. The first study concerns an analysis and evaluation of the scope for energy end-use savings in the food processing sector. This in order to formulate directly applicable measures for the companies in this industrial sector and to design a consistent efficiency-stimulating, sector of policy programme by the Ministry to back up these measures. In fact, the approach consisted of: analysis of options, barriers and incentives for Implementing savings in the food industry; energy audits of a number of companies to identify options (technical, managerial and of the production process). The second study analysed the scope of energy conservation in the industry of the Czech and Slovak Republics. (Oostvorn, F.; Nieuwenhout, F.; Harmelen, T.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (5 January 1994), ENERGY/SEM.13/R.8, pp. (Summary) [in English].)

0413 LABELLING SYSTEM ON ENERGY EFFICIENCY IN CALIFORNIA [BIB-ECEE000012]

Most American homes contain dozens of appliances, from essential ones like stoves, refrigerators, and heating/cooling equipment, to convenience extras like food processors and deep fryers. Using energy-efficient models can save energy and money over time, even if the initial cost is more than the cost of a standard model. Labelling systems (LS) are designed to help customers in selecting more efficient appliances when shopping, and by that to promote energy efficiency. Three types of energy labels are currently in use in California; energy cost, energy efficiency ratio and generic. Each of them is discussed in details. A contribution of LS to energy conservation in California is assessed. Prospective further LS development is discussed. (McAuliffe, Patrick; Berlostosky, Albert; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (7 January 1994), ENERGY/SEM.13/R.11, pp. (Summary) [in English].)

0414 INSTITUTIONAL AND COMMERCIAL ASPECTS OF THE ENERGY EFFICIENCY MANAGEMENT [BIB-ECEE000013]

Case study: Romanian Agency for Energy Conservation (ARCE). A successful policy of energy efficiency management implies mainly three aspects: institutional - the creation of a body (Agency, Centre, etc) specialised in the implementation of the energy efficiency policy, as it is defined by the Government; financial - funds allocation for the operational budget of the Body, as well as for the projects and programmes within the energy efficiency policy; legislation - this could be, in the author's opinion the most important of the three aspects, especially in the transition period; there is a strong need for a modern and adequate legal framework in these new democracies, especially in terms of incentives and regulations for the energy producers as well as the consumers. Romania, was and still is, as far as we know, the first and sole of the Eastern and Central European countries that have solved the first aspect, even if in an imperfect way. The early creation (1990) of the Romanian Agency for Energy conservation, as a public institution, functioning under the Ministry of Industries was the first important step of the Romanian Government towards a sustainable energy efficiency policy. The financial aspect has been only partially solved; the Agency has its operational budget as well as a rather small budget for energy efficiency grants coming from the State Budget. As for the specific legislative framework, very little has been done so far. The present paper will present the achievements as well as the failures of the three full years of operation of the Romanian Energy Conservation Agency. (Kogalniceanu, Violeta; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (7 January 1994), ENERGY/SEM.13/R.12, pp. (Summary) [in English].)

0415 ENHANCING THE ENERGY EFFICIENCY THROUGH THE ECONOMIC ASSESSMENT OF THE POWER PROJECTS [BIB-ECEE000014]

The permanent price increase in the power sector emphasized the economic role of losses. The price of electric power has increased more rapidly than the price of power equipment and installations. In this way, the projects with less waste energy by an increased amount of equipment were promoted. Among them, one could mention, in the frame of electric networks, larger sections and increased number of conductors. For the same reasons, the intermediate voltage levels, due to their increased share in the total electricity losses are to be limited or even excluded, step by step. As regards thermal energy, due to the same high cost of fuels, the solutions based on the energy saving results were promoted with priority. Among them, one could also mention the cogeneration projects which were promoted replacing the separate production of electricity and heat. (Sima, Constantin; Cusuta, Maria; Manolescu, George; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (7 January 1994), ENERGY/SEM.13/R.13, pp. (Summary) [in English].)

0416 COLLABORATIVELY DESIGNED DEMAND-SIDE MANAGEMENT PROGRAMS IN THE UNLTED STATES AND THEIR IMPLICATIONS FOR CENTRAL AND EASTERN EUROPE [BIB-ECEE000015]

American collaboratively designed demand-side management (DSM) portfolios, through both the size of their programs and the program designs themselves, have redefined tile scope and nature of the feasible acquisition of demand-side resources. Collaboratives are a means for the utility to design DSM programs together with non-utility parties such as government agencies, industrial consumers, residential consumers, and environmental groups. Collaboratives generally lead to a resolution that is better, faster, cheaper, and more amicable than their alternative, litigation. The US collaboratives have developed a set of DSM program design principles that allow them to capture high levels of savings. These principles include comprehensively targeting all opportunities for energy saving; identifying market barriers to customer implementation of energy efficiency, and designing programs to overcome those barriers, and incorporating monitoring and evaluation into program design from the beginning. Collaborative programs are projected to save their utilities, on average, 5 % of all energy generated, and 6 % of peak demand, over the next five years, for an overall investment equal to about 2 to 5 % of the utility's revenues in a year. Aspects of this process that can be applied in Central and Eastern Europe (CEE) include collaborative's role in avoiding conflict between the utility and its customers; the opportunity for DSM programs to provide a new source of utility revenue and to retain existing customers that might otherwise go out of business; the importance of data gathering; the urgency of capturing savings from new construction and remodelling projects; utilities' potential role in developing the market capacity for providing energy-efficient goods and service; and the need for regulatory reform to incorporate DSM. (Birner, S.; Boyle, S.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (12 January 1994), ENERGY/SEM.13/R.14, pp. (Summary) [in English].)

0417 THE ELECTRIC POWER CONTROL AND MANAGEMENT AT THE INDUSTRIAL ENTERPRISES [BIB-ECEE000016]

One of the main ways of raising the effectiveness of electric power consumption in the enterprises of mining industry is the search for the electric power conservation. Traditionally, the reserves were obtained by minimizing the losses in transformers, in air lines and in cable lines by keeping optimal voltage and the distribution of the reactive powers in power network of an enterprise. The most effective way of power conservation is obtained through the power intensive technological installation control and the effect obtained thanks to such an approach to the problem solution will be much higher. The decisive factor of the electric power reserves preservation by means of technological processes operation control is the information supply and the decision making concerning control and management operations. The present state of information supply in mining industry enterprises is characterized by the availability of out-of-date information and imperfect processing. That is why we find it necessary to use

the measuring systems which make it possible to select and control data with required frequency. Mining enterprises are considered to be potentially dangerous - this factor is to be taken into consideration in the system of electric power conservation. The methodological supply of data is to be revised and the real scale of time-measurements is to be taken into account just as well as the irregularity of most parameters. (Pivnyak, G.G.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (12 January 1994), ENERGY/SEM.13/R.15, pp. (Summary) [in English].)

0418 PROBLEMS OF THE RATIONAL MANAGEMENT AND EFFICIENT USE OF ENERGY RESOURCES IN UKRAINE [BIB-ECEE000017]

The current severe energy crisis in Ukraine requires the adoption of a large number of measures both by the State and by the producers and consumers of fuel and energy. These very important measures must include more efficient energy use and the design of a rational system for management of this process. In recent years the efficiency of the use of energy resources has deteriorated in step with the decline in the demand for fuel and energy caused by the drop in production. For example, the amount of power consumed in producing Ukraine's national income, which was two or three times higher than the indicators of developed European countries in the stable year 1985, increased by 15.2% in 1991-1992 alone. This poor energy efficiency is due primarily to a preponderance (which is constantly increasing) of outdated technology and equipment and the lack of proper controls over the expenditure of energy resources and over the system of energy efficiency management. The basic steps to improve energy efficiency in Ukraine must include: the implementation of a vigorous State energy savings policy; the creation of a system for the control and accounting of energy resources adapted to modern requirements; the widespread use of new advanced technology and an increase in the stock of science-intensive and less resource-intensive plant and the reshaping of the inter-branch and intra-branch structure of production in order to reduce the consumption of fuel and energy. Such a management system presupposes the establishment of the legal, economic and organizational conditions for the implementation of measures to enhance energy efficiency. The State and regional government organs must ensure the creation of an environment in which enterprises will have an economic interest in supporting a high level of fuel and energy use. The draft law on energy savings proposes an economic mechanism, a legal framework and organizational and administrative measures which, in our view, will facilitate efficient management of energy use. (Tonkal, Vladimir E.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (6 January 1994), ENERGY/SEM.13/R.16, pp. (Summary) [in Russian].)

0419 ENERGY BALANCES FOR SLOVENIA - MULTIREGIONAL APPROACH [BIB-ECEE000019]

The article describes the project of Joint Slovenian and Austrian Energy Initiative: implementation of a system of multiregional energy balances for Slovenia. The system used for preparing the energy balances for Styria and 17 districts, which was developed by ADEP - Graz in accordance with the federal energy balance of Austria, is being applied to Slovenia. Energy balances are necessary for monitoring the impact of measures initiated by energy policy. Therefore the balances are of basic mutual interest, also in connection with balances of air pollutants (air pollution) that can be calculated from energy balances. Slovenia was divided into five regions and for each region the energy balance was calculated which is consistent to the Slovenian balance. Among others the 'energy dependence' of each region, energy flow from primary to useful energy level and contribution of each region to the air pollution (Statistics). (Suvorov, B.; Schechtner, O.; Zelle, K.; Brecevic, D.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (19 January 1994), ENERGY/SEM.13/R.21, pp. (Summary) [in English].)

0420 ENERGY EFFICIENCY STANDARDIZATION AND LABELLING IN ROMANIA [BIB-ECEE000020]

Romania carried out a programme for energy efficiency standardization and labelling with about 80 categories of energy usage frome industryal, domestic, services and transportation. Lighting and residential heating have been also taken into consideration. The programme covers three years (1994-1996), its goal being to determine energy performance. The programme will facilitate Romanian energy producers participation in the common market a high level of competition and an increase in the efficient use of domestic and imported energy. The report presents levels and values of energy performance analysed in 1993: electric chamber furnaces for heat treatments (with fixed hearth); chamber with vertical roller-hearth and salt baths; arc furnaces for steel production and induction furnaces for cast iron production. (Cotenescu, S.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (19 January 1994), ENERGY/SEM.13/R.22, pp. (Summary) [in English].)

0421 CROSS-COUNTRY COMPARISON ON ENERGY EFFICIENCY INDICATORS [BIB-ECEE000021]

A Network of 13 Agencies in charge of energy efficiency and environmental policies implementation for assessing energy efficiency achievement has been set up. The topic of the paper is to present an on-going project of cross-country comparison of energy efficiency indicators. The project shows the necessity and the value-added of implementing a network of partners which are politically and practically in charge of energy efficiency implementation. A major issue of energy efficiency policy has always been evaluation of results achieved, evaluation of targets, evaluation of relative situation among countries. The debate about greenhouse effect and adequate international measures to prevent it (carbon tax, polluting rights, emissions standards, etc.) has strongly highlighted the necessity to base negotiations on consistent, comparable evaluation of energy efficiency and CO_2 emissions in the various countries. Past experiences and actual debates show that comparisons in this field are currently extremely difficult. Data used are not homogeneous in definition and measurement, ratios and indicators for assessing energy efficiency changes are calculated and interpreted in different ways. There is no information system on this matter, commonly agreed upon by all parties, that may serve as a reference for cross-country comparison and international negotiation. National agencies in charge of implementing energy efficiency policy and/or environmental policy are concerned with this lack. This is why Ademe (France) took the initiative of designing and launching a project on energy efficiency indicators with the collaboration of seven European countries within the Club EnR. (Bosseboeuf, D.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (31 January 1994), ENERGY/SEM.13/R.26, pp. (Summary) [in English].)

0422 ECONOMIC MECHANISM AND FINANCIAL WAYS OF POWER SOURCES DEMANDS REGULATING [BIB-ECEE000022]

In the forseeable future the place of coal as a fuel and in power generation will steadily increase. The situation is typical for Ukraine which lacks sufficient oil (petroleum) and gas resources as well as future development of nuclear energy and alternative power industry. Thus one may state that in the period of 2015-2025 coal mining wii be the main power potential of Ukraine and provide the majority of its energy demand. The demand for coals after 2000 equals 170-172 Mt, including 118-120 Mt for power purposes. Consequently, the demand for coal is much higher than the real potential of the industry. This high demand is not favorable for the coal mining industry because of the past condition of mining facilities. More than 80% of all coal mines operating are over 20 years without repair which is much higher than normal. A reduction in production costs is expected through "negative" rationalization as construction of new coalmines and repair of existing ones. The basic measures of "negative" rationalization are selective mining and closing old, inefficient coalmines. (Surgai, N.S.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (31 January 1994), ENERGY/SEM.13/R.27, pp. (Summary) [in English].)

0423 METHODOLOGICAL, INFORMATION AND INSTRUMENTAL SUPPORT OF ENERGY EFFICIENCY EXPERTISE IN INDUSTRY [BIB-ECEE000024]

The greatest possibilities of achieving energy savings in Ukraine are offered by industrial enterprises. If these possibilities are to be realized, however, information must be obtained on actual energy consumption by the many sectors and on the places where unjustified energy losses occur, as well as on the reasons for such losses. Such information is sometimes difficult to obtain owing to the fact

that the enterprise lacks (sufficient) instruments to calculate and monitor energy consumption (and particularly heat consumption). Energy efficiency expertise is therefore used to provide objective information about the actual situation as regards energy consumption and energy use and also to identify economically sound ways and means of achieving savings and ensuring the rational use of fuel and energy resources. The Institute for Energy Saving Problems of the Ukrainian Academy of Sciences has developed methods and compiled programmes and information, as well as instruments, as a mean of providing comprehensive energy expertise for industrial enterprises that can be used to determine how efficiently energy resources are being used in the enterprise as a whole as well as in its various subdivisions, in technological processes and by various pieces of equipment. Energy efficiency expertise comprises: analysis of documentation containing information on the consumption and use of energy; elaboration of a measurement and testing programme in order to obtain objective information on actual consumption and use of energy by power and equipment, shops, shop subdivisions and the enterprise as a whole; measurements and tests and processing of the results; establishment of energy balances for various units and determination and analysis of energy use indicators (such as specific consumption of fuel, heat and electric power per unit of output); analysis of losses and identification of possible ways and means of achieving energy savings. (Raptsun, Nikolai V.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (21 February 1994), ENERGY/SEM.13/R.30, pp. (Summary) [in Russian].)

0424 UKRAINIAN STATE ENERGY CONSERVATION STANDARDS [BIB-ECEE000025]

The Ukrainian State standardization system requires the development of a set of energy conservation standards. This set of standards comprises: the terms employed and a definition of the basic concepts used in energy conservation matters; the nomenclature and values of indicators for energy efficiency of using fuel and energy resources and the procedure for their incorporation in technical documentation; fuel and energy consumption standards and methods of determining such standards; methods of calculating the energy balances of industrial and technological processes and at enterprises; methods of determining the economic effectiveness of energy conservation measures. Methods of testing and certifying various units in the light of energy conservation requirements; methods of data collecting and data processing on fuel and energy consumption; requirements in respect of devices to measure energy consumption and energy conservation; requirements in respect of energy conservation technology and energy conservation equipment; requirements in respect of the use and consumption of secondary energy resources and requirements in respect of unconventional and renewable energy sources. Four of these standards have already been elaborated and will be applied from 1 July 1994. Work is proceeding at the present time on the elaboration of various standards governing fuel and energy consumption in: energy-intensive processes; energy-consuming equipment and installations; energy-intensive production; household electrical appliances; etc. The report also discusses the basic provisions of Ukrainian energy conservation standards that have been and are being elaborated. The intensification of work on the development of energy conservation standards will have the effect of promoting Ukraine's energy policy. (Stoyanova, I.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (31 January 1994), ENERGY/SEM.13/R.20, pp. (Summary) [in Russian].)

0425 MANAGEMENT AND ORGANIZATION OF A STATE CONTROL SYSTEM FOR ELECTRIC POWER AND HEAT CONSERVATION IN UKRAINE [BIB-ECEE000026]

The paper discusses the structure of the existing State system for managing and monitoring energy conservation using the control exercised with a view to electric and heat energy conservation by the State Energy Inspectorate of Ukraine (Gosenergonadzor) as an example. The Inspectorate's methods of work, the use of the mass media and other aspects of its work are described. The results of the electric power and heat savings achieved during the past five years in Ukraine are analysed. Significant trends and measures designed to reduce electric power and heat consumption are discussed. An analysis is made of possible ways of further reducing electric power and heat consumption in various branches of Ukraine's economy. Likely ways are considered, using selected Ministries as examples. A number of measures are proposed with a view to improving State control over energy conservation and disseminating the results of the experience acquired in this connection within the European Union. (Sosnovsky,; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (19 January 1994), ENERGY/SEM.13/R.24, pp. (Summary) [in Russian].)

0426 INFORMATION AND MODELLING SYSTEM FOR THE RATIONAL MANAGEMENT OF THE ENERGY SECTOR IN UKRAINE [BIB-ECEE000027]

The "PIRAMIDA" information and modelling system (IMS), intended to optimize the development of the fuel and energy sector (FES) was developed at the Institute for Energy Saving Problems of the Academy of Sciences of Ukraine. The IMS was designed as a multi-level hierarchical unit. The mathematical models and methods system which was specially created at the upper, macroeconomics, level uses methods for the identification of relationships and mathematical statistics with a view to macroeconomic analysis for the purpose of forecasting State fuel and energy demands. At the second level the FES is analysed from the inter-branch standpoint, linear and separable programming methods being used for this purpose. The third level is used to analyze all the individual branches of the FES (the electric power and heat power power engineering, coal, gas, petroleum and oil refining industries). Discrete and continuous discrete programming models and methods are used in this connection. The need to ensure the rational use of natural resources is automatically taken into account during the decision making process at all levels. An information and programming interface between all levels has been built into the system. All the "PIRAMIDA" information and programming functions are performed on a personal computer of the IBM PC/AT 486 DX type in the form of a portable package. A large amount of research connected with the mathematical analysis of the most rational ways of developing Ukraine's power industry has been carried out using the "PIRAMIDA" IMS. (Kulik, M.H.; Kostyukovsky, B.A.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (19 January 1994), ENERGY/SEM.13/R.23, pp. (Summary) [in Russian].)

0427 DATABASE OF ENERGY CONSUMPTION AND ENERGY UTILIZATION IN INDUSTRY [BIB-ECEE000028]

If electric power and heat consumption is to be monitored in a rational and effective manner, information is required about the way in which energy is actually used where it is consumed, and above all in industrial enterprises which are the main consumers. The Institute for Energy Saving Problems of the Academy of Sciences of Ukraine, together with the Gosenergonadzor of Ukraine, have developed a database of energy consumption and energy utilization at Ukraine's largest enterprises (of which there are about 700). The database is subdivided as follows: consumption of fuel and energy resources; specific expenditure on energy resources per unit of output; present situation and prospects for introducing energy conservation measures, technology and control and measuring instruments at enterprises. The software employed is used to process the information contained in the database and to obtain requisite indicators for branches, regions and individual enterprises. A set of documents containing a questionnaire, instructions on how it should be completed as well as code classifiers, has been compiled with a view to data collecting. The hardware used in connection with the database is based on personal computers compatible with the IBM PC/AT. (Svetelik, A.; Sasnovsky, A.; Raptsun, Nikolai V.; Karatsuba, A.S.; Melikhov, A.N.; Baglik, M.V.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (19 January 1994), ENERGY/SEM.13/R.25, pp. (Summary) [in Russian].)

0428 AUTOMATIC MANAGEMENT OF BALANCES IN LARGE ELECTRIC POWER SYSTEMS [BIB-ECEE000029]

The report discusses the theoretical and methodological basis for the automatic management of the operating regimes of a large electric power system. The concept of functional system management (FSM) is used as the theoretical basis for this purpose. The FSM is a dynamic management system of variable structure, selectively switching in the energy units in question at all levels of the large electric power system with a view to achieving the desired programmed result (goal) at minimum cost. The methodology of the FSM is based on methods for the analytical design of system regulators using criteria of reliability and

quality of management; methods for solving problems connected with the dynamic optimization of operating regimes taking management expenditure into account; methods of coordinating interaction between decision making systems in the unified electric power system; and methods of State vector extension and identifying management matrixes in FSM models. The problems that arise in connection with the optimum stochastic management of active and reactive power as well as their solutions are indicated. (Leporsky, V.D.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (31 January 1994), ENERGY/SEM.13/R.19, pp. (Summary) [in Russian].)

0429 SYSTEM FOR AUTOMATIC CONTROL FOR ELECTRICAL POWER CONSUMPTION BASED ON AUTONOMOUS LOCAL COMMUTATORS [BIB-ECEE000030]

Analysis of state-of-art of world energy industry shows that, in general, no country in the world can provide enough energy to cover the needs of all possible power consumers. Dependence of energy consumption on the time of day and the existence of intervals when the consumption grows, creates serious problems for energy manufacturers. Therefore, development of devices, to improve energy system by-cutting off of consumers in crisis seems to be very attractive. This can be especially important for the Ukraine and other newly independent States, where the energy deficit is significant. The original concept of energy saving, developed by the authors, is based on the automatic local commutators (ALC). While current Ukrainian systems for energy consumption control collect and analyze information about consumers in certain centres and then issue the orders for cutting-off of some of them, ALC works autonomously and analyzes the characteristics of energy at the point of the electrical net where the consumer is connected. The method is effective in both, centrally planned and free market economys. Under the conditions of market relations, the consumer, willing to install the ALC, buys energy for lower prices in exchange. Principles making the cost of power profitable for both manufacturer and consumer and a computer program developed in the Institute of Energy Saving Problems of Ukrainian AS. Under a centrally planned economy and energy deficit conditions, implementation of ALC can be forced by the government energy-saving organization. The advantages of the proposed ALC method over the currently used ones are the following: the decisions adopted by the system are more substantiated because ALC is much more specific; automatic procedures eliminate the possibility of ignoring signals to cut off the electrical load. (Simonenko, I.; Kravchenko, A.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (3 March 1994), ENERGY/SEM.13/R.32, pp. (Summary) [in English].)

0430 ENERGY MANAGEMENT [BIB-ECEE000031]

Energy management may appear to be merely a currently fashionable phenomenon, but the effect of its introduction as an instrument of management is to gain active control over the ENERGY overheads. Through the integral inclusion of energy as a manageable cost item among the various other structured means of production the phenomenon of energy comes to be seen in an entirely different light. It no longer represents an uncontrolled slumbering cost item but behaves more like one that can be calculated for in advance. In a large number of cases energy costs are being offset against company turnover. Yet this in itself is unjustified; in point of fact it has an influence on immediate net profits rather than turnover. The correct relationship of energy costs to either profit or turnover makes a world of difference. When measured against turnover these costs often amount for no more than 10%, but when measured against the net profit, more significant figures are quickly reached. Bearing this in mind, many companies operating inside the European Union have become more and more aware of the influential role of energy. Naturally the current recession has led to close examination of costs on all fronts, but within the framework of introducing more control into production processes themselves, energy has remained a largely overlooked factor down to the present time. Only in the case of the heavy petrochemical industry, has energy been long-regarded as an extremely high cost item, and it is here that the most cost-effective energy management systems have been developed. Even so, outside of this sector the experiences of smaller firms in using less energy per product have shown that energy management can be profitable. Energy management after all is not just an energy control system which depends on all kinds of complex software and hardware systems. It is precisely this sort of implementation which makes energy systems very expensive and involves long periods of time before the investment is recouped. (Driel, Roland; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (21 February 1994), ENERGY/SEM.13/R.31, pp. (Summary) [in Russian].)

0431 SYMPOSIUM ON THE ENVIRONMENTAL BENEFITS OF ENERGY CONSERVATION [BIB-ECEE000050]

A symposium, held in September 1993, to review developments in the field of international and national energy policies and prospects is reported. The environmental benefits of energy efficiency improvements, the implementation of energy efficient technologies and energy management in city-scale projects are discussed. A number of general conclusions and recommendations are made. In central and eastern European countries, energy conservation is linked to economic transition. Centralized control over the inefficient use of plentiful and inexpensive energy resources needs to be replaced by individual consumers who control increasingly expensive energy at the point of use. Environmental benefits should arise from more efficient energy systems as the economies adapt to new energy prices and fuel mix changes, new management methods are introduced and obsolete equipment is replaced. (UN/ECE EE2000 Secretariat; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (5 November 1993), ENERGY/SEM.11/2, pp. 15 [in English].)

0432 ENVIRONMENTAL BENEFITS OF ENERGY EFFICIENCY IMPROVEMENTS [BIB-ECEE000051]

Between 1980 and 1990, the emission of pollutants in Russia and the former USSR had stabilized and shown a downward trend. The rate of investment has since declined generally and has been matched by a decline in investment in the environment. Environmental investment and the rational use of natural resources at existing plants, and plants under construction, has now halted. Tables showing the amount and composition of pollutants are presented. The power industry has the greatest adverse environmental effect; some possible steps to reduce emissions in this sector are outlined. Technical improvements, which would reduce emissions of nitrogen and sulphur oxides, are explained. The development of hydro electric power stations and nuclear power plants are considered. Tariffs have been established for emission, discharge and dumping within the permissible standards, with extra payments for environmental pollution beyond these limits. (Ziberov, V.E.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (13 August 1993), ENERGY/SEM.11/R.103, pp. 17 [in English].)

0433 ENVIRONMENTAL CONSEQUENCES OF ECONOMIC TRANSITION [BIB-ECEE000052]

Russia's high energy intensity of national income is attributed to the energy-intensive structure of material production. Energy conservation and environmental protection should improve as economic restructuring procedures. The first stage of economic restructuring, referred to as market adaptation, will take two to four years and require considerable investment. The objectives of this phase and the measures that the government intends to take are listed. Projections up to 1995 for growth and gross output, by sector, are tabulated. Gross output will fall during this phase, stabilize in 1995 and then start to rise. Some key areas in which technological restructuring will contribute to energy saving are discussed. These include the fuel and power, iron and steel, and chemical sectors. The projected impact of the fuel and power industry on different atmospheric pollutants, up to the year 2010, is tabulated. (Troitsky, A.A.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (13 August 1993), ENERGY/SEM.11/R.104, pp. 9 [in Russian].)

0434 CITY SCALE ECONOMIC DEVELOPMENT AND ENERGY EFFICIENCY PROJECTS [BIB-ECEE000054]

Energy efficiency projects, aimed at reducing pollution, in a number of Western European cities are described. These schemes are analogous to the Demonstration Zones established, but not yet functional, in Russia. The possibility of co-operation between western countries and Russia is considered. The experience in West European cities has shown that major improvements can be made to energy efficiency within cities. There are few technical constraints to the implementation of energy efficiency projects in Russia. The relevant technology has been proved in Western Europe, and studies have indicated that it is appropriate in Russia. The main constraints to implementing these projects in

Russia are economic. Opportunities for economic collaboration in the Demonstration Zones in Russia are listed. These include the technology transfer for construction, and the development of energy management programmes and information campaigns in the zones. (Watt, J.; Hyde, J.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (23 August 1993), ENERGY/SEM.11/R.102, pp. 6 [in Russian].)

0435 PRINCIPAL AREAS OF RUSSIAN RESEARCH AND DEVELOPMENT IN ENERGY CONSERVATION AND ENVIRONMENTAL PROTECTION AND RESULTS [BIB-ECEE000055]

Expanding the production, processing and consumption of energy resources as quickly as is necessary while at the same time reducing the negative environmental effects of the fuel/energy complex is an extremely complicated task, difficult to accomplish in the short run owing to the inertia and capital intensiveness of the energy sector and a number of scientific and technological problems associated with cleaning up the environment that remain unresolved. Research both in Russia and abroad indicates that energy and resources conservation, i.e. reducing unproductive losses, improving fuel efficiency and making better use of electric power and heat energy, and advances in the resource intensiveness and structure of the economy can do a great deal to ensure reliable energy supply, slow the rate at which the adverse impact of the power industry on the environment grows and generate substantial social and economic returns. A lack of regulatory legislation and effective economic stimuli, and the target-oriented system used to manage energy consumption and conservation, continue to have an adverse effect on energy intensity. The report lists the principal areas of energy conservation in industry, the communal services and utilities sector, agriculture, transport and construction industry. (Dobrokhotov, V.I.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (22 April 1993), ENERGY/SEM.11/R.2, pp. (Summary) [in Russian].)

0436 INTERNATIONAL PROGRAMMES AND PROSPECTS FOR THE DEVELOPMENT OF INTERNATIONAL COOPERATION IN EFFICIENT ENERGY USE AND THEIR ENVIRONMENTAL BENEFITS" [BIB-ECEE000056]

Recent decades have seen relatively rapid development in international cooperation in energy, energy conservation and environmental problems associated with energy management. A number of large international and national programmes have been devised and are being put into effect, and activity in such major governmental and non-governmental international organizations as the World Energy Council and the International Energy Agency, the energy departments of United Nations regional commissions and international organizations in the United Nations system, has unerased. Efforts are being made to place international cooperation in energy conservation and environmental protection on a new footing, corresponding to the changed political situation since the end of the cold war and the transformation of the former Soviet Union into a group of independent States oriented towards democratic development and entry into the world market economy. Steps being undertaken in Europe are extremely important in this regard. A European Energy Charter has been adopted and a major project entitled "Energy Efficiency 2000" is being carried out by the United Nations Economic Commission for Europe (ECE), while cooperation between Central and Eastern European countries and the Commission of the European Communities is expanding. Despite these and other positive factors, the potential for further development and advances in international cooperation to improve the energy efficiency of the economy and reduce the undesirable effects of the power generation industry on the environment is far from exhausted. (Volfberg, D.B.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (23 April 1993), ENERGY/SEM.11/R.3, pp. (Summary) [in Russian].)

0437 ENERGY CONSERVATION POLICY OF THE RUSSIAN FEDERATION AND ITS SIGNIFICANCE FOR ENVIRONMENTAL CONSERVATION [BIB-ECEE000057]

One of the main underlying reasons for the energy crisis Russia has been the low energy efficiency of the Russian economy. Compared with levels of energy use in economically developed countries, the potential for technological energy savings in Russia is put at roughly 500 million TOE, or one third of overall annual energy consumption. Between 150 and 180 million TOE can be saved in the fuel/energy complex, 100 million TOE in housing and communal services, 45 to 50 million TOE in transport, and 150 to 170 million TOE in industry. Practicable annual energy savings, given current financial opportunities, are put at between 180 and 240 million TOE in the year 2000. Energy savings would make a substantial, not to say fundamental, contribution towards the resolution of environmental problems by reducing emissions of toxic and greenhouse gases. Not burning primary fuel in the quantities permitted by potential savings in Russia could reduce emissions of CO, NO_x,SO_2, soot and dust by 18 to 22 per cent from overall levels in the economy and emissions of carbon dioxide by 45 per cent from the 1990 level. Such wide-ranging energy savings must be accompanied by an economic mechanism. This would require legal and economic conditions to be established permitting energy conservation activities by energy users and managing bodies (regulation of relations between energy suppliers and consumers, and a law requiring economical energy use); a system of energy saving management bodies (energy saving agencies, federal and regional energy saving funds, and energy users' associations). (Bushuev, V.V.; Makarov, Alexi A.; Chupiatov, V.B.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (23 April 1993), ENERGY/SEM.11/R.4, pp. (Summary) [in English, Russian].)

0438 ENERGY AND ENVIRONMENT [BIB-ECEE000058]

The report analyses the effects of energy installations on the environment within the Russian Federation and the former USSR, with special reference to the undesirable effects of thermal power plants on air quality and surface water. The introductory section provides brief information on investment in environmental protection in the former USSR and CIS countries over the period 1981-1992. The report gives detailed information on atmospheric emissions of pollutants from energy installations in Russia. An annex provides information on atmospheric pollution in the former USSR. The atmospheric effects of stations burning different kinds of fuel are presented separately, and the question of fly ash capture at thermal power stations is briefly addressed. The problems of reducing emissions of nitrous oxides and sulphur dioxide, and the effects on surface waters of polluted waste water from power installations, are addressed in more detail. The report also lays out the basic environmental requirements for the siting, planning, construction (rebuilding) and operation of power installations, and the problems of collecting payment for pollution of the environment. The concluding section of the report outlines prospects for reducing the impact of power installations on the environment in accordance with the Conceptual Framework for Russian Energy Policy under New Economic Conditions adopted in September 1992. (Ziberov, V.E.; Bulynko, M.Y.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (30 April 1993), ENERGY/SEM.11/R.5, pp. (Summary) [in English, Russian].)

0439 THE CITY OF MOSCOW'S ENERGY CONSERVATION PROGRAMME AND MEANS OF PUTTING IT INTO EFFECT [BIB-ECEE000059]

The energy crisis of the 1970s in Western Europe, Japan and North America forced countries there to introduce energy conservation mechanisms 20 years ago, the effects of which are now clear. Suffice it to say that national output in Russian is 1.5 times as energy-intensive as in the United States of America and twice as energy-intensive as in the Europe Region. Western European and United States experience shows that energy conservation programmes will be successful only if backed up by a combination of legislative, economic, organizational and technological measures carried out together at national and regional levels. The "Programme of energy conservation around Moscow to 1995" is the first official pronouncement in Russia to lay the economic and managerial foundations for a regionally managed energy conservation policy. Following international practice, the Moscow programme calls for a combination of activities in the following areas: establishment of an economic mechanism for energy conservation; creation of the legal foundations for its introduction; establishment of structures to monitor and stimulate energy conservation policy in the city; creation and introduction of means of accounting for and monitoring the distribution of fuel and energy. Further areas include creation and introduction of energy conservation technology and equipment in industry and in the housing and communal services sector, financing of energy conservation measures and the promotion among the general public of energy conservation

philosophy. (Rekk, B.A.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (23 April 1993), ENERGY/SEM.11/R.6, pp. (Summary) [in Russian, English].)

0440 BASIC PROVISIONS OF THE RUSSIAN FEDERATION ENERGY CONSERVATION BILL [BIB-ECEE000060]

The passage of a Russian Federation energy conservation bill governing legal relations as a market for the rational and economic use of fuel and energy resources in all areas of the economy evolves between the State, businesses, organizations and the public, is likely to be an important step in the application by the State of the principles of an energy conservation policy. The bill defines the jurisdiction of bodies at various levels of government for dealing with energy conservation problems. It proposes financial and economic mechanisms to regulate and stimulate the parties concerned to carry out and invest in energy conservation schemes. It provides for tax, credit and amortization advantages and lays down the procedure for State financial support at the federal and regional levels, both from federal and regional budgets and from the resources of a proposed Russian extra-budgetary inter-industry fund for energy conservation operating at the federal and regional levels. This machinery also includes systems to supply business consumers with energy resources out of extra-budgetary funds, and economic penalties for permitting direct losses of energy resources or wasteful uses of energy. The bill lays down measures for the standardization and certification of energy consumption overall and statutory requirements for energy-consuming equipment and technologies in the form of State standards. It sets up a procedure for accounting for energy consumption and maintaining State statistics, and a hierarchy of energy conservation and State energy monitoring bodies at the federal and regional levels. (Vasiliev, V.M.; Khrillev, L..S.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (23 April 1993), ENERGY/SEM.11/R.7, pp. (Summary) [in Russian].)

0441 ENERGY EFFICIENCY DEMONSTRATION ZONES IN THE MOSCOW REGION [BIB-ECEE000062]

As suggested by the United Nations Economic Commission for Europe (ECE), energy efficiency demonstration zones have begun to be set up in eastern Europe and Russia. The purpose of establishing them is to reduce the disparity in efficiency of fuel and energy use between the Eastern European and developed Western European countries. Calculations indicate that if this disparity were roughly halved, savings by the year 2000 would be in the order of 500 million tonnes of standard fuel equivalent, and harmful emissions of SO_2 and CO_2 would be reduced by 20 to 25 per cent. The report sets out the basic criteria for the identification of energy efficiency demonstration zones and describes the current state of efforts by Russian and foreign participants to establish them. (Dobrokhotov, V.I.; Veretennikov, G.A.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (23 April 1993), ENERGY/SEM.11/R.9, pp. (Summary) [in Russian, English].)

0442 METHODOLOGICAL BASIS FOR CONDUCTING ENERGY AUDITS AND SURVEYS OF INDUSTRIAL ENTERPRISES WITH A VIEW TO ASSESSING THE ENVIRONMENTAL IMPACT OF ENERGY CONSERVATION [BIB-ECEE000063]

The report presents the results of work by the authors on theoretical aspects and practical means of improving the efficiency of electric power use on the basis of physical and technical system analysis of complex technological facilities. Account is taken of the significant environmental impact of productive activities. In this connection, particular attention is devoted to energy audits and comprehensive surveys of industrial enterprises, which will help to assess the environmental impact of energy conservation. The way in which the above approach was applied to study energy consumption in Donbass coalmines serves to illustrate methods of constructing multi-factor energy functions of industrial enterprises which make it possible to examine the influence of the most important factors on changes in electricity consumption and the state of the environment. This has helped to establish the basis for a regional and sectoral method of managing the electricity consumption and ecology of complex technological facilities and industrial enterprises. The results of this research were tested in many coalmines during control calculations and have been reported to research institutions and scientific meetings. (Kovalev, V.E.; Kovalev, M.V.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (20 August 1993), ENERGY/SEM.11/R.23, pp. (Summary) [in Russian, English].)

0443 ENERGY EFFICIENCY DEMONSTRATION ZONE IN THE TOWN OF ISTRA [BIB-ECEE000064]

With a population of 35,600, Istra is a typical small Russian town. The country has over 3,000 such towns, with a total of 40 million inhabitants. Distinctive features of all small towns are: a characteristic structure to the housing stock and building materials; a lack of their own electricity generation facilities; industry accounting for a high proportion of energy consumption (up to 60 or 70%); and the presence of a large number of low-powered boilers of various types. Istra also displays features characteristic of a certain number of small towns, particularly near Moscow. Educational levels are high in a population which includes skilled scientific, engineering, technical and industrial workers. The process of setting up a demonstration zone is divided into two stages. Initial activities involving the minimum possible investment are being carried out over the period 1993-1995. The scientific and planning underpinnings for long-term activities are being created, and a combination of measures to apply economic and non-economic pressure on operating staff and consumers are being carried out to encourage them to save fuel, water and heat. At the same time, information campaigns on development programmes for small towns are being mounted. Longer-term technical and organizational measures requiring significant investment are planned for the second phase, to allow for changes in ownership relationships and fuel prices, among other factors. (Bondaletov, V.N.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (23 April 1993), ENERGY/SEM.11/R.10, pp. (Summary) [in Russian, English].)

0444 THE CEC ENERGY EFFICIENCY DEMONSTRATION CENTRE IN MOSCOW [BIB-ECEE000065]

The CEC Energy Centre in Moscow was set up by the Directorate-General for Energy (DG XVII) of the Commission of the European Communities and began work in January 1992. Its main tasks are to promote advanced Western European energy technology in Russia; to create favorable conditions for Western European businesses to operate in the Russian market; and to promote the establishment of joint ventures. The Centre carried out over 20 projects in 1992. Steam traps were installed at four industrial enterprises in Moscow, saving between 15 and 30% of the steam used. The possibility of saving between 10 and 30% of the energy used at non-manufacturing enterprises by installing a variety of energy efficient lighting systems was demonstrated. Demonstrations were given at power installations in Moscow of modern technology for measuring inputs of water and heat and the chemical composition of the gases leaving the boiler assembly, thus making it possible to optimize the fuel/air mix and reduce fuel consumption by 1 to 2%. A device for determining the dewpoint has been tested at the Kashir district electric power station. Economically speaking, far from all these projects proved effective given current domestic fuel prices and the exchange rate of the rouble. On the other hand the steam traps, for example, will have paid for themselves in about two years . (Usievich, V.A.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (23 April 1993), ENERGY/SEM.11/R.11, pp. (Summary) [in Russian, English].)

0445 STRUCTURAL REFORM OF THE RUSSIAN ECONOMY AND ITS ROLE IN MEETING THE CHALLENGES OF ENERGY CONSERVATION AND ENVIRONMENTAL PROTECTION [BIB-ECEE000066]

The report shows that the specific structure of GNP in Russia resulting from a number of factors is the main reason why Russia's national income is more energy-intensive than that of developed Western European countries. The goals of a structural reform of the economy and a shift to market management methods which Russia has set for itself and is now pursuing are organically bound up with increased efficiency of energy use and related environmental improvements. Bringing about structural changes in the economy, however, will require significant investment and time. The report forecasts that over the next few years, when investment resources will be severely limited and market mechanisms will still be being put in place, there are no grounds for expecting any quick or substantial effect in energy terms from structural reform. Once the economy has stabilized and begun to pick up, and as market forces develop, there should be substantial energy savings and environmental improvements since the savings

in fuel and energy resources in Russia from 1990 levels due to structural changes across the economy are put at 250 to 300 million tonnes of standard fuel equivalent in the year 2000 and up to 600 million tonnes of standard fuel equivalent by 2010. The report also discusses the main areas of structural reform within the main industries and economic sectors, and forecasts the possible effects in energy terms. (Troitsky, A.A.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (23 April 1993), ENERGY/SEM.11/R.12, pp. (Summary) [in Russian, English].)

0446 IMPACT OF ECONOMIC TRANSITION SCENARIOS ON CO_2 EMISSIONS IN THE CZECH REPUBLIC [BIB-ECEE000067]

The report presents the preliminary results of a study on CO_2 emission developments in the Czech Republic, which is part of a large project commissioned by the Dutch Ministry of Economic Affairs, collects policy information to formulate joint reduction targets on CO_2 for meeting the targets of the UN Convention on Climate Change. For this objective background, information about CO_2 developments in Western European countries is needed. Furthermore the UN/ECE is preparing a second protocol for SO_2 and NO_x emission reductions in the Europe region and needs information about the reductions (potentials) in Central European countries. The EC model EFOM-ENV is implemented for the Czech Republic, for providing comparable and useful insights in the relationship between energy and emissions up to 2015. Similar studies have been undertaken in (Poland) and will be conducted for Slovak Republic, Hungary, Bulgaria and other Eastern European countries. Present study is undertaken collaboratively by two research centres, ECN in the Netherlands and VUPEK in the Czech Republic. Two transition scenarios and their respective CO_2 developments, reduction options and costs are analysed. This provides valuable policy information for formulation of cost-effective greenhouse gas policies and reduction targets. But before identifying opportunities a reference path or scenario is necessary to indicate how the emissions will vary without the joint implementation of projects or policies. First objective of the study concerns collecting information on CO_2 emissions in the Czech Republic, a reference scenario for CO_2 developments and the reduction scope till the year 2015. Second objective is the development of the CEC energy/environmental model EFOM-ENV (Energy Flow and Optimisation Model - ENVironment) for the Czech Republic. (Energy modelling, environmental modelling). (Kruijk, H.; Broek, M.; Maly, M.; Harmelen, T.; Oostvorn, F.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (26 July 1993), ENERGY/SEM.11/R.13, pp. (Summary) [in English].)

0447 ENVIRONMENTALLY CLEAN COAL TECHNOLOGY IN RUSSIA: STATUS AND PROSPECTS FOR APPLICATION DURING THE SHIFT TO A MARKET ECONOMY [BIB-ECEE000068]

In most coal-mining countries, among which the United States of America, Australia and Canada must rank prominently, the notion of environmentally clean coal technology refers in the main to direct combustion technologies, since the problems of protecting the environment during the mining and transport of coal have been virtually overcome. In the Russian Federation, as in most coal-mining Republics in the former USSR, the concept of environmentally clean coal technology must include technologies not only for recovering fuel coal but also for winning, dressing and transporting coal, since problems with protecting the environment throughout the technological chain from prospecting to direct combustion remain unresolved. Accordingly, the first part of the report includes a review of the current status of, and prospects for improvement in environmental protection at both open-cast and underground coal workings, methods of dressing coal and making thorough use of the products, and the reduction of undesirable effects on the environment as coal is transported by various means. The second part offers an analysis of modern technology for the use of coal as fuel in industrial electric power and heat generation and in the communal services and utilities sector, and considers the prospects for making coal technology more efficient environmentally and in energy terms, laying down quality specifications for fuel coal. The concluding section contains preliminary evaluations of the economic and environmental effects of making wide-scale use of new coal technologies in the power industry in the Russian Federation over the medium term. (Kovalchuk, A.B.; Tcheglov, A.E.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (23 April 1993), ENERGY/SEM.11/R.14, pp. (Summary) [in Russian, English].)

0448 IMPROVING THE ENVIRONMENT THROUGH ENERGY CONSERVATION: THE CALIFORNIA EXPERIENCE [BIB-ECEE000069]

This paper describes the California experience regarding the development of energy conservation and of environmental protection. It covers major federal and state government initiatives in both areas, and describes the effects of these initiatives. In both areas California has achieved impressive results during the last twenty years. While total population in the state grew by 50% and gross state product by 100%, total energy consumption rose just 29%. Energy consumption per gross state product declined from 20,500 Btu/S to 12,600 Btu/$; per capita consumption of energy declined by 12%; and emissions of critical pollutants such as SO_x and NO_x were reduced. The energy crisis of 1973 clearly highlighted the vulnerability of the developed countries to oil (petroleum) supplies from politically unstable regions. At the same time, the emergence of a strong and vocal environmental movement resulted in codification of the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEOA). In response to these events, California and federal regulators pursued the goals of more efficient energy production and use, reduction of pollutant emissions, and substitution of natural gas for petroleum. These goals were pursued at two levels: first, strategic policy development, and second, a design of practical measures to implement the selected strategic policies. On the supply side, these policies supported the development of ultra clean synthetic fuels (clean technology) and alternative energy sources (geothermal energy, wind energy, solar energy, biomass and cogeneration). On the demand side, these policies proclaimed a reduction in gasoline use in transportation and switch from oil use at power plants. Priority was given to energy conservation, considered a most efficient "energy resources". Also emission control requirements were imposed on both stationary sources and automobiles. (Berlostosky, Albert; McAuliffe, Patrick; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (18 Mail 1993), ENERGY/SEM.11/R.15, pp. (Summary) [in English].)

0449 ECONOMIC REALISATION OF ENVIRONMENTAL BENEFITS FROM ENERGY EFFICIENCY: IMPLICATIONS FOR ENERGY EFFICIENCY MEASURES IN THE UK RESIDENTIAL SECTOR [BIB-ECEE000070]

The environmental benefits of energy efficiency have in recent years become one of the main arguments for policy interest in energy efficiency measures. Any full social cost-benefit analysis of energy efficiency should include environmental benefits as well as the social costs of energy efficiency measures. This paper uses available estimates of the economic damage cost of air pollution emissions from fuel consumption to analyze its impact on a cost-effectiveness appraisal of some energy efficiency measures in the UK residential sector. The residential sector is particularly relevant for policy makers in that decision making is fragmented on a multitude of small users. The residential sector is also an important contributor to carbon dioxide emissions in the UK, its emissions making up 25% of total UK carbon dioxide emissions in 1990. Realizing that damage cost estimates are as yet only approximations to what would constitute an economically optimal environmental charge on fuel emissions, the illustrative analysis nevertheless gives an indication of the relative impact of such costs on the outcome of a valuation of energy efficiency measures. Different designs of an environmental charge on the externalities of energy use will also affect the cost effectiveness calculations of energy efficiency measures. Social costs of energy efficiency programmes include what some analysts refer to as "hidden" costs, in particular the administrative costs of policy measures introduced by a central agency to increase the uptake of energy efficiency measures. The ranking of energy efficiency measures used in a least-cost curve of abatement clearly depends on the policy instrument that is chosen to increase energy efficiency in a given sector or technology segment. This area has received less attention, perhaps because of a lack of data on the administrative costs of realized energy savings through grants and standards or other regulations. (Millock, Katrin; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (9 June 1993), ENERGY/SEM.11/R.16, pp. (Summary) [in English].)

0450 EFFECTIVE ENERGY EFFICIENCY POLICY INSTRUMENTS FOR COUNTRIES IN ECONOMIC TRANSITION - A SELECTION ON THE BASIS OF A RUSSIAN-GERMAN CO-OPERATION [BIB-ECEE000071]

Major barriers to energy efficiency improvement in countries in economic transition are the following: extremely low, non cost-based energy prices, for the residential sector in particular; lack of capital in all sectors of economy with particularly severe impacts in countries with high inflation rates - necessary investments in energy efficiency are almost impossible; a widespread lack of measuring instruments to record heat, gas or oil (petroleum) consumption or decentralized use of electric power; lack of relevant information, knowledge and knowhow of involved persons (households, supervisors, boiler house staff); insufficient laws and inadequate standards for energy efficiency, and lack of control and implementation by the responsible authorities. These obstacles are often sector- or technology-specific and are very similar to those observed in the former German Democratic Republic during the last three years. Measures and instruments to alleviate these obstacles and to realize high existing energy efficiency potentials have to consider the specific conditions in the countries in transition such as the break-down of former trade relations among the former Comecon countries; delays in clarifying issues of ownership by the administration and jurisdiction; a lack of rules and legislation as a framework for market economys, or lacking entrepreneurial abilities and experience. Russia has its specific conditions: a federal structure, a large geographical extension with different climates, different levels of development, sufficient domestic energy resources and presently hyper-inflation. Measures which are successful in this difficult situation of transition are first of all organizational measures and legislation (e.g. training of energy managers in companies and public authorities, improved maintenance, information and education of private households, energy pricing which reflects real costs, introduction and implementation of an energy efficiency legislation for mass products and buildings, (Jochem, Eberhard; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (9 June 1993), ENERGY/SEM.11/R.17, pp. (Summary) [in English].)

0451 THE EC-ENERGY CENTRE MOSCOW [BIB-ECEE000072]

The European Community opened its Energy Centre in Moscow in 1992. The Centre is located at the ENIN Power Institute in Leninsky Prospekt. It is used to enhance relations between Moscow and the EC. In particular, it concentrates on bringing the newest energy technologies and Western European knowhow to Russia. It importantly provides support for the new economic framework in Russia in the form of advanced energy technologies. The Centre is staffed by Western European and Russian personnel, supplemented by a team of freelancers from the C.I.S. and the Member States of the European Community. The Centre has been established within the framework of THERMIE, a programme of the Commission of the European Communities (CEC) which promotes advanced energy technologies through established and experienced organizations within its OPET network. At present, this network consists of 41 organizations located throughout Europe, with over 1,500 experts in the energy and related fields. Measures for technical improvement in the field of energy conservation are being implemented by experts from this OPET network at different locations in Moscow. The Centre has assisted the network and other international organizations in a number of ways such as identifying speakers for various OPET seminars and workshops and giving organizational and administrative support to, amongst others, Members of the European Parliament and the International Institute for Energy Legislation. Projects carried out by the Centre include the improvement of lighting at an exhibition hall and in a school, reductions of final energy demand in a swimming pool, increasing boilers efficiency through controlling flue gas parameters in the district heating network, demonstrating energy saving apparatus for power plant to Russian specialists and running a permanent exhibition on energy efficient equipment in cooperation with Moscow energy utilities. (Weber, Werner; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (9 June 1993), ENERGY/SEM.11/R.18, pp. (Summary) [in English].)

0452 HOW TO IMPROVE BOTH ENVIRONMENT AND PRODUCTION ECONOMY AT A CITY-SCALE OR MUNICIPALITY LEVEL [BIB-ECEE000073]

"Our Common Future" - the report from the UN Brundtland Commission in 1987 - recommended that development should be sustainable. Development of the energy systems (as well as other infrastructure) must consider the environmental impact. The Commission pointed out two ways of maintaining growth and at the same time safeguarding the environment. One is the conversion to renewable energy sources. The other is clean technology with a higher output per unit of energy used. Since the report was published many countries have made plans in order to decrease the energy consumption and the pollution from energy production. Also several studies have been carried out on the costs when sustainability is to be obtained. In Denmark in April 1990 the Government adopted a plan, Energy 2000, which is a plan of action for sustainable development. Energy 2000 shows how Denmark can contribute, nationally and internationally, to ensure the necessary sustainable development in the field of energy - a development that will result in the necessary reduction of energy consumption and its environmental impact. The plan of action also shows that it is possible to effect changes in Danish energy policy along positively more environmentally acceptable lines yet not at the expense of continued economic growth. But of course this plan of action alone cannot ensure the attainment of the goals. At a former ECE Meeting in Rome, October 1992, Mrs. Elbaek-Jorgensen from The Danish Energy Agency delivered a lecture on the Brundtland-town concept. The philosophy of this concept is at the municipal level to secure sustainable development. Another Danish initiative is taken by NEED - an abbreviation for National Board for Energy and Environment Development where public authorities and private enterprises work together to the mutual benefit for both environment and the production economy. In NEED the Nordic countries' leading environmental and energy technology is gathered. (Rimmen, Per; Lewinsky, Claus; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (9 July 1993), ENERGY/SEM.11/R.19, pp. (Summary) [in English].)

0453 ENERGY MANAGEMENT VIA A CENTRALIZED CONTROL SYSTEM CONNECTED BY MODEM TO 300 SCHOOLS TO MONITOR, TARGET ENERGY DEMAND AND EDUCATION OF OCCUPANTS [BIB-ECEE000074]

In 1990 the municipality of Rotterdam started an energy saving programme with an accent on energy management. The method that is followed is the top-down approach of the NOVEM. Managers of municipal services have to designate energy managers. The energy managers have to register the weekly/monthly energy consumption. The energy saving programme is being carried out in co-operation with the working group Energy Saving Rotterdam. Rotterdam has 40 municipal services and about 900 municipal buildings. The services have many buildings and these are used during different periods. The Education Services of Rotterdam for instance have about 300 municipal schools. It costs a lot of manpower to carry out energy management in these schools. The central energy manager needs a number of local energy managers. Public Works want to develop a central management system which gives information on the energy consumption related to the technical state of the installations for heating and ventilation and related to the energy quality of the building envelope. After analyzing this information the schools get results. The feedback of this information gives more motivation to school team and student for reducing the energy consumption in the school. The results will be available for interested people in the Netherlands or elsewhere in Europe. It is the intention to look for more possibilities within EC demonstration programmes like THERMIE. (Verhagen, J.W.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (16 July 1993), ENERGY/SEM.11/R.20, pp. (Summary) [in English].)

0454 ENERGY MANAGEMENT AND ENERGY SAVING IN MUNICIPAL BUILDINGS IN ROTTERDAM [BIB-ECEE000075]

In the period 1980-1987 Rotterdam carried out an energy saving programme for municipal buildings in the non-profit sector (hospitals, schools, offices, libraries,

etc.). The target of this programme was to save energy with a yearly balance between costs and benefits. In 1987 this programme resulted in an investment of HFL 42,000,000,-. The energy consumption was reduced by 16,000,000 m^3 gas. After 1987 the energy consumption slowly grew to the situation of 1980. In 1989 Rotterdam started with the introduction of energy management. For schools and some theaters the energy managers use automatic control systems. (Verhagen, J.W.; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (16 July 1993), ENERGY/SEM.11/R.21, pp. (Summary) [in Russian, English].)

0455 SPACE HEATING MASTER PLAN [BIB-ECEE000076]

Denmark is the leading country in the European Community when it comes to energy savings in the heating sector. According to official EC, DG 17 statistics, the energy demand in the domestic sector on a national basis has been reduced significantly in the last decade from 1980-90 compared with the rest of the EC. National statistics from the Danish Energy Agency show furthermore that the average energy demand per square meter of floor space has been reduced by 50% from 1970-90. A closer look at the Danish heating sector shows that modern central district heating systems utilizing surplus heat from combined heat and power plants (cogeneration) (CHP) and incineration plants have been the main source of this remarkable reduction. In fact, in cities supplied mainly by central district heating, the fuel demand for supplying space heating and domestic hot water has typically been reduced by more than a factor 3 during a period of 10-15 years At the same time the pollution from the space heating sector has been reduced significantly and is now limited on a few, controlled sources. In the typical cities in the former planned economys - Eastern Europe and the CIS - the fuel demand for heating is much higher than in Denmark. One reason is the colder climate, another reason is inefficient use of energy due to lack of market prices and economic incentives. It is typical for these cities, as in Denmark today, that most of the buildings are supplied by large central district heating systems. (Dyrelund, Anders; Symposium on the Environmental Benefits of Energy Conservation, Moscow, 930920-24, Publisher: UN/ECE, (16 July 1993), ENERGY/SEM.11/R.22, pp. (Summary) [in English].)

0456 SYMPOSIUM ON ENERGY EFFICIENCY AND ECONOMIC TRANSITION IN CENTRAL AND EASTERN EUROPE [BIB-ECEE000100]

A symposium, held in May 1993, to review energy conservation policies in Central and Eastern European countries is reported. Developments in energy-consuming sectors such as industry, agro-industry, transport and housing are explained; general recommendations which were adopted, and conclusions are outlined. A number of achievements in efficient energy use have been made in these countries, but progress has been uneven and inadequate from a long-term perspective. A deterioration in the macro-economic framework for efficiency improvements is reported. Delaying energy efficiency policies is not justified, despite economic recession; energy efficiency is not an impediment to economic recovery but a precondition. Energy savings of up to 30%, which can be achieved quickly at low financial cost, are identified. The importance of international cooperation and technical assistance is emphasized. (UN/ECE EE2000 Secretariat; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (21 June 1993), ENERGY/SEM.12/R.2, pp. 20 [in English].)

0457 NATIONAL POLICIES FOR ECONOMIC TRANSITION [BIB-ECEE000101]

Policies for reducing the specific energy consumption of the former Soviet Union and other Eastern European (EE) countries are discussed. Market conditions could be introduced by reorganizing the fuel industry as independent economic entities. New energy trading partnerships would allow higher quality fuels to be mixed with the present low grade fuels. Obsolete equipment would be replaced and new management techniques introduced. Lack of capital is the principal barrier to rehabilitation of the energy sectors in EE countries. It is suggested that a rehabilitation programme should be funded by western countries or international organizations. Economic restructuring will lead to a reduction in energy consumption in future years. Western countries should provide information to the governments, industry and public, in EE countries, about energy management and energy conservation. (Erban, Pavel; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (1 April 1993), ENERGY/SEM.12/R.101, pp. 14 [in English].)

0458 INDUSTRY AND AGRO-INDUSTRIES [BIB-ECEE000102]

Methods of reducing the current high rate of energy consumption in eastern European (EE) countries are considered. Managerial solutions to the problem of high energy consumption include implementing a market economy, reducing subsidies, monitoring energy balances, abolition of monopolies, public education about energy efficiency, information exchange regarding the best technologies, financial incentives for energy saving and the introduction of a new legislative framework. Technical measures which would reduce energy consumption include rehabilitation of industrial processes e.g. agro-industry, waste heat recovery and pumps, thermal insulation and fluid tightness improvements, and a review of energy building management systems. A table showing the energy efficiency of these various measures is presented. Various forms of international cooperation are outlined, such as exchanges of information/experience on a bilateral or multilateral basis, and joint ventures on a specific contractual basis. (Manolescu, George; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (1 April 1993), ENERGY/SEM.12/R.102, pp. 8 [in English].)

0459 URBAN MANAGEMENT [BIB-ECEE000103]

Points from several papers on energy management and energy consumption in Central and Eastern European (CEE) countries are summarized. Conclusions indicate that existing and designed competencies should be verified in practice by actions in West as well as East European cities. Local problems can be overcome with the help of global state energy policy. Utilisation of geothermal energy is a technical possibility but may not be generally supported. Combined heat and power (cogeneration) (CHP) gives scope for energy conservation in industry and urban heating at relatively low cost. The evolution of an urban transport system is also an important area of activity. In CEE countries, the economy of energy supply and energy demand is in transition from a centrally planned economy to a market economy. It is therefore difficult to assess the economic consequences of implementing plans for future development of the energy systems. (Zmijewski, K.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (4 May 1993), ENERGY/SEM.12/R.103, pp. 5 [in English].)

0460 ENERGY EFFICIENCY DEMONSTRATION ZONES [BIB-ECEE000104]

Efforts to improve fuel and energy efficiency in Russia are hampered by the very low prices for primary energy sources, and the energy carriers produced by them, within the country. Consumers have no interest in the rational and economic use of energy. The Energy Efficiency 2000 Project involves the establishment of energy efficiency demonstration zones which show the economic and ecological benefits of energy saving combined with market mechanisms. Six such zones are in different stages of establishment in the Russian Federation, supported by finance from the federal budget. Western partners are actively encouraged to participate in setting up demonstration zones but, so far, no western country has signed the draft technical agreement. This could delay the development of mutually profitable co-operation in energy saving. (Volfberg, D.B.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (8 April 1993), ENERGY/SEM.12/R.104, pp. 6 [in English, Russian].)

0461 ENERGY EFFICIENCY FINANCING [BIB-ECEE000105]

Financing of the investments needed to create and increase energy efficiency in fuel production and consumption, in central and eastern European (CEE) countries, is discussed. The energy sector in CEE countries was previously highly subsidized. This gave no incentive for energy saving or efficiency. An equity investor in efficient energy production has to take a long term view; no dividend is likely in the first five to ten years. The economic risks for such projects rest in the construction contract, fuel supply and pricing, energy sales contracts and energy tariffs. and assurances which would be required by an investor are explained. The guarantees and insurance required by an investor are explained. Investments in energy saving equipment and procedures are generally smaller, with a shorter pay-back time. The risk here lies in the credit-worthiness of the

customer. The investor might seek security in the form of retained ownership of the equipment. (Vennmark, B.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (1 April 1993), ENERGY/SEM.12/R.105, pp. 4 [in English].)

0462 NEW ENERGY RELATIONS IN CENTRAL AND EASTERN EUROPE [BIB-ECEE000106]

The end of the CMEA (Council for Mutual Economic Assistance) opens up new possibilities for exchanges between the countries of Central and Eastern Europe. The old exchange model, based on the hydrocarbons-focused energy union of the planned economy countries is no longer viable. In moving towards a market economy, these countries must find less energy-intensive forms of economic growth capable of sustaining new energy relations. (Locatelli, Catherine; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (3 February 1993), ENERGY/SEM.12/R.2, pp. (Summary) [in English, French].)

0463 THE ENERGY ASPECTS OF THE ECONOMIC TRANSITION [BIB-ECEE000107]

The market forces, such as free foreign trade, market prices, abolishment of subsidy systems, etc., being presently implemented in the Eastern economies, first stopped the decreased economic growth and energy consumption. The profound economic restructuring which is very much needed in these economies, partly results in abandoning the energy intensive activities mainly in industry. The energy consumption can by this way be drastically reduced, but it runs parallel with reductions of economic output. The economic restructuring has a substantial effect on the energy intensity of the economy. Restructuring has approximately one order of magnitude greater effect on energy intensity than the various technological end-use efficiency modifications. The shocks which are provided by the energy price increase for various sectors of the economy have severe effects on foreign trade and social systems. Another major dilemma for the economy and energy policy makers is how to set the speed of the restructuring without destroying substantially the hard currency earning capacities in the industry, i.e. the more energy intensive industry, and create far less energy intensive production capacities which would be able to compete with Western manufacturers in the EEC. Presently the export from the Eastern European economies to the West mainly consists of products which are energy intensive and they are importing goods which are far less energy intensive. This fact indicates a special division of labour developed historically between the East and West, namely the energy intensive i.e. directly and/or indirectly more polluting industries, produce output for the Western market, avoiding these disadvantageous activities in the latter countries. Consequently, for narrowing the energy efficiency gap, it is necessary to change the "industrial backyard" role of the Eastern countries primarily by improving their economies and within that, the industrial achievements. (Lengyel, L.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 March 1993), ENERGY/SEM.12/R.3, pp. (Summary) [in English].)

0464 NATIONAL POLICY FOR ENERGY-ECONOMIC TRANSITION IN THE CZECH REPUBLIC [BIB-ECEE000108]

The economic and energy-policy reform in the Czech Republicaims to keep the sustainable development. The unfavorable impact of the energy systems on the environment is influenced by: the structure of primary energy used; the high energy-intensity of the national economy; the structure and technology of industry; and the efficiency of the heat supply and other appliances in the buildings and household sector. There exists a great import-dependance on the supply of oil (petroleum) (99,14 per cent) and natural gas (93,66 per cent) from the former USSR which has commercial, political and technical risks. The domestic solid fuel supply is lignite of bad quality and therefore with harmful impact on the environment. The transition of the economy, energy systems and environment must be harmonious. The improvement of the environment is the first criterion for energy policy while energy reform is an extremely important tool for the economic transition. (Erban, Pavel; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (3 February 1993), ENERGY/SEM.12/R.4, pp. (Summary) [in English].)

0465 THE DANISH ELECTRICITY SYSTEM [BIB-ECEE000109]

Electricity production in Denmark as an example of efficient, low-cost electricity production based on coal combined with an important amount of renewable energy sources from wind energy turbines and use of biomass (straw and wood chips). Denmark has a tradition for building power plants with a very high efficiency. There are plans to build a 400 MW pulverized coal-fired power plant with a net efficiency of above 47% (based on the lower heat value) to be commissioned by the end of 1998. Today all power plants have cogeneration of heat for district heating systems. The combined efficiency for electricity and heat is above 60% today. The construction cost for large power plants is the lowest in the world (OECD). The main reason for this is the use of the multicontract principle. With this principle a project for a new power plant will comprise detailed invitation of tenders for more than 1000 functions and components. This will secure the lowest possible price and the maximum local supply. The installed capacity of wind turbines is 450 MW (5-6% of the total electric capacity), and the production in KWh was 2-3% of the production in 1991. Waste, straw and wood chips have been used for district heating for a long time, however, now these fuels are used in local plants for combined heat and electricity production. The utilities are now considering to use straw in large power plants in order to reduce the CO_2 emissions. (Bugge, Jan; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 February 1993), ENERGY/SEM.12/R.5, pp. (Summary) [in English].)

0466 ENERGY EFFICIENCY AND CONSERVATION IN LATVIA [BIB-ECEE000110]

The Republic of Latvia is not rich in natural energy resources. Its natural energy resources are mainly the hydro potential of the Daugava River, fuelwood (solid fuel), peat, and renewable energy sources. Latvia has to rely on imports of oil (petroleum), natural gas, and coal. More than 50% of the electric power consumption is imported. The Latvian power system is a mixed hydro-thermal power system. In 1991 25% of total power supply in Latvia was produced by hydro, 25% by thermal power, and the remaining power was imported from Estonia and Lithuania. Total consumption of electricity in Latvia was 9.8 billion kWh in 1991. In order to improve the efficiency and conservation, it is very important to estimate the potential of energy savings. Calculating the economic profitability of energy saving measures, one should keep in mind rather high energy costs in Latvia, hence the biggest industry here prevails. Such calculation allows to determine the priorities of energy saving measures. Great difficulties are expected in the process of energy saving introduction during the transition period from planned economy to market economy. Applying the Western consumer management methods in Latvia, one should take into account local peculiarities. Generally, the energy economy can mainly be achieved in the following ways: by improving the structure of inter branches and branches of national economy; by introducing modern energy efficient technologies and technical equipment; by energy substitution, i.e. the traditional fuel and energy types by alternative energy resources. The measures taken by the authorities in Latvia for energy conservation are classified in three groups: economic control, information, and control by statutes (i.e. regulations and standards). Research is important to the promotion of technology and methods for conservation — conservation measures that are necessary for the national economy and the environment. (Shipkovs, P.; Kashkarova, G.; Shipkovs, A.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 March 1993), ENERGY/SEM.12/R.6, pp. (Summary) [in English].)

0467 ENERGY CONSERVATION PROBLEMS IN LITHUANIA DURING TRANSITION PERIOD [BIB-ECEE000111]

Energy conservation potential in Lithuania is very high — from 22 million t.c.e., consumed in 1989, about 5 million t.c.e. were considered inefficient. After the transition to international prices, the deficit in import and export of energy resources would be about 1 billion USD. The prepared conception for integrated energy resources planning and control includes: an essential reform of prices and tariffs, based on real costs, differentiated according to the fuel sorts, formation of incentives finance and credit system; plan of implementation of institutional and technical measures. The increase of fuel prices to international

standards will cause the increase of energy costs up to such a level that national income decreases catastrophically, and the minimal level of income per capita will not cover the cost of energy. To avoid a catastrophe, it is necessary for state regulation of some energy systems. At present, the stabilization of energy systems is impossible without absolute and relative reduction of energy consumption. The programme foresees means for creation of a private sector, establishes the priorities for energy conservation in industry, energy supply and consumption. It is compatible with the Lithuanian economy stabilization programme prepared by the World Bank. (Klevas, V.; Tamonis, M.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 March 1993), ENERGY/SEM.12/R.7, pp. (Summary) [in English].)

0468 APPROACHES TO REALIZATION OF ENERGY SAVING PROGRAMME IN BELARUS [BIB-ECEE000112]

The national economy of Belarus is a large user of fuel and energy. Some 10-12 per cent of energy needs are provided with its own natural energy resources. While in 1965, one per cent of saved fuel was equivalent to 0.2 M ton of fuel equivalent TOE), nowadays it corresponds to 0.4 M TOE. Therefore, rational use of energy resources result in essential saving of finance and investments in the energy sector. At the same time, realization of the energy saving policy in the Republic has been somewhat delayed. In order to improve the energy efficiency and energy conservation, it is very important to estimate the potential of energy savings. Such estimates allows determination of the priorities of energy conservation measures. In April 1993, the Government of Belarus founded a State Committee on Energy Conservation and Energy Audits. The purpose is to assist both state and private sectors in the rational use of energy and to develop appropriate programmes for rational energy use while considering the environmental aspects. The Government is considering the following fiscal measures: raise tariffs according to quantities of consumed energy, which exceed agreed level; abolish taxation on enhanced energy efficient investments by research and development departments in the fuel and energy industry; establish an Energy Conservation Fund, from which subsidies for the efficient use of energy can be granted; establish tax discount for energy efficient equipment (under development). At the same time, attention must be given to the energy efficiency infrastructure, first of all to basic data and analysis on which a sound policy can be built. The energy-saving programme under development relies on the following methodology: accurate estimation of the energy saving potential in the Republic; reliable determination of the factors affecting the real output of energy conservation efforts, including finance, payment balance, pricing policy, infrastructure capacity and other factors; efficiency of energy conservation incentive improvement for the Republic under its specific economic conditions; consideration of environmental problems; creation of a network of information exchange on optimization of energy-saving policy. (Levchenko, Sergei A.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (10 May 1993), ENERGY/SEM.12/R.42, pp. (Summary) [in English].)

0469 A STUDY OF HUMAN AND NATURAL DETERMINANTS OF ENERGY/ENVIRONMENT CRISIS [BIB-ECEE000114]

The primary source of environmental crisis, in general, lies within man himself: in his outward activities aimed at satisfying his own needs. Therefore, actions taken for abatement of this crisis should first of all influence human beings. The present study attempts to indicate the undertakings for a realistic civilized evolution of society and its mechanisms towards minimizing environmental impacts without lowering the quality of life. In accordance with the motto: treat the disease not the symptoms — one should invest in people rather than in chimneys. To answer this challenge requires a thorough, interdisciplinary study on underestimated, yet unquestionable laws predetermining energy consumption and man-environment interactions, since the neglect of fundamental properties of human beings and of laws ruling society and nature, predestine any attempts of counteraction to be hopelessly idle. A chance of success seems minute without the most cost-effective investment ever attainable i.e. the enlightenment of the decision- and option-making circles of the society: politicians, businessmen, journalists, etc. The goal can be attained through the elaboration of well-weighted, concise, non-specialist oriented publications. Apart from the above universal aspects, the study deals with local problems of Central Europe and of Poland, in particular. The post-communist transition period in these countries is distinguished, among others, by a rapid spread of consumerism, filling in a way the ideological space left by former anti- or (rarely) - communist commitment. (Taczanowski, S.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 March 1993), ENERGY/SEM.12/R.8, pp. (Summary) [in English].)

0470 POLAND'S ENERGY POLICY PROBLEMS IN THE TRANSITION PERIOD [BIB-ECEE000115]

The report explains differences of partial aims of former central planned economys and market economys. On this basis some general directions of economic changes on energy consumption problems, which are realized in all countries being in transition, are described. The background of these analyses are the results of the "Energy Conservation in Industry" - UNDP-UNIDO project (till 1991) and the last experiences in the Polish economy where the transition period is the longest. In the last part of the report the most important obstacles for energy conservation activities and some recommendations for future activities by government and other institutions are stressed. (Krawczynski, F.; Michna, J.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 March 1993), ENERGY/SEM.12/R.9, pp. (Summary) [in English].)

0471 ELECTRICITY PRICING POLICY IN ECONOMIES IN TRANSITION [BIB-ECEE000116]

The pricing policy for electric power and heat and the price system for other services provided by the electricity utilities are playing an increasingly important role in an economy moving towards a market economy. To meet the requirements, tariffs must be kept in line with socio-economic realities by taking into account the effects of inflation and changes in purchasing power. The tariffs must also be clear, to enable them to be understood by the consumers. Moreover the relationships between the power company and the consumers should be established on a correct economic and legal basis through a set of regulations. It is well known that the pattern of energy consumption varies greatly from one customer to another and so do the tariffs, but the effectiveness of a tariff system is measured not only by its ability to reflect costs exactly but also by the readiness with which it can be understood. This new approach therefore implies the need to make the customer aware of the real cost. This transparency of tariffs, by keeping the customer informed enables him to choose out of several options the one that is the most advantageous to him in the particular case. The tariff system must be so arranged so that the best choice for the customer is also the best choice for the community. The paper deals in detail with the importance of tariff policies in countries moving from a planned economy towards a market economy. (Manea, D.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 March 1993), ENERGY/SEM.12/R.10, pp. (Summary) [in English, French].)

0472 DEVELOPMENT POLICY OF THE ROMANIAN POWER SYSTEM AND ITS ADAPTATION TO MARKET ECONOMY [BIB-ECEE000117]

The Romanian power system has an installed power of more than 22,000 MW in hydro electric power (25%) and thermal energy (75%). Despite this installed power, the present peak load of 7,000-8,000 MW can be hardly covered. This is due to many difficulties encountered mainly in the thermal power plants, ranging from the poor quality and insufficient quantities of lignite (as main fuel) to unavailability of the thermal units of coal. Nowadays, during transition to a market economy, there are two categories of problem to be faced: decreasing consumption at values registered in 1975-1980; this is due to the restructuring of the national economy which, with priority, reduced the energy intensive industries; high rate of unavailability in the power plants. Taking this demand reduction as an opportunity, some power plants with problems are already under rehabilitation. In parallel, the works at the first nuclear power plant are resumed on a new basis; special attention is paid to the first two units, in order to meet the future increase of demand, correlated with the national economy recovering and also to compensate the dismantling of old generating units. (Popescu, A.; Gheorghiu, D.; Manolescu, George; Vladescu, A.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 March 1993), ENERGY/SEM.12/R.11, pp. (Summary) [in English].)

0473 ECONOMIC EFFICIENCY ASSESSMENT OF THE POWER PROJECTS IN A TRANSITION ECONOMY [BIB-ECEE000118]

The lack of a real price policy, common in all planned economys was registered also in Romania specially in the energy sector. Consequently, many wrong decisions were taken which lead to the execution of inefficient projects. Nowadays, in the transition period, a correct economic assessment of energy efficiency for the power projects requires two basic conditions: real price policy and assessment methods of economic and financial efficiency, especially in the current transition stage. The report introduces the present achievements in this respect, i.e. problems encountered and a new assessment basis already implemented or under implementation. (Cusuta, Maria; Sima, Constantin; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (2 February 1993), ENERGY/SEM.12/R.12, pp. (Summary) [in English].)

0474 ENERGY IN SLOVENIA - TODAY AND TOMORROW [BIB-ECEE000119]

The transition from planned economy to market economy has for Slovenia (as well as for other Central and Eastern Europe countries) far-reaching consequences. An extensive development of the energy system without considering its environmental effects, is not acceptable any more. According to our present situation and decisions upon the future energy system development, special attention should be paid to a critical analysis of energy elasticity of technological processes, social factors, constraint on economic parameters, industrial restructuring and environmental effects. The background data on the Slovenian energy system presented in the paper are related to the period of 1971-1990, in which the beginning of changes from an extensive, energy-demanding economy into an intensive and market-oriented economy can be visualized. A relatively fast growth of energy consumption, which was characteristic for the 1970's, gradually decreased in the 1980's. Total primary energy consumption increased by 5% between 1980 and 1990. Final energy demand in Slovenia in 1990 was 161 PJ and total primary energy requirements were 241 PJ. Through this period, energy prices were unrealistically low. Slovenia has high energy consumption per capita and very high consumption per GDP. Due to unappropriated fuel mixes, low-efficiency use of energy resources, and inadequate past energy policy, the environmental problems are very serious. In 1990, emissions amounted to 216,000 tons of SO_2, 47,100 tons of NO_X, 13,706 tons of CO_2, 33,200 tons of solid particles and 1,382,000 tons of fly ash. A new energy policy was designed based on the critical analysis of the past energy demand. Reliable energy supply and clean technology will be given priority. (Ivanjko, S.; Porenta, M.; Suvorov, B.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 March 1993), ENERGY/SEM.12/R.13, pp. (Summary) [in English].)

0475 RECENT ECONOMIC DEVELOPMENTS, INSTITUTIONAL AND STRUCTURAL CHANGE IN CENTRAL AND EASTERN EUROPE [BIB-ECEE000120]

Recent economic developments in central and eastern Europe have featured a number of unfavorable tendencies which may have come to an end in a few advanced reform countries but in most countries still continue. This reduces the short-term prospects for economic recovery, limits possibilities for improving macroeconomics efficiency and requires coordinated suuport of all parties involved. Perhaps the most dramatic developments in central and eastern Europe are those relating to production levels: sharp recessionary tendencies which began in 1990 continued, albeit more slowly, in the smaller eastern European countries (minus 10 per cent), but at a much higher rate in the CIS countries (minus 19 per cent in Annual changes varied enormously - from an unweighted average of -36 per cent in the Baltic States and -27 per cent in the Federal Republic of Yugoslavia (Serbia and Montenegro) up to only -(4-6) per cent in Hungary and perhaps a small positive rate in Poland. Together with the falls already recorded in 1990-1991, the recession in central and eastern Europe has already turned into a deep depression. At the end of 1992 the levels of NMP (net value added of the material sphere) and/or of gross domestic product in smaller east European countries was lower than at the end of 1989 by some 30.5 per cent, in the CIS countries by 36.5 per cent (Russia - 31.0 per cent) and in the Baltic States by unweighted average of almost 46 per cent. All these figures indicate a much bigger fall in output levels than in Western Europe at the time of the Great Depression in the early 1930s (16-18 per cent). Industrial production has been hit harder than most other sectors, but construction and agriculture, the latter especially in 1992, also contributed to the falling output levels. Services thus appear as the only sector which may have expanded, at least in some countries. Incomplete figures indicate that domestic demand, especially investment but also public consumption, went down in parallel with output or even faster and that exports have been the only demand component that generally tended to pull (or to restrain less) the output growth. (Vacic, Aleksandar. M.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (16 April 1993), ENERGY/SEM.12/R.14, pp. (Summary) [in English].)

0476 ENERGY EFFICIENCY IN UKRAINE - PRESENT DAY SITUATION AND PROSPECTS [BIB-ECEE000121]

The report gives a general description of the standards of power engineering and energy efficiency in Ukraine and a comparison of major indicators of national economy, power development and atmospheric pollution (carbon dioxide emissions) in Ukraine and in Western Europe. Figures show that energy demand of Ukraine national income is 2 to 3 times as high as in Western Europe. Under the conditions of large deficiency of its own energy resources (in 1990 Ukraine imported about 130 Mtons of fossil fuel, which represents 52 per cent of its general energy consumption) energy conservation has become one of the most important directions of national economic policy. An estimation of potential energy conservation in the country is given up to the year 2030. Analysis was made of the major directions for energy conservation policy implementation during economic transition and also of the existing technical and economic constraints. (Raptsun, Nikolai V.; Tonkal, Vladimir E.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (14 April 1993), ENERGY/SEM.12/R.40, pp. (Summary) [in English].)

0477 ENERGY CONSUMPTION IN THE COUNTRIES OF CENTRAL EUROPE THE NEED FOR ENERGY EFFICIENCY [BIB-ECEE000122]

The energy situation in five countries of Central Europe: Bulgaria, Czech Republic, Slovak Republic, Hungary, Poland and Romania is examined and compared with the situation in the 'Eur' countries averaged out for the Europe of the Twelve (EEC). This comparison demonstrates primary and final energy intensities and ratios of energy consumption to gross domestic product that are very high in Central Europe. The same applies to electric power consumption. The consequences of inefficient utilization of energy are catastrophic for the economic development, the environment and the quality of life. Energy efficiency obviously constitutes the first energy "resource" that must be exploited. The possibilities are considerable. They can be demonstrated roughly but extremely vividly (and probably quite fairly) on the basis of the following hypothesis: in less than 20 years or 60 the countries of central Europe may attain the levels of energy efficiency and energy intensity of the countries of Western Europe. If they did not succeed in doing so their economic and social development would be seriously jeopardized. On the basis of this hypothesis, it is possible to determine what the energy consumption of these countries should be around the year 2000. The results obtained are extremely interesting: they show that energy consumption can be decreased considerably at the same time as there is a very appreciable increase in GDP, the make-up of which will obviously be profoundly modified. This is not a prediction but a picture of a reasonable objective that can be attained if a global energy efficiency policy is implemented with political commitment and by appropriate means. Lastly, the paper examines the conditions for carrying out these measures that should accompany restructuring of production facilities and adjustments in the prices of energy products: energy efficiency programmes, national and local institutions and bodies, regulations and legislation, financial and human resources and active international cooperation. (Laponche, Bernard; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (12 February 1993), ENERGY/SEM.12/R.15, pp. (Summary) [in English, French].)

0478 CRASH AND REBIRTH: ENERGY DEMAND IN THE FORMER SOVIET UNION [BIB-ECEE000123]

In our previous papers we have characterized the extreme inefficiency of energy use in the former Soviet Union. What can happen if an effort is made to improve this dismal energy efficiency situation? Using a detailed, bottom-up model

(energy modelling) of the energy demand in the former Soviet Union, we built scenarios for energy consumption there in 1995 to 2010. In this paper we consider three different scenarios for efficiency and energy conservation improvements by the year 2010. Based on previous estimates of potential energy intensity improvements together with assumptions about the structure of the economy in 2010, we calculate total energy consumption for each main end use sector (residential, services, industry, and transportation). The "Slow Reform" scenario illustrates what might happen if economic development proceed very slowly. Energy prices rise slowly, to roughly 2-4 times the 1985 levels, although still remain below Western standards. Energy intensities decline slowly through gradual replacement of old facilities and equipment. Relatively little effort and capital is focused on energy efficiency, however, and only a modest amount of Western technology penetrates into the former Soviet economies. In the "Rapid Reform" scenario, development of a market economy proceeds at a relatively fast pace, and there is substantial technical assistance and investment from the West. Energy intensities decline to the average levels found in Western Europe in 1985. Today's least productive factories are closed, and there is considerable investment in new factories and new technology. The energy efficiency of new homes increases through improved design and components. The "Extra Effort" scenario is similar to "Rapid Reform", except it assumes that energy efficiency is given higher priority by authorities and energy users alike. The result is that average energy intensities in 2010 are below 1992 Western European intensities for new equipment, or approximately the average level of Western European energy intensities we expect in 2010. In "Slow Reform", the final demand for energy in 2010 is about at its 1985 level. In "Rapid Reform", the level in 2010 is below 19857 and in "Extra Effort" energy demand is far below its 1985 level. (Schipper, Lee; Martinot, Eric; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (22 March 1993), ENERGY/SEM.12/R.16, pp. (Summary) [in English].)

0479 EAST-WEST COMPARISONS OF ENERGY EFFICIENCY IN ENERGY INTENSIVE INDUSTRIES [BIB-ECEE000124]

Use of a technical energy efficiency concept. Statistics available from Eastern Europe follow the logic of the System of Material Product Balances (MPS). Aggregated energy and economic data are not compatible with the system used in Western Europe. Energy data discrepancies are especially in the classification of energy consumption between demand side and supply side, and in the classification of energy consumption between individual sectors. In the economic data, the absence of the value added concept within the MPS system deprives energy economists of the most commonly used indicator of economic activity for energy efficiency analysis. To overcome this methodological problem, we use a technical energy efficiency concept. Our analysis is based on specific energy consumption data per physical unit of a product (e.g MJ/t) collected at the process level (e.g. blast furnace or cement kiln). This approach will be used for the Study on "Opportunities to improve energy efficiency in the Czech Republic and Slovak Republic" for the energy intensive industries (i.e. iron and steel industry; glass industry; building materials industry; pulp and paper industry; aluminium industry; petrochemical industry). As waste of materials implies waste of energy, data on energy and material use will undergo a combined evaluation in a process chain model. This process chain analysis will then constitute the basis for evaluating the impact of different technical measures. **Example of the glass container industry.** The following table shows some comparative figures on average energy intensity per ton of glass container. High improvement potentials can be expected in the Slovak and especially in the Czech Republic where approximately 80% more energy was consumed in 1988 in comparison to the average in the French industry in 1991: Slovak Republic (1988) 10,146 MJ/t; Czech Republic (1988) 12,228 MJ/t; St-Gobain, France (1991) 6,664 MJ/t; Vetropack, Switzerland (1990) 7,631 MJ/t. (Vallance, B.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (18 March 1993), ENERGY/SEM.12/R.17, pp. (Summary) [in English].)

0480 ECONOMIC TRANSITION IN SLOVENIA - ENERGY CONSUMPTION AND EFFICIENCY IN THE INDUSTRIAL SECTOR [BIB-ECEE000125]

Loss of traditional markets to the East (mainly the area of the former SFR Yugoslavia) and the transition to tighter economic conditions has caused a severe decrease of industrial activities, down by 35% in 1992 compared to 1986. The statistical indicators of final energy consumption, down 18% in 1991 compared to 1986, and production value imply a relative decrease of energy efficiency. Current status and outlooks for the development in the energy intensive sectors (iron and steel industry, aluminium industry, pulp and paper industry) as well as for the introduction of energy efficient technologies (clean technologies), such as CHP, and other efficiency improvements are given. The efficiency increase potential and the actual energy supply options require an integral resource planning (or least-cost planning) approach, especially for the power supply. and energy demand matching. (Tomsic, M.; Mansour, F.A.; Psenica, V.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (18 March 1993), ENERGY/SEM.12/R.39, pp. (Summary) [in English].)

0481 COMMUNAL SKILLS AND URBAN ENERGY MANAGEMENT POLICIES [BIB-ECEE000126]

Having recalled the merits of a decentralized approach at the urban level to energy management and environmental management policies, the authors will review the various means that communes have at their disposal in Eastern Europe and in Western Europe. The aim is to demonstrate that whereas changes are needed both in the east and in the west, most communes already have, at varying degrees, the skills that would enable them to implement effective energy management policies. These skills will be examined through the measures undertaken by Polish, German and French towns in the following area: Urban energy supply policies; Energy management in the municipal context; Informative and explanatory measures undertaken by the municipal authorities; Travel and urban transport policies; Waste management and prospects for energy generation from waste (waste energy). (Blaize, Jacques; Gula, Adam; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (12 March 1993), ENERGY/SEM.12/R.18, pp. (Summary) [in English, French].)

0482 THOUGHTS ON THE EVOLUTION OF URBAN TRANSPORT SYSTEMS [BIB-ECEE000127]

Once the broad problems of economic transition in the countries of Central and Eastern Europe and its relationship to energy consumption management and environmental protection are considered, the question of what policy to adopt for urban transport, and more generally passenger transport, is bound to arise. Those responsible for transport policies in Western Europe concern themselves with major macroeconomics questions (impact on the energy independence policy, improvement of the quality of life and the abatement of nuisances) and micro-economic matters (financing of infrastructures, profitability of networks, etc.). It appears worthwhile comparing these ideas with the present situation in the cities of Central and Eastern Europe and with the developments that are under way. The process of economic transformation is in fact taking place as far as the urban transport sector is concerned in a very different context from that seen in the West. In particular the importance attached to public transport is a primary characteristic of existing urban planning. But what is the future of these urban transport networks in a generally poor economic context? How will they evolve against a background of generalized privatization that may lead to the haphazard emergence of an increasingly extensive private-car sector? And how can this be squared with a more comprehensive approach to urban passenger travel and an inevitable demand for mobility? With what approach to the use of the available space and with what results in terms of energy and environmental balances? Within what financial framework and on the basis of what budget allocations? (Jamet, Bernard; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (12 February 1993), ENERGY/SEM.12/R.19, pp. (Summary) [in English, French].)

0483 ENERGY-SAVING POLICIES IN CZECH AND SLOVAK HOUSING [BIB-ECEE000128]

This paper analyses the impact of various energy-saving policies in the housing sector in the Czech and Slovak Republics. On the basis of sets of figures showing energy consumption in 1990 it proposes various energy policies for the next 25 years. These policies are concerned essentially with energy management activities. Their impact from the energy and environmental point of view is analyzed with the help of the MURE computer program (Model for the Rational Utilization of Energy (energy modelling)) of INESTENE. Finally the wider effects of these energy management measures are described. This analysis of energy consumption in the housing sector takes into account all the parameters that contribute to consumption in a building. It makes it possible to classify residential buildings into types on the basis of the quality of the building and the systems that produce and emit heat. This work has been based on various Czech, Slovak and other sources. An analysis is given of the quality and consistency of these sources. A balance-sheet of energy consumption in the housing sector is drawn up for the year 1990. The data obtained are used in a computer program for forecasting energy consumption, the MURE model. On the basis of the figures for 1990, the MURE model makes it possible to construct various scenarios of energy consumption for the housing sector up to the year 2015. These scenarios, based on economic growth estimates, make it possible to follow up, in five-year steps, the construction and destruction of housing. (Rialhe, A.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (19 March 1993), ENERGY/SEM.12/R.20, pp. (Summary) [in English, French].)

0484 LOCAL AND REGIONAL MEASURES FOR ENERGY MANAGEMENT AND ENERGY EFFICIENCY [BIB-ECEE000129]

In recent years considerable emphasis is given towards the design and implementation of a framework of actions for energy management and energy efficiency. Such actions are considered important both in terms of economic aspects and environmental aspects especially when considering the city or region as both energy producer and manager. In this paper the current status of energy matters at the local and regional scale is described with focus given to large urban areas, such as the metropolitan areas of Athens, Greece. In addition information is given with respect to the framework of actions for the transition of the energy related responsibilities from Central to Local Governments, including economic and legislative issues. Finally the potential for energy savings is examined with respect to the use of natural gas and solar energy and the energy, pricing alternatives. (Cartalis, Constantinos; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (19 March 1993), ENERGY/SEM.12/R.21, pp. (Summary) [in English].)

0485 ENERGY CONSUMPTION IN THE TERTIARY SECTOR IN ITALY [BIB-ECEE000130]

The Tertiary sector encompasses economic activities which are needed for "community life" - "saleable services" (trade, handicraft, transport, hotels and restaurants, banks, insurance companies ...) and "non-saleable services" (public administration, social services ...) and has an economic growth faster than other productive sectors. In Italy, energy consumption in the Tertiary sector, like in other industrialized countries, had even faster dynamics than in industry and other economic sectors, since electricity was used with increasing intensity, particularly during the past two decades. Given the fact that electric and non-electric energy consumption (and its determinants) in the Tertiary sector is less well-known than in other sectors, this paper is thus aimed at analyzing energy consumption in the Tertiary sector and its dynamics, and at collecting all available data on the topic. (LaBella, S.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (18 March 1993), ENERGY/SEM.12/R.22, pp. (Summary) [in English].)

0486 PRODUCTION AND DISTRIBUTION OF HEAT IN CHEVILLY-LARUE AND L'HAY-LES-ROSES [BIB-ECEE000131]

The geothermal system in Chevilly-Larue and l'Hay-les-Roses (Ile de France), one of the largest in Europe, supplies domestic heating and hot water to about 13,000 dwelling-equivalents. Production is based on two doublets, each capable of a rate of flow of 300 m^3/h of water at 74 °C, supplemented by 6 central boilers - standby boiler-rooms working on natural gas and some 30 local standby boiler-rooms working on domestic gas or fuel oil. Distribution to the 130 domestic heating and hot-water substations is done through a multipipe urban maine network (58 km of high, medium, low and very low temperature pipes), using thermal energy in steps depending on the various modes of operation of the blocks connected to the system. This arrangement leads to the lowest possible return temperatures and makes the energy efficiency of this scheme exceptionally high. Brought into operation in October 1985 it encountered financial problems in 1986 connected with the economic situation and resulting from the considerable fall in the cost of traditional forms of energy, which regulates the price at which heat is sold to users. A rescheduling of the loans that had financed the investments made it possible to restore financial equilibrium. The annual saving in fuel is 10,000 TEP. The cost per geothermal MWh is 132 French francs. Technically these installations are managed by the COFRETH company for the above-ground portion and the mains and by the CFG (French Company for the Development of Geothermy and New Forms of Energy) as far as the geothermal loop is concerned. Today the operation is continuing to expand both in the number of users (about 2,000 to 3,000 supplementary dwellings are expected to be connected within three years) and in regard to its means of production. Various studies for optimum use of energy are being carried out at percent (mathematical model (energy modelling) and computer modelling of the very complex heat network, utilization of heat pumps and heat storage) and the first results seem very interesting. (Andres, M.; Boissavy, C.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (19 March 1993), ENERGY/SEM.12/R.23, pp. (Summary) [in English, French].)

0487 ENERGY MANAGEMENT POLICY FOR MUNICIPALITIES; IS A SUCCESSFUL APPROACH IN THE NETHERLANDS 'TRANSLATABLE' TO EASTERN EUROPE? [BIB-ECEE000132]

Novem (a Dutch Agency for Energy and the Environment) executes programmes for energy saving and environmental care in the Netherlands. Most of the programmes are funded by the Dutch government or related organizations. Over the past years, experience has been gained with a program to stimulate Dutch municipalities to develop energy policies. The approach has been quite successful. Elements of the developed methodology could be very useful for municipalities in countries in Eastern Europe. Over several years, Novem executes a program to encourage Dutch municipalities to develop policies for energy conservation as an integral part of their policy for environmental care. Part of the costs to define the energy policy is refunded to the municipalities as financial incentives. The gross rule for financial aid is 1 guilder per inhabitant. After an originally rather technocratic approach, the method was redefined. Currently, the emphases is on development of the process to come to a well-defined and well-supported energy policy. Roughly, it now distinguishes the next phases: plan of action selection of target groups building partnership relations definition of the energy policy execution of the energy policy. Also, we have discovered that municipalities with less than 100,000 inhabitants, are much more effective when they co-operate with others municipalities. Therefore, financial incentives are adjusted in such a way that co-operating municipalities can claim a higher refund. In the clustering process of municipalities, the Dutch Utilities and the province (county) play an important role. The checkpoints between the various phases are well-defined. The financial refund is paid in parts, depending on the checkpoint that has been met successfully. (Nuijen, W.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (18 March 1993), ENERGY/SEM.12/R.24, pp. (Summary) [in English].)

0488 SCOPE FOR EXPANSION OF CHP IN HUNGARY [BIB-ECEE000133]

The study concerns the evaluation of the potential CHP locations, both in industry and district heating with a heat demand of at least 20 GJ/h or ca 1 MWe capacity. Note that at many locations district heating provides also heat to industries. In fact 57 Hungarian locations were analyzed on scope and profitability for investment in CHP, using financial accounting models and criteria such as Internal Rate of Return and Pay-back Period. Due to the already existing favorable infrastructure, the present expectations in Hungary about the CHP-capacity to be developed in the future, are very optimistic (1300 up till 2000

MWe in the year 2000). This is too optimistic because the economic restructuring and energy savings will diminish the scope for CHP substantially. (Oostvorn, F.; Harmelen, A.K..; Heel, P.; Lontay, Z.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (18 March 1993), ENERGY/SEM.12/R.25, pp. (Summary) [in English].)

0489 EFFICIENT USE OF RENEWABLE AND OTHER ENERGY SOURCES IN BOHEMIA - A COMPREHENSIVE ENERGY SYSTEMS APPROACH [BIB-ECEE000134]

A comprehensive energy systems model comprising the end-use sector, the energy conversion and transmission system, and the system of energy sources, is being set up for the Hradec Kralove/Pardubice region in Eastern Bohemia. Energy modelling is based on an advanced computer systems for the modelling of regional energy systems: the SESAM-model (Sustainable Energy Systems Analysis Model) developed at Aalborg University. The SESAM-model has been used for the analysis of scenarios for the future development of regional energy systems in Denmark. The SESAM-model enables the analysis of a range of technological scenarios for the development of the regional energy system and the environmental and economic consequences of different scenarios. The project shall thus provide a basis for rational least-cost planning and implementation for renewal of the region's energy systems in such a manner that the regional as well as the global demand for environmental protection and prevention of resource depletion can be met. The project is being carried out from October 1992 to May 1993 in close collaboration between Aalborg University, energy planning institutions in Denmark and Czechoslovakia, and the municipalities of the cities of Hradec Kralove and Pardubice. (Illum, K.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (19 March 1993), ENERGY/SEM.12/R.26, pp. (Summary) [in English].)

0490 OPPORTUNITIES TO IMPROVE ENERGY EFFICIENCY LN SLOVAKIA AND THE CZECH REPUBLIC [BIB-ECEE000136]

The major objective of the study is to design energy strategies for the Czech and Slovak Republics which are based on: efficient use of energy; energy conservation; renewable energy sources; social and ecological compatibility and which should serve as a basis for planning and action for decision making, energy experts, and all interested in the topic. The analysis centers around energy services which should be provided with the lowest possible energy input. After analyzing the current situation in energy systems, measures to improve energy efficiency will be described, which are appropriate for the special framework conditions in the two republics. These measures include not only technical but also political, economic, and organizational measures and are presented together with the necessary instruments for their implementation. In a third step, these measures are combined with strategies which: - include different areas of action (local, regional, national) - are initiated, organized and conducted by different "players" - are robust against changing framework conditions - are modular designed - could be further developed and modified. Measures are combined with respect to their different time horizons for implementation and for becoming effective, having in mind the need for immediate short-term actions. Special attention will be given to the role of cities and municipalities in the design and implementation of such energy strategies. Following the needs of our Czech and Slovak partners, the transfer of knowhow and experience in implementing, managing, and financing energy efficiency measures is of high importance. This will lead to the preparation of concrete pilot projects. (Mühlberger, M.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (19 March 1993), ENERGY/SEM.12/R.28, pp. (Summary) [in English].)

0491 THE DEVELOPMENT OF ENERGY EFFICIENCY DEMONSTRATION ZONES [BIB-ECEE000137]

An Energy Efficiency Demonstration Zone is a city-scale project, an energy efficiency demonstration enterprise zone is a town, district, or limited area, in which favorable conditions in every sphere are established to stimulate enterprise and initiative in market approaches to energy efficiency, in the same way urban development or regional economic development zones have been successfully established in Western Europe. It demonstrates, on a city-wide scale, the combined effect of energy-efficient technology; energy pricing policy; favorable tariff structures; advisory services; information campaigns; metering, monitoring and controls; energy audits; tax incentives, grants and government-guaranteed loan schemes; international technical assistance and trade development programmes. The intention is to replicate successful measures nationally once proven on a limited scale. This paper explains the background and procedures for the development of the Demonstration Zones. It reviews work in progress in Moscow (Russian Federation) and describes proposals for demonstration zones in Gabrovo and Aitos (Bulgaria), the Istra Peninsula (Croatia), the Ceska Lipa region (Czech Republic), Tallin (Estonia), Pecs (Hungary), Plagana (Lithuania), Valetta (Malta), Warsaw and Cracow (Poland), Deva (Romania), Bratislava (Slovak Republic), Maribor (Slovenia) and Kiev and Lvov (Ukraine). (UN/ECE EE2000 Secretariat; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (19 March 1993), ENERGY/SEM.12/R.29, pp. (Summary) [in English].)

0492 FINANCING ENERGY EFFICIENCY AT THE EUROPEAN BANK [BIB-ECEE000138]

Energy efficiency investments play an important role for the restructuring of the economies in Central and Eastern Europe and are an integral part of the energy sector operations of EBRD. Such operations include measures that help countries enhance the efficiency of existing energy supply options, which promote improvements in the efficiency of energy end-use such as in industry and buildings and which improve the environmental performance of energy supply industries. Since its foundation in April 1992 the Bank initiated various projects which cover a wide range of energy efficiency measures, such as rehabilitation of power plants, the refurbishment of heat transmission and distribution systems, the installation of heat and electricity measuring instruments in industry and measures to reduce energy wastes in buildings through the installation of metering and controlling equipment as well as improved insulation. The bank also offers technical assistance to strengthen energy sector management and human resources development. The Bank follows in its operations a least cost strategy, taking into account the economic and environmental benefits of various supply and demand options. Current technical cooperation projects assist national and regional governments as well as utilities in the development of such a strategy. (Unterwurzacher, Erich; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (18 February 1993), ENERGY/SEM.12/R.30, pp. (Summary) [in English].)

0493 INNOVATIVE ENERGY EFFICIENCY FINANCING [BIB-ECEE000140]

This paper is based on the author's experiences in financing energy projects. Through careful examination of the interests of all potential beneficiaries in an energy efficiency improvement project, means of profitable private sector financing can frequently be found. Methods of analysis and structuring are described. All economic and financial aspects of proposed energy efficiency and environmental improvement investments (or expenditures) must be analyzed. The goals are to: - improve payback periods for both investors and investment recipients, - minimize investment and costs to public sector institutions and municipalities, - reduce high profit margins demanded by foreign currency investors, and - minimize national balance of payments costs and risks of foreign financing. We must structure investments to reduce costs and foreign exchange risk. We must: - maximize local purchases (when consistent with investors' export credits) - maximize use of local financing, fiscal incentives and tax deductions, and - compensate with export trade (including partial subcontracting to order), or - sequester of currency streams on project related (or unrelated) exports, - sequester of currency streams on project related (or unrelated) import-avoidance, and - 'partner' with local firms to multiply skills on subsequent projects. Many more projects in Eastern Europe are economic than some public-sector planners and economists believe. Some projects have 'immediate' payback (under one year). Our next task is to train eastern Europeans (and 'western' bankers and businessmen) how: - to identify such projects and bring them to the attention of the private sector, - to 'package' such projects for financial attractiveness and lowest cost, - if needed, to attract foreign equity, loans, technology, suppliers and customers, - to negotiate projects in the best interest of all parties and Eastern Europe, - to avoid unnecessary foreign participation, costs and imports. (Trumpy, Thomas; Symposium on Energy

Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (31 March 1993), ENERGY/SEM.12/R.32, pp. (Summary) [in English, french].)

0494 SELECTION CRITERIA USED IN EFFICIENCY ANALYSES AND TO DETERMINE PRIORITIES AND CONDITIONS FOR CONTINUING INVESTMENTS IN THERMAL POWER PLANTS DURING ECONOMIC TRANSITION IN ROMANIA [BIB-ECEE000141]

Economic transition in Romania has profound implications for the choice of the selection criteria used during analyzing of the economic viability of the various options. One of the basic energy problems in Romania today is how to determine whether the investments that had already begun in thermal power plants should be continued and, if so, in what order of priority. The report describes the criteria at present used in analyzing economic viability in the cases mentioned above during economic transition in Romania. (Panait, L.; Neagu, C.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (19 March 1993), ENERGY/SEM.12/R.33, pp. (Summary) [in English, french].)

0495 BILATERAL EAST-WEST ENERGY PROJECTS: WHO CAN LEARN WHAT? [BIB-ECEE000142]

Like many other western countries, Denmark has established a programme of initiatives in support of the reform process in the Central and Eastern European countries implying a transition towards democracy and market economy. The Danish programme for Central and Eastern Europe, launched in 1990, includes a project fund, aimed at supporting bilateral cooperation projects (mainly technical assistance projects) within several sectors. including energy. Up to now, about 50 energy projects have been supported in 8 countries. This paper gives a review of some experiences drawn from these project activities, concerning inter alia i.e. the commitment of national authorities in project preparation (identification of the needs and how to specify these in operative terms); differences in project criteria as formulated by recipient country respectively donor country ("paper projects" versus demonstration projects, short term versus long term aspects, etc.); obstacles in project implementation; and practical and principal problems connected to project evaluation. It seems obvious that such energy projects can act as vehicles for transfer of knowhow and technology transfer from West to East. However, it should not be overlooked that activities of this kind may challenge traditional energy sector development knowledge established within a Danish - or more generally speaking - a western context. (Josephsen, Lars; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 February 1993), ENERGY/SEM.12/R.34, pp. (Summary) [in English].)

0496 ENERGY EFFICIENCY IN GREECE: FROM ENVIRONMENTAL IMPACTS TO ECONOMIC VALUES [BIB-ECEE000143]

Energy is a key factor for economic development as the increasing use and energy demand of all types of fuels influences significantly several sectors of life at both the national and local scale. Taken the shortage met for some types of fuels that are used today and the pollution caused by several types of fuels, considerable emphasis is recently given towards the use of both alternative fuels and energy efficiency measures. The latter constitutes the most easily accessible strategy for ameliorating ecological, economic, health and development consequences caused by energy and energy related environmental problems as the cost and the time required for implementation is now and short respectively In this paper the framework of actions for energy efficiency in Greece is described. Several dimensions are examined with considerable emphasis given to the present legislative status for energy transition, the need for capacity building and training at all levels of production life (industry, agriculture, construction, etc.) the market requirements and market imperfections for the implementation of energy efficiency measures, the energy management plans applied so far as well as the decision tools designed for future implementation. The latter dimension is examined with respect to the energy efficiency financing plans of public or private origin and in conjunction with the economic costing criteria used for the valuation of variable energy resources. (Asimakopoulos, D.N.; Cartalis, Constantinos; Santamouris, M.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 February 1993), ENERGY/SEM.12/R.35, pp. (Summary) [in English].)

0497 ENERGY EFFICIENCY - A PRIORITY FOR ROMANIA [BIB-ECEE000144]

The transition from a planned economy towards a market economy based on the play of market forces is encountering a series of difficulties. The first is the absence of a tried and tested model that can be used as a universal panacea. As a result the features specific to each country determine the framework for transition and dictate the methods for carrying it out. From the energy point of view, Romania is characterized by intensive energy consumption. The structural changes that occurred during the years 1990-1992 have a fundamental influence based on the programme of reforms with privatization as its main element. It is advocated that privatization should be effected through a transfer of State enterprises to the private sector and through encouragement of the creation of a new private sector. The paper describes the elements that govern this transition process and the results obtained. An increase in energy efficiency is the effect of this process. For that reason the paper describes the obstacles which have hindered and are still hindering such an increase, the measures adopted to eliminate those obstacles and the stages that we consider necessary to achieve that aim. An important aspect is the legislative and organizational framework. In that context the paper emphasizes the role that must be played by the Romanian Agency for Energy Conservation. (ARCE). Moreover, stress must be laid on the role of private commercial companies and of State companies on the consultancy and technology market in regard to energy efficiency. The document is an attempt to present one point of view on this matter. (Musatescu, V.; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (19 March 1993), ENERGY/SEM.12/R.36, pp. (Summary) [in English, French].)

0498 GETTING STARTED - SOME APPROACHES [BIB-ECEE000145]

One of the main trends in the recent Finnish policy in cooperation with the Russian Federation and other countries of the earlier Soviet Union is focusing on the neighboring areas of North-West Russia and Estonia. This is true especially in co-operation regarding energy and environmental policy. Finland has long traditions and wide contacts in economical co-operations with the former Soviet Union and subsequently Finnish firms have been able to continue activities in this region even in continually changing circumstances. Independent Estonia has very close relations with Finland, with roots coming from cultural similarities such as the same origin of language. Earlier experience offers the basis on which new forms of co-operation can be made. In the energy and environmental sectors Finnish businesses have themselves developed projects with Russian or Estonian partners. The Government has decided on financial aid to these prepared plans. This has guaranteed, that cooperation projects have sound economical profits. Governmental support has limited in energy projects principally to feasibility study of technological solutions. Investments rely on other sources like the "European Bank for Reconstruction and Development" and the "Nordic Investment Bank". Co-operation is carried out under changing and unsure circumstances. It is necessary to improve the continuity in developing agreements at many levels e.g. between governments, between clients and consultants and between consultants and local firms. Also evaluation and monitoring of projects demands special arrangements. Energy sectors in Finland are gathering experience of project administration for example in the following activities: Energy Plan of Karelia (1992-1993), Energy Conservation Study for Nine Industrial and Energy Utility Plants in the Russian Federation (1992-1993), Conservation Studies in Estonian Industrial and Residential Buildings, Studies to Further Peat Utilisation in Estonia. (Kosonen, Mirja; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (17 February 1993), ENERGY/SEM.12/R.37, pp. (Summary) [in English].)

0499 ENERGY EFFICIENCY IN FORMER SOVIET REPUBLICS - OPPORTUNITIES FOR THE EAST AND WEST [BIB-ECEE000146]

In this paper we review what energy former Soviet Republics need to implement energy efficiency improvements in both the short and long term. We examine the different ways in which public and private authorities might accelerate these

improvements. We envisage an enormous role for Western Europe to aid these countries, although institutional barriers are formidable. We caution against a narrow, 'enercentric' approach that focuses on the energy sector, arguing that economic reform and structural changes within energy end-use sectors should be the vehicles for improving efficiency. We find it useful to separate five kinds of needs as targets for Western intervention: (1) equipment and technologies,(2) management and planning tools, (3) education and training, (4) institutional needs, and (5) data and informational needs. Opportunities exist to help with all of these needs, although the form of such help will be different in each case. We review equipment and technology needs for each sector. In the residential sector improvements are especially needed in windows, electrical appliances, lights, district heating systems, measuring instruments and control of heat. In services, the needs are for energy management systems, ventilation systems, lighting and incorporating new technologies into new buildings. In industry, process improvements, waste heat recovery, and better gas combustion controls are priority needs, for those industries which have a clear chance of survival . Institutional needs and barriers related to energy efficiency are many. There is a lack of experience, products, financing, decision making mechanisms, decision criteria, and both economic and noneconomic incentives. Infrastructure ownership is not clear and changing. Legislation and policies are difficult to implement. (Martinot, Eric; Schipper, Lee; Symposium on Energy Efficiency and Economic Transition in Central and Eastern Europe, Paris, 19930525-28, Publisher: UN/ECE, (29 March 1993), ENERGY/SEM.12/R.38, pp. (Summary) [in English].)

0500 SYMPOSIUM ON ENERQY EFFICIENCY MANAGEMENT AND ITS WIDESPREAD DISSEMINATION IN CENTRAL AND EASTERN EUROPE. [BIB-ECEE000033]

The symposium was the last of a series of four following a decision on behalf of ECE member states to implement Energy Efficiency Project 2000, which seeks to improve energy efficiencies and energy conservation throughout Europe. The business of the symposium was conducted in five working sessions, and dealt with the need to raise the energy efficiency levels which are low in Central and Eastern European countries with economies in transition to a market economy, and particularly so in the Ukraine. The discussion,conclusions and recommendations of each session are summarized, In general it was agreed that the price of energy should reflect the cost of production and the world market price. National and international efficiency standards should be introduced, and efficiencies monitored and analysed. This would require the introduction of measuring instruments of supplies. Energy management agencies, responsible to government should be set up to mange the transition to an efficient use of energy for all purposes, and should be supported financially and by legislation, and by taxation when necessary. (UN/ECE EE2000 Secretariat; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (29 April 1994), ENERGY/SEM.13/2, pp. 15 [in English].)

0501 INTERNATIONAL AND NATIONAL LEGISLATION, STANDARDS AND LABELLING ON ENERGY EFFICIENCY [BIB-ECEE000034]

In Central and Eastern European countries low energy efficiency and energy conservation have become prime issues in the course of economic restructuring and the need to import energy at world market prices. The manner of energy management is a matter for national decision and in these countries legislation is being proposed to promote and ensure energy conservation and the efficient use of fuel and energy through economic and directive measures. In order to monitor the effectiveness of these measures, standards (Labelling) of efficiency must be established. In the Ukraine where the problem is acute a state policy of energy conservation is being incorporated in an Energy Conservation Act. (Gagurin, Evgeni V.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (22 March 1994), ENERGY/SEM.13/R.101, pp. 4 [in Russian, English].)

0502 ECONOMIC MECHANISM AND FINANCIAL MEANS FOR ENERGY DEMAND MANAGEMENT [BIB-ECEE000035]

Heavily increasing energy costs have caused major difficulties for the Eastern and Central European countries where the economies are in a state of transition. Measures for energy conservation and improve efficiency in its use are hampered by a lack of measuring instruments and low consumer prices which isolate the consumer from the need for change. There is a need for a transfer of expertise from western members of the EEC, where resource planning and demand side management (energy demand) have been found effective in improving the energy efficiency levels. (Kamstrup, Jens; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (15 March 1994), ENERGY/SEM.13/R.102, pp. 9 [in English].)

0503 INFORMATION SUPPORT OF ENERGY EFFICIENCY MANAGEMENT, EXPERTISE AND AUDITS [BIB-ECEE000036]

The extensive approach to energy consumption in Eastern and Central European countries has not been associated with its efficient use. The introduction of international norms and standards is called for to render effective the monitoring of consumption (energy audits) and subsequent recommendations for the efficient use of energy in domestic and industrial applications. An increased use of computers is proposed for data accumulation and analysis, and for automatic monitoring of energy supply and efficiency in use. (Prakhovnik, Artur V.; Symposium on Energy Efficiency Management and its Widespread Dissemination in Central and Eastern Europe, Kiev, 940418-22, Publisher: UN/ECE, (17 March 1994), ENERGY/SEM.13/R.104, pp. 4 [in Russian].)

0504 THE PETROLEUM INDUSTRY AND CHEMICALS (ERDOELINDUSTRIE UND CHEMIE) [BIB-UBAA000003]

In this part the industrial location of the Schwechat Refinery is described with particular emphasis on air pollution. and its effects on the neighbourhood, the waste water, ground water and soil. The problem of waste management is considered. Similarly, the impact of the storage tank facilities at Lobau Vienna on the neighbourhood is discussed. In this case the effects on vegetation and animals are emphasized. Data is given on the measurements obtained from H_2S and CS_2 emitted by the fashion material works at St. Poelten. Similarly, the effluents from the Chemical works at Bruckl and the paint production works at Vienna are described and their impact discussed. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 261-282 [in German]. 3-85457-139-9)

0505 THE CELLULOSE AND PAPER INDUSTRIES (ZELLSTOFF UND PAPIERINDUSTRIE) [BIB-UBAA000004]

The development of the load on the waterways by the cellulose and paper industries is described with particular reference to the effluent from seven plants. The various emissions by the cellulose industry for all Austria is tabulated for the years 1987 to 1993 and, in all cases, there is a steady decrease. Data are presented for the BSB, CSB, AOX and solids and also for H_2S, CS_2 and SO_2. Pollution in the Ager in particular is discussed as well as the ground water problem. Air pollution is also outlined and new developments are listed briefly. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 283-296 [in German]. 3-85457-139-9)

0506 THE BUILDING MATERIAL INDUSTRY AND QUARRIES (BAUSTOFFINDUSTRIE UND STEINBRUECHE) [BIB-UBAA000005]

Details are given on the increase in the dust load in Bad Deutsch Altenburg followed by an account of the determination of the air load by synthetic mineral fibres in Ferndorf. Data are tabulated for fibres of 2.5 to 5.0 10^{-6}m and 5 to 100 10^{-6}m in numbers per litre; values up to some 10 fibres per litre are listed. Results from 14 probes are given. These results are briefly discussed and health implications examined. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 297-300 [in German]. 3-85457-139-9)

0507 STORAGE PLACES AND DUMPS (LAGERPLAETZE UND DEPONIEN) [BIB-UBAA000006]

Dust measurements in Strasshof are described. Much of this dust is from the plant of Colpack-Kolkoks-Wihoko which handles bulk transportation of coke und coal. They generate a high load of fly ash and dust in the area. Similarly, measurements of the dust load in the neighbourhood of the rubbish dump at Rautenweg Vienna are described and discussed. Some values of methane production reaching 60 ppm are quoted and values of some 14 ppm for H_2S. The municipal dump at Frohnleiten has been investigated and shown to produce dangerous quantities of various chemicals and heavy metals in the seapage water. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 301-303 [in German]. 3-85457-139-9)

0508 SPECIAL OPERATIONS (SONSTIGE BETRIEBE) [BIB-UBAA000007]

The environmental consequences of the Vienna-Schwechat airport are examined. Air pollution with NO_x,HC, CO and CO_2 is tabulated and its impact on the surroundings is discussed. After a sharp drop in noise level between 1980 and 1982 there has been no substantial change up to 1990 in spite of some 50 percent increase in traffic. Waste water management is described as well as energy demands and the impact of ground traffic and space requirements. Measurements of the emission of dust pollution, Pb and As from the heating plant of the Kufstein Gaswerks are outlined. The toluene load in the neighbourhood of the Neudoerfl printing works and the solvent emission from cabinet makers is presented. Further details are given on leatherworks and tanneries. Finally, the pollutants from the Austrian Textile (textiles) works are discussed. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 304-328 [in German]. 3-85457-139-9)

0509 AIR (LUFT) [BIB-UBAA000008]

A surface reconnaissance for NO_2 and SO_2 carried out in mountain areas in winter 1990/1991 provides some general information over a very large area. Monthly averages for NO_2 and SO_2 obtained for 1992 to 1993 show a marked peak in NO_2 during the winter months and a marked reduction in SO_2 during the summer months. Data are given on benzol, O_3 and H_2O_2. Transmission measurements are made for sulphur compounds, NO and NO_2 in the Pressburg area and for the movement of pollutants across the Pressburg/Kittsee boundary. Pollution from the Plabutsch tunnel is measured by an SF_6-tracer method. The effects of dioxin in Linz, Steyregg, Vienna and Graz are discussed. Data are given on the inorganic fibre load for air in the region of Vienna. Values of up to some 3 fibres/l are noted. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 329-349 [in German]. 3-85457-139-9)

0510 WATER (WASSER) [BIB-UBAA000009]

Pilot studies are carried out on the groundwater quality in Tullner Feld, in particular on the nitrate content. Pesticide tests are made on the groundwater in Leibnitzer Feld and a note is included on the use of enzymic-linked immunosorbent assays. Data on pH and inorganic and organic parameters are tabulated. Karst hydraulic tests are made in the Dachstein area and in the Schneealpen some 100 km SW of Vienna. Detailed graphs show the results of numerous tests along the Inn river for various pollutants as a function of the time of the year. Further studies are made on the Cr load in waters at Feldbach polluted by tanneries (leather industry). The presence of microorganisms is also studied in various areas. Precipitation tests are reported; these include tests for the presence of pesticides and tritium content. Finally, studies in the ski areas are described. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 350-389 [in German]. 3-85457-139-9)

0511 THE GROUND (BODEN) [BIB-UBAA000010]

Tests on heavy metal and organic pollutants are carried out in the Linz area and for polycyclic aromatic hydrocarbons in the Inntal area and the Brennerbahn. Maximum values are obtained at approx. 10 m from the Autobahn. Ground biological tests are made in the region of the Cu works in Brixlegg/Tirol at depth of 5-10 cm. The effects of heavy metals are compared with results obtained at a controlled area. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 390-398 [in German]. 3-85457-139-9)

0512 FOREST (WALD) [BIB-UBAA000011]

Temporary changes in the forest conditions are described in four permanent observation areas during 1984 to 1992. The "upper forests" of the Esterhazy'schen Forestry Commission Lackenbach show an unusually large amount of wildlife damage. Ecological tests on vegetation are carried out in the Brixlegg area. Details are given on the effects of pine needles on growth structures. Scanning electron microscope pictures show impressive effects. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 399-407 [in German]. 3-85457-139-9)

0513 NATURE AND LANDSCAPE (NATUR UND LANDSCHAFT) [BIB-UBAA000012]

The question of maintenance and care of the traditional "cultural landscape" in the Malinitz area is discussed and a new programme is being undertaken with a pilot project starting in April 1993. Biotope indexing in the planted national park "Thayatal" is undertaken for the meadows and dry grass area and for over 30 landscape "elements". Similarly, a landscape inventory is made for the Burgenland region. Improvement of the wet meadows in eastern Austria by increasing drainage is being undertaken. Aerial pictures are used to record the landscape elements in the Ramsar-Gebiet Donau-March-Auen areas. The spreading of fieldmice in the middle and south Burgenland is also documented. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 408-415 [in German]. 3-85457-139-9)

0514 ASSESSMENT OF LANDFILLS (ERHEBUNG VON ALT-LASTEN) [BIB-UBAA000013]

Estimates are made on the dangers of various old deposits; in particular, for Kapellerfeld, Tuttendorfer Breite, Wageneder Schottergrube, Kindspielplatz Poschacherstrasse, Renova and the Deponie Steirische Montanwerke. Further lists are given for class II and III priority treatment. A systematic recording of old deposits in the southern part of Graz town is undertaken as well as recording and first estimates for old deposits in the Mitterndorfer Senke. Possible groundwater contamination in Marchfeld is considered. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 416-425 [in German]. 3-85457-139-9)

0515 RADIO-ECOLOGY (RADIOOEKOLOGIE) [BIB-UBAA000014]

The question of the influence of radionuclides on the forest eco-system are discussed. This is with particular reference to the fall-out from the Chernobyl disaster. The most important aspect here is the Cs-137 content of the forest ground and pine needles in the Weinsberger and Kobernausser Wald. The activity varies from 373 Bq/kg TS for needles to 1885 Bq/kg TS for the humus down to 9.6 Bq/kg TS at 10-20 cm in the ground for the Kobernausser Wald. Values for the Weinsburger Wald are 512, 2234 and 38.6 Bq/kg TS respectively. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 426-428 [in German]. 3-85457-139-9)

0516 NOISE (LAERM) [BIB-UBAA000015]

Noise levels from aircraft in the region of the Salzburg-Maxglan Airport are measured by a new method in 1990 in an attempt to quantify the noise load. This method is based on DIN 45631. Variations between aircraft are discussed. The sound pressure is greatest for the BAC 1-11 at 111 dB. Values for 13 different types of aircraft are tabulated. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 429-430 [in German]. 3-85457-139-9)

0517 SETTING UP OF AN ENVIRONMENTAL LAND REGISTER (ERSTELLUNG VON UMWELTKATASTEN) [BIB-UBAA000016]

The setting up of an environmental land register is described. This includes a list of suspected areas and an atlas of old deposit, in accordance with the regulations which came into force on July 1st 1989. The various entries are classified under priorities I, II and III. Consideration is given to raising the water quality in Austria. This refers to groundwater from porous ground, karst and crevasses. The protected areas in Austria are tabulated; these include national parks, nature reserves, protected landscapes, etc. A register of transport noise noise for all the main roads is given as well as railway and aircraft noise for a number of areas. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 431-447 [in German]. 3-85457-139-9)

0518 ESTIMATION AND REDUCTION OF POLLUTED AIR EMISSIONS (ABSCHAETZUNG UND MINDERUNG VON LUFTSCHADSTOFFEMISSIONEN) [BIB-UBAA000017]

The status of desulphurization and denitration by thermal power plants in Austria is tabulated by type and capacity. Reduction in emissions since 1980 are noted and all large coalfired power plants will be fitted with desulphurization and denitration plant by 1994. Estimates are given for ammonia emission in 1990 from human activities and from natural or biogenic sources. In 1990 the breakdown for nitrogenous emissions gave 54 percent NH_3 -N and 46 percent NO_x -N. The ammonia emissions from human activities totalled some 90,000 t/yr and natural emissions were some 8,000 tons/yr. Emission estimates for dioxine are also given; this is broken down into values for domestic fires, rubbish burning, power stations, straw burning, metallurgy and tobacco. The new restrictions on emission standards for steam boiler plants are outlined. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 448-456 [in German]. 3-85457-139-9)

0519 MEASUREMENTS OF THE EFFECT OF POLLUTED AIR AND THE CLEAN AIR CONCEPT (IMMISSIENSMESSUNGEN VON LUFTSCHADSTOFFEN UND KONZEPTE ZUR LUFTREINHALTUNG) [BIB-UBAA000018]

The idea of a measurement network and data combination for the enforcement of ozone regulations is described. A two-dimensional ozone distribution of ozone in Austria has been determined for 1991. Care must be taken because of the strong dependence on height. Quantification of ozone producing substances and the effects of emission reduction are considered. The production of a daily report on air quality is detailed and typical examples are given. The charting of the critical loads for acid rain deposition in forests and possible mapping programmes are also considered. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 457-475 [in German]. 3-85457-139-9)

0520 THE DEVELOPMENT OF METHODS AND QUALITY ASSURANCE FOR ANALYSIS IN THE FRAMEWORK OF ENVIRONMENTAL CONTROL (METHODENENTWICKLUNG UND SICHERUNG DER ANALYSENQUALITAET IM RAHMEN DER UMWELTKONTROLLE) [BIB-UBAA000019]

A comparison of measurements between a number of laboratories is considered to be the best way of assuring integrity of results. The problem of herbicides in ground and drinking water is considered and details for 1991 and 1992 are tabulated. Further details on pesticides are also given. A section is included on the selection of parameters required for improving water quality. The adsorption of organically bound halogens and methods of analysis of metals in water are discussed. Other methods of analysis are described, such as, the determination of nitrophenols by polarography and five ways of measurings in pine needles. Methods of ground analysis and the use of bio-indicators for environmental control are also described. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 476-490 [in German]. 3-85457-139-9)

0521 CONTROL OF CHEMICALS (KONTROLLE VON CHEMIKALIEN) [BIB-UBAA000020]

The setting up of a register and information centre for chemicals is discussed. This would include the source, movement, quantities, value, etc of the material. A flow chart is drawn up to show the official procedures in the handling of materials. A section is included on the implementation of the official procedures and the drawing up of an Austrian old-materials list and register which would include identification, purity, physical and chemical properties, toxicity, bio-accumulation and mobility, etc. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 491-500 [in German]. 3-85457-139-9)

0522 HERBICIDES (PFLANZENSCHUTZMITTEL) [BIB-UBAA000021]

The execution of herbicidal regulations is discussed in some detail including recommendations for their usage and handling. The use of herbicides in forestry is also explained. All aspects are considered, including their use in conjunction with pesticides. Ecological effects are discussed. Toxicity to humans is outlined and a short list of the relevant chemical regulations is given. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 501-504 [in German]. 3-85457-139-9)

0523 GENE- AND BIOTECHNOLOGY (GEN- UND BIOTECHNOLOGIE) [BIB-UBAA000023]

The exploitation possibilities, potential dangers and handling requirements in Austria are discussed very briefly in view of the publication of the Vienna Environmental Office Report No 28 in 1991 on Gene and Biotechnology and the report on "Gene Technology in Discussion" Vol.5 from the same office in 1992. A brief assessment is also made on the release and monitoring of genetically altered organisms and of putting the ecological criteria into an understandable form. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 537-538 [in German]. 3-85457-139-9)

0524 NOISE (LAERM) [BIB-UBAA000024]

Experiments are carried out on the effect of interference absorbers on noise protection walls by comparing noise levels behind walls with and without the absorber at the Franz-Josefs railway. The efficiency of the absorbers depends strongly on the spread of the noise. A section is included on the checking of noise level measurement methods, particularly for railway traffic. The noise emission geometry from railway wagons is charted and a loudness or intensity level analysis is carried out. The effect of train speed is also determined. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 539-542 [in German]. 3-85457-139-9)

0525 NATURE AND LANDSCAPE (NATUR UND LANDSCHAFT) [BIB-UBAA000025]

In March 1993 there were 324 nature protection areas in Austria and 247 of these were evaluated. It was shown that 23 were very good, 78 were good, 102 were potentially endangered, 38 were bad and acutely endangered and 6 were destroyed. The extent and further development of artificial snow areas is discussed. A section on birds of prey is included and the improvement of nationally important water bird breeding areas is described. The situation of white storks in Austria is outlined and measures to improve their survival are suggested. The publication of the "Austrian Breeding Bird Atlas" in Vienna, 1993, is mentioned. Details are given on ecological stocktaking and the situation of dry grasslands. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 543-553 [in German]. 3-85457-139-9)

0526 SPECIAL NATIONWIDE INVESTIGATIONS (SONSTIGE BUNDESWEITE ERHEBUNGEN) [BIB-UBAA000026]

The subject of bio-agriculture in Austria is discussed in some detail. The economic performance of these areas and degree of environmental protection they provide is also studied. The development of bio-agriculture over the years 1970 to 1992 shows an exponential increase in registered membership of thee Austrian bio-agricultural organization. The situation and practice of bio-agriculture in Austria is evaluated on the basis of 104 areas. Research on the subject is being carried out in Austria, Germany and Switzerland and results are being published. The organisation in the three countries is compared. A last section deals with the documentation of the karst hydraulic studies in Austria. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 554-560 [in German]. 3-85457-139-9)

0527 THE ENVIRONMENTAL ACCEPTABILITY OF PRODUCTS - THE AUSTRIAN ENVIRONMENTAL SIGN (UMWELTVERTRAEGLICHKEIT VON PRODUKTEN - DAS OESTERREICHISCHE UMWELTZEICHEN) [BIB-UBAA000027]

The basic requirements for environmental acceptability are outlined. This means the transition from a "Throughflowing" economy to a "Circulating" one; not to use environmentally damaging materials in products; to consider the life cycle of products; repair friendliness, recyclability; clean technology, etc. Guidelines for acceptability are laid down and flow charts are presented. A list of the product groups which have been accepted is given; these range from toilet paper to solar collectors. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 561-564 [in German]. 3-85457-139-9)

0528 COLLABORATION WITH THE EUROPEAN COMMUNITY PROGRAMMES (MITARBEIT AN EG-PROGRAMMEN) [BIB-UBAA000028]

The programme CORINE (Coordinated Information on the Environment) is an experimental plan for the compilation, coordination and weighting of information on the status of the environment and the natural resources in the European Community by the use of an integrated Geographical Information System. Part of this is the CORINAIR 90 programme which deals with air pollution. The various pollutants SO_2,NO_x,CO, CO_2,NH_3,CH_4,N_2O etc are tabulated and grouped under their sources. Regional pie charts are also given. Details are given on the CORINE Landcover project and on an Austrian European Environmental report. Information is also provided on the COST-65 project which is for the protection of ground water. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 565-578 [in German]. 3-85457-139-9)

0529 WORKING GROUPS AND THE PROGRAMME OF THE UN-EEC IN THE FRAMEWORK OF A CONVENTION ON CROSS-BOUNDARY AIR POLLUTION (ARBEITSGRUPPEN UND PROGRAMME DER UN-ECE IM RAHMEN DER KONVENTION UEBER WEITRAEUMIGE GRENZUBERSCHREITENE LUFTVERUNREINIGUNG) [BIB-UBAA000029]

Details of the working group on strategies are outlined. This includes integrated assessment modelling. Information is given on the working group on effects and an integrated monitoring programme. The mapping of critical levels and loads is briefly discussed and information is presented on the technology programme. A table provides information on the annual production of sulphur, fly ash, ash, gypsum, sulphuric acid, clinker, etc. Other task forces on heavy metals and persistent organic pollutants are included in the programme. The last section describes the monitoring and evaluation of the long-range transmission of air pollutants in Europe. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 579-593 [in German]. 3-85457-139-9)

0530 UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP) (UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP)) [BIB-UBAA000030]

Information is presented on the information network UNEP/INFOTERRA of the United Nations. This is a worldwide decentralized network for the exchange of environmental information. The numbers of information sources in the various member countries are shown on a bar chart with the United Kingdom topping the list at 1054 and Austria 8th at 141 in a total of 155 partaking states. There are 29 problem areas in various countries listed for 1992. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 594-596 [in German]. 3-85457-139-9)

0531 INTERNATIONAL NATURE PROTECTION (INTERNATIONALER NATURSCHUTZ) [BIB-UBAA000031]

Information is given on the IUCN, the International Union for Conservation of Nature and Natural Resources. This is an independent international nature conservation organization. Similarly, the IWRB is an International Waterfowl and Wetland Research Bureau. The setting up of a digital chart of the Austrian-Slovakia-Hungarian boundary regions is outlined. This will show planned protected areas, such as, national parks, natural and landscape protection areas, etc. A pilot project on cross-boundary alpine biotope mapping between Austria and Germany is also being undertaken. The area considered will include alpine, forest, dry and infertile land and wetlands. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 597-599 [in German]. 3-85457-139-9)

0532 COOPERATION IN CENTRAL EUROPE (KOOPERATION IN ZENTRALEUROPA) [BIB-UBAA000032]

The Central European Initiative is to provide a task force on data exchange and standardization. This was initiated in November 1990 and three meetings have already taken place. A section is devoted to international exchange of air pollution measurements on smog events. This exchange between Austria and Germany includes O_3 and NO_2 data in the summer as well as meteorological data and SO_2, dust and NO_2 data in the winter. Other neighbouring countries are also interested. Some comments are made on measuring methods for data comparison. The setting up of an Austrian research project in conjunction with the German data bank on environmental research (UFORDAT) is mentioned. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 600-602 [in German]. 3-85457-139-9)

0533 SPECIAL INTERNATIONAL WORKING GROUPS AND PROGRAMMES (SONSTIGE INTERNATIONALEN ARBEITSGRUPPEN UND PROGRAMME) [BIB-UBAA000033]

A brief description is given on the intergovernmental panel on climate change (IPCC). This is mainly concerned with the so-called "Greenhouse Effect". The functions of the group are divided into three sections. The provision of environmental data for a World Health Organization (WHO) report is described. This would include maps showing healthy and environmentally protected areas in Europe. A third section covers the work of a group of national experts in safety in biotechnology (GNE) for the OECD. This is to provide guidance in the handling of genetically modified plants and microorganisms and also on the monitoring of such work. The question of collaboration on European standardization in biotechnology is outlined. Finally, new negotiations are described on the international tropical wood agreement. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Umweltkontrolle und Bestandsaufnahmen*, Vol. B, pp. 603-606 [in German]. 3-85457-139-9)

0534 STATE OF THE ENVIRONMENT IN AUSTRIA (UMWELTSITUATION IN OSTERREICH) [BIB-UBAA000034]

The publication takes an overview of important environmental issues as they affect Austria. It reviews Austrian attitudes on protection of the global climate and the stratospheric ozone layer, working towards reduction of damaging acidic gases which are presently transported over Europe, and the impact of introduction of genetically modified organisms into the environment. Austria's participation in international nature conservancy is highlighted with reference to the conventions of Ramsar, Washington, Berne, and the Alpine convention, as well as the European Nature Reserve Network. Separate sections of the book review the legal situation and aspirations in 12 different aspects in some detail. All of these now have an individual abstract each. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Vol. A, 174 pages (German), 168 pages (English) [in German, English]. 3-85457-138-0)

0535 AIR QUALITY (LUFT) [BIB-UBAA000035]

The harmful materials emitted into the atmosphere in Austria fall largely into the following categories; sulphur dioxide (SO_2), dust, nitrogen oxides (NO_x) carbon monoxide (CO), and volatile organic compounds (VOC) which are mostly benzene, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, dioxines, furanes etc. Emission control measures taken in earlier years has led to considerable reductions in harmful materials in the period 1980-1991 in all but VOCs for example $SO_2$397 [84]; dust 79 [38]; NO_x246 [216]; CO 1636 [1503]; and VOC 374 [419], where the units are 1000t, the first figure is the emission rate in 1980 and that in square brackets the 1991 figure. The sources of these emissions (e.g. power stations, traffic, industry etc) are itemized, quantified, and combatting methods suggested. Also quantified are the local emission values in all the various Austrian provinces, as well as estimated "import" and "export" levels of pollution from and to Austria's neighbours. Ozone emission is discussed with reference to the geographic sites in Austria where the measurements are made and the local concentrations of O_3 pollution. In 1990 the generation of ammonia in Austria reached 90,000 tonnes, largely as a result of animal farming, suggestions of methods of bringing this figure down are made. Emission of greenhouse gases such as CO_2,CH_4,N_2O, chlorofluorocarbons, steam etc is mentioned with regard to global agreements. Vast increases in CO_2 production have been noted in the second half of this century, a doubling occurred between 1950 and 1980, this has been followed by some reduction accruing in the period 1980-90 as a result of measures taken in Austria. Since that time a small increase has been experienced. The critical load of acid rain precipitation in the soil of forests continues to give concern. Figures are presented for the various Austrian regions. Unfortunately, most of the acid gases causing this pollution comes from Austria's European neighbours. (Hojesky, Helmut; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 1-41 [in German, English]. 3-85457-138-0)

0536 WATER RESOURCES AND WATER QUALITY CONTROL (WASSERWIRTSCHAFT UND GEWAESSERSCHUTZ) [BIB-UBAA000036]

The management of water resources in Austria and the protection of standing and flowing water therein are carefully reviewed. The authorities responsible for the condition of ground water and supply of drinking water are shown and stepwise reduction of nitrate and atrazine in water supplies are requirements of Austrian law in accordance with the following timetable; NO_3 (mg/l) 1993 - 100, by 1.7.94 - 50, and by 1.7.99 - 30: atrazine (microgrammes/l) up to 31.12.92 - 2, by 1.1.93 - 0.5, and by 1.7.95 - 0.1. Hydrography legislation is discussed, as are the methods and frequency of testing and data recording leading up to classification of water and keeping an Austrian water/land register. The principal sources of Austrian ground water are demonstrated on a map along with the flow rates and types of rock from which it springs. A research programme for 1991/2 has detected the levels of principal pollutants (nitrates, pesticides, and halogenated hydrocarbons) in the various regions of Austria and the figures are presented, also the phosphate levels in the Austrian lakes in 1986 are published. Moreover, the lakes' bacterial concentrations in 1992 are shown and a classification made (1-4, 1 good bathing quality, 4 unsuitable for bathing). All the lakes achieved figures of 1 or 2. A full map is presented of all Austrian rivers including flow rates and types (local levels of pollution, susceptibility to flood, extent of damming etc). The problem of increasing waste water generation from buildings in mountainous alpine regions is highlighted. This is due to the impact of the large numbers of visitors and tourists. (Chovanec, Andreas; Grath, Johannes; Herlicska, Helmut; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 42-81 (German), 42-69 (English) [in German, English]. 3-85457-138-0)

0537 SOIL (BODEN) [BIB-UBAA000037]

A review is presented of the condition of the soil in Austria, prevailing mechanisms of endangerment of the land, and means of overcoming these. In the year 1990, exploitation of the land was estimated as follows; gardens and fields 20 percent, forests 43 percent, meadows 26 percent, and others 11 percent. Changes in the pattern of land usage in the period 1937-89 are illustrated as bar charts, as are the changes in this period in all the various Austrian regions. The principal dangers to the land are categorized as follows; 1) chemical - from agriculture, industry, household fuel burning etc, 2) physical - erosion by wind and rain, compaction by heavy machinery, and 3) loss due to intensive building, houses etc. The use of herbicides, pesticides and fungicides is outlined. The extent of use of natural agricultural fertilizer on the land is shown on a map and discussed with reference to the legal aspects, indication being made of the possible loading of ground water with nitrates along with the instances (and severity) of pollution incidents. Developments in Austrian agriculture over the period 1945-93 are outlined, showing a strong movement away from draft animals to mechanization. Further dangers to the land include; acid deposition (from acid gas emissions, both domestic and foreign), use of fertilizer slurry (with its small heavy metals content including Zn, Cu, Cr, Pb, Ni, Co, As, Mo, Cd, and Hg), harmful volatile organic compounds (VOCs), polychlorodioxins and furanes from refuse combustion and radioactive fall out largely from Chernobyl. Details are given of measurements of these (as well as the sites) in tabular form. A fully detailed land inventory is presented including all the various regions, outlining usage, pollution, and extent of building along with changes of these over a period of time. Finally, land erosion in Austria is quantified. Some 600-700,000 hectares are at risk, and soil erosion in these areas can reach 80 tonnes/ha/year. (Kasperowski, Elfriede; Schwarz, Sigrid; Zethner, Gerhard; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 82-100 (German), 70-87 (English) [in German, English]. 3-85457-138-0)

0538 FORESTS (WALD) [BIB-UBAA000038]

Woodland is a significant feature of the Austrian landscape, presently covering some 46 percent of the land surface, it makes Austria the most densely wooded country in central Europe. A fully detailed forest inventory is published and shown on maps. The production of wood in the period 1955-1990 is plotted in terms of useful wood and wood as a fuel. The forests are a considerable national asset and act as a protection against the elements (floods, rock slides and avalanches etc), a map indicates areas in which such forestall protections are afforded. Damage to the forests come about from many different sources. Acid rain effects are shown from the results of a sulphur test made in the framework of a forest bioindicator network. Maps show the damaged areas in a total classification index 1 to 4, also areas of Cd contamination are shown, again with a classification. "Crown disease" is exhibited by all species of tree - the loss of needles and foliage being a symptom, regions prone to this effect are also shown on a land map. In addition, forests are subject to damage by game grazing and

browsing the bark, figures quantifying this and estimates of numbers of the species of game are published on a regional basis. Other damage to trees results from storm damage, fires, avalanches, snow and rock falls, also various pests notably the bark beetle. A breakdown of figures for such damage in the various regions is tabulated. (Hackl, J.; Lebenits, Rudolf; Weiss, Peter; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 101-117 (German), 88-102 (English) [in German, English]. 3-85457-138-0)

0539 NATURE AND LANDSCAPE (NATUR UND LANDSCHAFT) [BIB-UBAA000039]

The Austrian contributions to the conservation of nature and the landscape are outlined. Two national parks were created in the years 1991 (Tirol) and 1992 (Neusiedlersee-Seewinkel) making a total of three, and there are four at the planning stage. The national attitude to nature conservation and the legal position are explained and the development of protected areas in the period 1980-93 is shown for the separate regions as bar charts. Categories of protected land are tabulated along with the numbers of these zones and the areas that they occupy. The expenditure on nature protection for 1992 totalled 118.9M Austrian schillings, the figures are broken down for the regions, Tirol being the largest spender at 30.2M schillings. Austria participates fully in international nature conservancy and its position on all the international conventions is explained. Endangered wildlife species (mammals, fish, and birds) as well as plant types in Austria which appear on the "red list" are expressed in pie-charts which indicate the number of species graded according to the local degree of danger ranging from "not endangered" to "extinct". Causes of the threats to these species are discussed and the countermeasures being taken in their defence outlined. The national interest in nature protection as well as the future policy are explained. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 118-130 (German), 103-114 (English) [in German, English]. 3-85457-138-0)

0540 CHEMICALS (SCHUTZ VOR GEFAEHRLICHEN CHEMIKALIEN) [BIB-UBAA000040]

Legal controls have been in force since February 1989 for the protection of people and the environment against the damaging effects of dangerous chemicals. Austria's present legislative position is outlined on the registration, marking, and reporting obligations on all such dangerous materials. The legal definition of a substance as "Environmentally dangerous" is explained as is its capacity for harming the ozone layer. Existing prohibitions and limitations on dangerous substances are enumerated thus, organic solvents chlorinated hydrocarbons and benzene and their planned phasing out; plant protecting materials (see next abstract), F 22 propellant gases, 1,1,3-trichloroethane, carbon tetrachloride, halogenated biphenyls, triphenyls, naphthalenes, and diphenylmethanes. In addition to the above, prohibition or limitation of the following substances is at the planning or outline stage of legislation; Lead/Cadmium, partially halogenated chloro fluorohydrocarbons (CFCs), 2.solvent regulation, and washing medium legislation to be integrated with that for chemicals. (Witzani, Helmut; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 131-136 (German), 115-120 (English) [in German, English]. 3-85457-138-0)

0541 PESTICIDES (PFLANZENSCHUTZMITTEL) [BIB-UBAA000041]

In 1991 some 4500 tonnes of pesticidal agents were used in Austria compared with 4300 tonnes in 1990. Largely consumed by agriculture, this figure is split up as follows; 50 percent herbicides, 40 percent fungicides, less than 5 percent insecticides, and the rest being rodenticides, soil disinfectants, growth regulators etc. This represents a burden to the environment of 27,500 tonnes of plant protection media (PPM) when formulation of these active agents is considered. Presently the Official State Register of PPMs lists about 600 PPMs consisting of 280 active agents. The legal basis for the control of such materials came into force 1.8.91 and is the Plant Protection Media Law (PMG), BGBl. Nr.476/1990. The essential terms of this legislation, which is based on the equal principle of protecting the environment and the populace are fully outlined and include; an obligation to register all types of PPM including chemical, biological and all additives; the protected objects can be agricultural land, gardens, forests, plants, fungus cultures etc.; authorization for a PPM is for 10 years maximum and this can be rescinded after even a limited time if the interests of the environment are thought to be compromised; standardization of classifications, markings, and information leaflets; and the establishment of rigorous controls/tight restrictions. (Sattelberger, Robert; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 137-138 (German), 121-122 (English) [in German, English]. 3-85457-138-0)

0542 WASTE (ABFALL) [BIB-UBAA000042]

The waste management law (AWG) came into force in Austria on 1.7.90, and contained the following principles; ceasing (or minimizing to the greatest degree) the creation and spreading of wastes which are harmful to the environment or populace, refining and improving crude materials and energy reserves, and dumping the minimum possible volume of rubbish. In 1992, the total waste material generated was 44M tonnes/year made up as follows; 59 percent of a mineral nature (mostly building residues), 15 percent from water treatment (largely sludge), 10 percent household refuse, 15 percent other non-hazardous waste, and 1.4 percent of dangerous waste. Statistics are quoted and expressed as histograms breaking down the waste into type (paper, glass etc); and the rate of growth of problem wastes in the period 1985-90. Maps indicate sites for dumping/burying waste, as well as for reprocessing scrap material and treatment plants. A breakdown pie-chart for the composition of dangerous wastes (ashes, slag, spent oil, old batteries, acids, laboratory residues etc) and installations for the thermal, chemical, physical, and other methods of treating them are indicated on maps. In 1990 Environment Ministry figures show that Austria imported 50,000 tonnes of dangerous waste and exported some 70,000 tonnes. The legal aspects of waste philosophy and future aspirations are discussed and include; prohibition of asbestos and CFCs, a target of 80 percent reuse of packaging materials to be achieved by the year 200, establishment of a recycling quota for containers of drinks (e.g. beer, juices, mineral waters etc), and separate collection of biological wastes etc. (Domenig, Manfred; Dreier, Patrizia; Krammer, Hans-Jörg; Lassnig, Doris; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 139-151 (German), 123-135 (English) [in German, English]. 3-85457-138-0)

0543 NOISE (LAERM) [BIB-UBAA000043]

The extent of environmental noise pollution in Austria is discussed. Annoyance by noise is not by a physical or chemical pollutant such as ozone or CO but by an energy form and causes not only physical symptoms but emotional problems like personality changes. The Statistical Office carries out periodic surveys on noise problems both domestic and industrial on personnel. In 1991, some 6.9 percent of people suffered severe noise nuisance; 12 percent considerable noise, 16.5 percent negligible, and the rest nothing. Histograms are produced which illustrates these trends over the period 1970-1991. In this time, the noise problem has been reduced by about a third. Bar charts give a breakdown of the major noise sources (traffic, neighbours, industry, etc) and show traffic to be easily the worst offender. The amounts of noise generated by the various forms of traffic (street, railway, aircraft etc) are quantified, and figures split this noise into daytime and nighttime. Efforts to control noise in Austria are explained, and the noise emission legislation for road vehicles, trains, aircraft, industry, and machinery is presented and discussed. (Kalivoda, Manfred; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 152-159 (German), 136-143 (English) [in German, English]. 3-85457-138-0)

0544 ENERGY (ENERGIE) [BIB-UBAA000044]

The state of energy production and consumption in Austria is fully discussed. A table of data is presented which breaks down the human requirements for energy both in the home and small businesses. A flow diagram indicates the energy balance in 1991 including export, import, and loss of energy. Figures show that over the period 1970-1990 the energy needs of Austria has increased (but not uniformly) from 782.8 to 1141.5 x 10^{15} Joules. Factors which have brought this about have been; a sharp increase in costs in the early 1980s followed by economic stagnation, and since 1983 a slow rise in energy demand. A graph indicates the proportions of energy created in this time span from all the different sources; coal, oil, gas, hydroelectricity, and other energy sources. The trend has been away from coal (28 percent in 1970, 16 percent in 1991) and towards gas (13 percent and 21 percent respectively) and other energy carriers (3.6 percent

to 9.1 percent). A pie-chart shows the proportions of the different types of "other" energy sources ranging from wood burning (66 percent) to solar energy (0.3 percent) and geothermal energy (0.1 percent). (Kienzl, Karl; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 160-167 (German), 144-151 (English) [in German, English]. 3-85457-138-0)

0545 RADIOACTIVITY CONTROL IN AUSTRIA (RADIOAKTIVITAETSKONTROLLE IN OESTERREICH) [BIB-UBAA000045]

Monitoring of radioactive contamination in Austria is carried out by a network of establishments consisting of universities, research institutes etc which is illustrated by a map. In this way, the environment is being permanently checked in the event of; an accident at a nuclear installation, detonation of an atomic device, crash of an aircraft carrying a nuclear cargo, as well as other possibilities such as sabotage or a transport accident. Since 1975, Austria has maintained a radiation early warning system of 336 stations which give a coded warning graded from 1-8 for radiation level (1 up to 300 micro Sv/hour ; 8 greater than 300 m Sv/hour). Laboratory supported monitoring is discussed with reference to radiation of aerosols, precipitation, surface water, sludge installations, and control of radionuclides in foodstuffs. The radiation contamination in Austria for the period 1963-1991 as regards Cs^{134} and Cs^{137} is illustrated by a histogram chart. There is a clear trend of falling Cs^{137} (the only nuclide present) from 1963 (7 kBq/year) to 1967 when the suspension of nuclear testing was announced. Then a period followed of slight rise until 1971 after which radioactivity fell to a negligible level until 1985 when a massive rise to 16 kBq/year of $Cs^{137} + Cs^{134}$ (ratio about 3:1) was observed in the wake of Chernobyl, then 18 kBq/year in 1986. After this the figures greatly reduced again until the level in 1991 was about the same as in 1970 (some 0.7 kBq/year). (Gaugitsch, Helmut; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 168-172 (German), 152-156 (English) [in German, English]. 3-85457-138-0)

0546 GENE TECHNOLOGY AND BIOTECHNOLOGY (GEN- UND BIOTECHNOLOGY) [BIB-UBAA000046]

With the growth of gene technology comes the accompanying environmental risks of both intentional exposure (useful plants in agriculture) and unintentional release of genetically modified organisms (GMO) due to an accident. Worldwide, some 1000 cases of intentional release of GMO are recorded, predominantly in the USA (mostly useful plants and about 600) and in China for the largest area. Since the first of these was in 1986, there is no absolute guarantee of no long term harmful effects. So far as is known, there are no cases of release of GMO in Austria, although genetically modified plants are the subject of laboratory experiments in closed systems both at universities and in industry, and there is one instance of a plant making pharmaceutical collaborating in these experiments. At the present time there is no official routine monitoring of GMO emission, and the State Environmental Office is engaged in discussions with sites involved with GMO. These are being examined case by case, and they are working towards a system in which a risk assessment is carried out prior to the experiments being carried out. In this, experiments will have to be small scale and in closed systems (climatic chambers etc) and done according to state of the art technology and fully proved to be safe before any release is sanctioned. Moreover, even after proving, the experiment will need to have an on-going risk management programme. Fear of the bad consequences of GMO release must not blind the populace to their undoubted benefits such as vast improvements in agricultural economics and saving polluting the land with chemical pesticides etc. All these questions are examined in a publication presently being worked on by the State Environmental Office, entitled "Environmental biotechnology in Austria". (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *State of the Environment in Austria*, Vol. A, pp. 173-174 (German), 157-158 (English) [in German, English]. 3-85457-138-0)

0547 BLAST FURNACE PLANT (WORKS UNIT 1) (SCHACHTOFENANLAGE) [BIB-UBAA000048]

The essential characteristics of the Brixlegg blast furnace, erected in 1966-1967, are:- cross-section 1000-2000 mm (at blowing level), height some 8000 mm, blast throughput 6000 m^3/h, burden (without coke) 146 t/day, yield some 49 t/day black copper, 5-8.5 t/day filter dust and some 45 t/day slag. The individual constituent parts of the plant - blast furnace, charging equipment, blast enrichment equipment, waste heat recovery plant, slag preparation plant and dust collection plant - are described. The burden consists of capital copper metal scrap, slags, oxidic ash and scrapings and in-plant waste residues, together with coke, lime and quartz. The main product is black copper of some 76 percent purity, whilst the slag contains, on average, 27.72 percent SiO_2,37.99 percent FeO, 7.23 percent ZnO, 6.55 percent Al_2O_2 and 5.86 percent MgO, with copper, nickel and tin as the principal accompanying elements, the contents of silicogenous, toxic and carcinogenous constituents are below German safety thresholds. Brief details are given of refractory linings. The flue dust contains, on average, 30 percent zinc, 14 percent lead and 5 percent copper, and the filter dust 60 percent zinc, 8 percent lead, 2 percent chlorine and 6 percent copper and the methods of their treatment are reported. (Müllebner, M.; Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 36-53. [in German]. 3-85457-060-0)

0548 CONVERTER PLANT (WORKS UNIT 2) (KONVERTERANLAGE) [BIB-UBAA000049]

The Brixlegg converter plant consists of two 7-t and one 25-t Peirce-Smith, side-blown, horizontal, drum-type converters, of which only the 25-t unit is in regular use, with one 7-t unit as standby. Comprehensive data on these converters, together with the ancillary settling chambers and waste gas filtration and de-sulphurisation plants, are presented. The 25-t unit has a chrome-magnesite lining and is powered by a 16-kW compressed-air engine. The burden consists of molten black copper with a sulphur content of 0.6-1.2 percent, various copper metal scraps and solid alloy wastes, together with coke and quartz, whilst the yield is comprised of crude copper of 96 percent purity, slags and filter dusts. The commercial-grade flue dusts resulting from bag filtration contain principally lead and zinc, accompanied by copper, whilst the filtrate obtained from waste-gas de-sulphurisation at the blowing stage contains some 17 percent $MgSO_4$, 0.5 percent $MgSO_3$ and 0.05 percent chlorine, with the remainder as heavy metals. (Müllebner, M.; Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 54-65. [in German]. 3-85457-060-0)

0549 REVERBERATORY-FURNACE PLANT (WORKS UNIT 3) (FLAMMOFENANLAGE) [BIB-UBAA000050]

Pyrometallurgical copper refining is carried out at the Brixlegg works with the production of anode copper in a 145-t hearth-type reverberatory furnace, with a 125-t furnace as standby. The main furnace has a special chrome-magnesite lining and a steel-sheet bath, concrete foundations and strong intermediate girders to aid floor cooling. The molten copper is fed directly from the furnace to an anode casting plant with a casting carousel of 14 anode moulds, anode lifting equipment and a cooling trough. The waste gases are extracted from both the converter and the casting plant, treated with calcium hydroxide and bag filtered. A typical reverberatory-furnace charge consists of 6 wt percent solid crude copper, 18.5 wt percent molten copper, 17 wt percent blister copper, 38 wt percent copper waste and scrap, 20 percent anode waste from electrolysis and 0.5 wt percent aluminium bronze. The resultant anode copper is of 98.8 percent purity, with nickel, lead and oxygen as the principal accompanying elements. The reverberatory-furnace flue dust contains mainly copper (29.2 percent) lead (14.8 percent), zinc (8.9 percent) and chlorine (5.5 percent), with only very slight traces of dioxines and polycyclic aromatics. (Müllebner, M.; Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 66-79. [in German]. 3-85457-060-0)

0550 SAMPLING PLANT (WORKS UNIT 4) (BEMUSTERUNGSANLAGE) [BIB-UBAA000051]

Melting and casting emission tests carried out at the Brixlegg sampling plant between 1982 and 1985 are described. The plant consists of three oil-fired crucible furnaces linked to casting plants. In the early tests cloth filters were used for dust collection, but in 1985 bag filters were introduced and also white lime was injected into the waste gas stream before the filters. On one furnace the moisture content of the charge material was determined after drying at less than 200 °C .In 1992 analyses of the flue dusts from two different charges showed no variation in composition viz. 20.4 percent zinc, 12.6 percent copper and 4.9 percent lead. A second series of tests on three charges in 1984 revealed a marked

influence of the nature of the charge on the flue dust composition; determinations of only nickel and cadmium showed 0.03-0.26 percent and 0.04-0.58 percent respectively. Since the introduction of bag filters and white lime in 1985 the filter dusts consist mainly of calcium sulphate, calcium oxide, copper, lead and zinc, with small amounts of various toxic heavy metals. (Müllebner, M.; Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 80-87. [in German]. 3-85457-060-0)

0551 ELECTROLYSIS PLANT (WORKS UNIT 5) (ELEKTROLYSEANLAGE) [BIB-UBAA000052]

Data on both the old (1953) and the new (1988) Brixlegg electrolytic refining plants for converting anode copper, containing 0.5-1.5 percent impurities, into highly pure cathode copper are reported, and the process itself is described. The anode copper, containing some 0.3 wt percent nickel, some 0.3 wt percent lead and small amounts of tin, arsenic, antimony, selenium, tellurium, gold, silver, platinum and palladium, is cast into anodes of 944 x 940 mm, weighing 230-340 kg. The electrolyte consists of 170 g/l sulphuric acid, 50 g/l copper, 20 g/l nickel and 4.5 g/l arsenic, accompanied by small amounts of sodium, antimony and chlorine. Organic inhibitors such as thiourea, bone glue or aviation and hydrochloric acid are added to ensure dense and smooth cathode deposits. A method of de-copperising the spent electrolyte is described briefly. (Müllebner, M.; Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 88-95 [in German]. 3-85457-060-0)

0552 CASTING PLANT (WORKS UNIT 6) (GIESSEREI) [BIB-UBAA000053]

The Brixlegg casting plant consists of five 300-kW, 3.5-t, core-type induction furnaces, two two-strand continuous-casting plants, a 1000- 3000-kg single-strand casting plant and a cold circular-sawing plant. The charge material consists of copper cathodes, works scrap and so-called direct-input material. The melt, heated by an alternating magnetic field, is cast at some 1000 °C . Mainly round bars 100-410 mm in diameter are cast discontinuously in short moulds and then sawn to length. Rolling slabs with dimensions of 675 x 125 mm max and square bars are also programmed. The quality programme includes, in addition to copper cathodes, pure copper, phosphor-deoxidised, silver-alloyed (0.21 percent max silver) and tin-alloyed (0.5 percent max tin) grades. No counter-measures against emissions harmful to the atmosphere are incorporated. (Müllebner, M.; Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 96-97 [in German]. 3-85457-060-0)

0553 NICKEL-SULPHATE PLANT (WORKS UNIT 7) (NICKELSULFATANLAGE) [BIB-UBAA000054]

In the Brixlegg nickel-sulphate plant, spent electrolytes are treated after de-copperisation to less than 0.5 g/l in the electrolysis plant (i) to stabilize the metal-ion concentration, (ii) to separate the dissolved impurities, (iii) to recover nickel sulphate and (iv) to recycle the sulphuric acid. The treatment involves: i) increase of the concentration of electrolyte from some 20 percent to some 70 percent sulphuric acid in vaporizers under vacuum, with the precipitation of crude nickel sulphate; (ii) filtration of this suspension, recycling of the sulphuric acid to the electrolysis plant, and dissolution of the nickel-sulphate cake in hot water; (iii) precipitation of ferrous metals with calcium carbonate, filtration of hydroxide under compressed air after the addition of hydrogen peroxide, generation of hydrogen sulphide from nickel-sulphate flakes and sulphuric acid, with the precipitation of impurities as sulfides; (iv) increase of the concentration of the nickel-sulphate solution in a circulatory crystallizer under vacuum, so that $NiSiO_4{,}6H_2O$ is precipitated, which is centrifuged and dried. (Müllebner, M.; Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 98-103 [in German]. 3-85457-060-0)

0554 ANODE-SLURRY PROCESSING PLANT (WORKS UNIT 8) (ANODENSCHLAMMAUFBEREITUNG) [BIB-UBAA000055]

In the Brixlegg anode-slurry processing plant, constructed in 1963, the metallic inclusions are recovered using a purely hydro-metallurgical process developed by Montanwerke Brixlegg, which is more efficient and more energy saving than conventional gold and silver electrolysis. The composition of the slurry varies from charge to charge, but a typical analysis shows (in kg/t of dry substance) lead 350, sulphate 200, barium 200, copper 60, noble metals 50, nickel 30, tin 30, antimony 30, arsenic 10, selenium 10 and residual elements 130. Basically, copper, lead and nickel are removed initially and recycled to the electrolysis plant. Then the other elements are extracted by dissolution, precipitation or cementation. Hydrate of lime and sodium sulphate are added to the residual slurry to avoid an excess of sulphide ions, and then the slurry is filtered and recycled to the blast furnace. At present the platinum-group metals and selenium are recovered only as cementates, but improvements to the process are being sought for their recovery as commercial-grade products. (Müllebner, M.; Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 104-107 [in German]. 3-85457-060-0)

0555 COPPER-OXYCHLORIDE PLANT (WORKS UNIT 9) (KUPFEROXICHLORIDANLAGE) [BIB-UBAA000056]

In the Brixlegg copper-oxychloride plant calcium carbonate is converted by ex-works copper-chloride solutions from the conductor plate industry into copper oxychloride ($3Cu(OH)_2\ CuCl_3$), which is then used as plant-protection material. The copper-chloride solutions contain 80-100 g/l copper (ii) chloride, 1-5 g/l copper (i) chloride and 70-100 g/l free hydrochloric acid. Essentially the process involves (i) oxidation of the copper chloride with hydrogen peroxide, (ii) precipitation with a calcium-carbonate suspension, (iii) filtration of the aqueous suspension and (iv) washing and drying of the filtrate. (Müllebner, M.; Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 108-112 [in German]. 3-85457-060-0)

0556 POWER SUPPLY (WORKS UNIT 10) (ENERGIEVERSORGUNG) [BIB-UBAA000057]

The total Brixlegg works' fuel consumption (t/year) in 1987 consisted of heavy heating oil 263, electric power 130, foundry coke 99, beech and alder wood 32 and extra-light heating oil 21. On average, the sulphur content of the heavy heating oil was 1.32 percent and that of the foundry coke 0.8 percent. Primary steam is generated in a 3.5-MW heavy oil-fired steamblock boiler and two 3.0-M extra-light oil-fired Henschel boilers, whilst secondary steam is provided by a 2.2-MW blast-furnace waste heat recovery boiler. Hot water is obtained from a CALIQUA plant of 8 t/h capacity. (Müllebner, M.; Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 113-115 [in German]. 3-85457-060-0)

0557 EMISSION OF AIR POLLUTANTS. BLAST-FURNACE PLANT (WORKS UNIT 1) (SCHACHTOFENANLAGE) [BIB-UBAA000058]

The findings of several investigations (1982, 1983, 1988) into the origins of the various air pollutants contained in the waste gases emitted by the Brixlegg blast-furnace plant and the dusts contained therein are discussed in some detail. Measurements of the amounts emitted are reported. The pollutants identified comprised (i) sulphur compounds, (ii) chlorine compounds and chlorinated, polycyclic, aromatic hydrocarbons and (iii) metals in the form of dusts antimony, arsenic, cadmium, copper, lead, mercury and tin. In slag processing the extra-light oil-fired drum drier was identified as the principal source of air-pollutant emissions, but data on the amounts involved are not available. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 116-129 [in German]. 3-85457-060-0)

0558 EMISSION OF AIR POLLUTANTS. CONVERTER PLANT (WORKS UNIT 2) (KONVERTERANLAGE) [BIB-UBAA000059]

The sources of air-pollutant emissions in the Brixlegg converter plant are identified and discussed. Measurements in 1982 and 1988 of the amounts involved are reported. The results demonstrate that the variable conditions in the different operational phases, conditional upon the purity of the crude copper and the nature of its metallic impurities, can lead to short-term emission of very high concentrations. The measurements relate to (i) sulphur compounds, (ii) chlorine

and hydrogen chloride, (iii) organic compounds and (iv) metals in the form of dusts - antimony, arsenic, cadmium, copper, lead, mercury, tin and zinc. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 130-138 [in German]. 3-85457-060-0)

0559 EMISSION OF AIR POLLUTANTS. REVERBERATORY-FURNACE PLANT (WORKS UNIT 3) (FLAMMOFENANLAGE) [BIB-UBAA000060]

The sources and nature of air-pollutant emissions from a 145-t reverberatory furnace and a 125-t standby unit at the Brixlegg works are described, and the amounts and analyses determined in 1982 and 1988 are reported. High localised dust emissions arise during casting, including the application of barium sulphate to the anode moulds. Sulphur-dioxide emissions present the greatest problem; even after dry-sorption de-sulphurisation they represent the highest sulphur-dioxide emissions from the entire works. Unlike converters, in reverberatory furnaces the main sulphur-dioxide source is the fuel; hence since 1988 more heavy heating oil with a sulphur content of 1 percent max has been used, and natural gas-fired furnaces have been considered. Markedly higher hydrogen-chloride emissions were recorded with the thermally treated metal scrap than with that treated mechanically. Emissions of organic compounds occur only during charging, blowing and poling. However, in the latter case the dust content of the cleaned gas depends on the condition of the filter cloth rather than on the composition of the crude waste gas. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 139-149 [in German]. 3-85457-060-0)

0560 EMISSION OF AIR POLLUTANTS. SAMPLING PLANT (WORKS UNIT 4) (BEMUSTERUNGSANLAGE) [BIB-UBAA000061]

Air-pollutant emission tests on the Brixlegg sampling plant between 1982 and 1988 showed that this plant is the works' largest dust emitter. Following wide differences in the charge-material dust emissions determined in 1982 and 1984 a cloth-filter plant with upstream white-lime injection was installed, with positive results. Sulphur-dioxide emissions are attributable to the sulphur content of the crucible-furnace fuel, but variations in concentration depend on the parameters of the lime injection and on solid sulphur additions to lower the metal scrap melting point. With an average energy consumption (45 kg/h) of heavy heating oil with 1.32 percent sulphur, the sulphur-dioxide emission rate was 1.19 kg/h. Prior to the installation of the lime-injection plant crude-gas chloride contents were low but thereafter cleaned-gas contents rose threefold. In 1982, with copper wire and shredder material, organic-compound concentrations were 16 mg/Nm^3 and emission rates 0.3 kg/h, but in 1988 with relay scrap the average emission rate dropped to less than 8 mg/Nm^3 carcinogenous substances were identified. Determinations in 1986 of the metal contents of crucible-furnace dusts showed that the lead content in the crucible-furnace zone exceeded the threshold limit, whilst around the roller table total dust and copper lead and aluminium contents showed multifold excesses. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 150-158 [in German]. 3-85457-060-0)

0561 EMISSION OF AIR POLLUTANTS. ELECTROLYSIS PLANT (WORKS UNIT 5) (ELEKTROLYSEANLAGE) [BIB-UBAA000062]

According to an investigation in 1966 fumes that could be produced by the Brixlegg electrolysis plant were so insignificant as not to be considered as emissions. Therefore only the vaporisation of sulphuric acid, the generation of sulphuric-acid mist and the production of arsine were studied. Vaporised sulphuric acid was determined as some 0.01 mg SO_3/m^3. Generation of sulphuric-acid mist, due to the formation of gas on the electrodes and the escape of electrolyte droplets with the gas bubbles, was avoided due to the reverse-current process used. In the refining electrolysis, the use of arsenic concentrations of 2-3 g/l instead of the conventional less than 10 g/l inhibited the emission of arsine. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 158-159 [in German]. 3-85457-060-0)

0562 EMISSION OF AIR POLLUTANTS. CASTING PLANT (WORKS UNIT 6) (GIESSEREI) [BIB-UBAA000063]

No provision is made in the Brixlegg casting plant for determining air-pollutant emissions. Management claims that no relevant emissions take place during melting, casting and sawing operations in this plant . (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 159-159 [in German]. 3-85457-060-0)

0563 EMISSION OF AIR POLLUTANTS. NICKEL-SULPHATE PLANT (WORKS UNIT 7) (NICKELSULFATANLAGE) [BIB-UBAA000064]

In the Brixlegg nickel-sulphate plant an alkali-absorption washer is used to extract the waste gases containing hydrogen sulphide. The acid-base reaction ensures high efficiency. Management claims that no other sources of emissions from the processes in this plant are possible. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 159-159 [in German]. 3-85457-060-0)

0564 EMISSION OF AIR POLLUTANTS. ANODE-SLURRY PROCESSING PLANT (WORKS UNIT 8) (ANODENSCHLAMMAUFBEREITUNG) [BIB-UBAA000065]

For reasons of secrecy, entry into the Brixlegg anode-slurry processing plant was not permitted. Estimations of the air-pollutant emissions from this plant are not possible therefore. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 159-159 [in German]. 3-85457-060-0)

0565 EMISSION OF AIR POLLUTANTS. COPPER-OXYCHLORIDE PLANT (WORKS UNIT 9) (KUPFEROXICHLORIDANLAGE) [BIB-UBAA000066]

Little information on the Brixlegg copper-oxychloride plant is available. In addition to the washer for the sedimentation-tank fumes, two cloth-filter plants deal with the pollutant-laden waste gases, a cloth filter separates the product after the fluidised-bed drier and the crusher. The obsolete continuous-monitoring system for the filter for the fluidised-bed drier is unsatisfactory, so reliable data on most emissions there are not available, whilst there are no data at all on the emissions from the silo and the crusher. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 160-161 [in German]. 3-85457-060-0)

0566 EMISSION OF AIR POLLUTANTS. POWER SUPPLY (WORKS UNIT 10) (ENERGIEVERSORGUNG) [BIB-UBAA000067]

Due to the lack of air-pollutant emission measurements for the individual sectors of the Brixlegg power-supply plant i.e. primary steam generation with heavy heating oil, preheating with extra-light heating oil and drying with extra-light heating oil during slag preparation, limited data are presented only on the emission of sulphur dioxide in relation to total heavy heating oil consumption. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 161 [in German]. 3-85457-060-0)

0567 EMISSION OF AIR POLLUTANTS. IN-WORKS STORAGE AND TRANSPORT (INNERBETRIEBLICHE LAGERUNG UND TRANSPORT) [BIB-UBAA000068]

Since emissions occurring during the storage, loading, transport and unloading of materials in dust form are difficult to quantify, only indications of the inherent problems at the Brixlegg works can be given. As regards the in-works handling of filter dusts and so far as is known, the discharge, transport and transfer points are designed as dustproof. Dust-like charge materials are transported in open vehicles, and the collective term "handling" is to be applied mainly to the charging of the blast furnace. Theoretically all the dust emissions are collected by the blast-furnace extraction plant and passed to the filters. Most emissions are wind-blown from open-air storage sites, thus these dumps should be sprayed

with water under suitable weather conditions. Since moist charge materials are undesirable technically, storage bays have been erected to accommodate these oxidic materials. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 161 [in German]. 3-85457-060-0)

0568 EMISSION OF AIR POLLUTANTS. OVERVIEW (EMISSION VON SCHADSTOFFEN. UEBERBLICK) [BIB-UBAA000069]

The four groups of data on the Brixlegg works collected during the various surveys covering energy consumption and composition, emissions in 1982 and 1987 and operational statistics are summarily reported and compared. Shortcomings in the measurement procedures used hitherto are identified and discussed, with emphasis on the absence of data on some specific air pollutants. Differences in measurements recorded are attributable, in part, to varied loading of the smelting plant and the introduction of additional anti-pollution measures. The most notable air pollutant omitted is nitrogen oxide. The requisite more detailed and precise study of pass-filter heavy metals emissions in the gaseous phase and surveillance of emissions of semi-metals and metallic compounds are now based on a two-stage sampling method involving filtration and wet chemistry. Summary tabulated data on emissions of: (i) air pollutants from the pyrometallurgical plants and primary steam generators; (ii) heavy metals from the pyrometallurgical plants; (iii) selected organic materials from the pyrometallurgical plants are presented. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 163-168 [in German]. 3-85457-060-0)

0569 EFFLUENT SITUATION (ABWASSERSITUATION) [BIB-UBAA000070]

Detailed data, obtained by measurement and/or calculation, on the effluents discharged from the Brixlegg works into the Alpacher Achs and Inn rivers are presented and compared with the numerous and varying national, regional and municipal statutory requirements and limitations. The survey covers flow rates and daily volumes of the effluents discharged within and outside the authorised mixing zone from the various plants and including fecal fluids, rainwater and cooling water and the concentrations therein of heavy metals and salts, and also fine-grained sediment. In general, the works' data conform with the consensus of statutory requirements. Solutions to the particular problems posed by copper chlorides and fine-grained slag sediments in meeting these are discussed. In future efforts must be concentrated on (i) conformity with the thresholds prescribed for the Inn, (ii) updating of effluent purification techniques and (iii) extension of the works' recycling systems. (Peschek, R.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 169-183 [in German]. 3-85457-060-0)

0570 PREVAILING METEOROLOGICAL CONDITIONS (METEOROLOGISCHE RAHMENBEDINGUNGEN) [BIB-UBAA000071]

In connection with the various meteorological parameters influencing emission climatology e.g. wind and air temperatures, radiation and precipitation, data on ground-wind conditions and inversion layers in the Brixlegg sector of the valley of the River Inn recorded in 1975-1980 and 1982-1985 are reported and discussed. Results of ground-wind speed measurements taken at heights of some 10 m to avoid ground-friction effects show an inordinately high frequency of calms (less than 1 m/s or 3.6 km/h) - particularly between 2300 hours and 0500 hours) - compared with the rest of the Inn valley. The average annual wind speed is 1.1-1.4 m/s, and the most frequent wind directions in the valley are N-NW and S-W. On at least 60 days a year inversion layers form at heights of 80-280 m above Brixlegg, and the consequent low-level mixed layers beneath these lead to heavy concentrations of air pollution and, depending on the air temperature, to the occurrence of fog or mist. (Hojesky, Helmut; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 184-191 [in German]. 3-85457-060-0)

0571 DESCRIPTION OF THE EMISSION SITUATION. DEVELOPMENTS HITHERTO AND PRESENT STATE (DARSTELLUNG DER EMISSIONSSITUATION. BISHERIGE ENTWICKLUNG UND STAND) [BIB-UBAA000072]

The Brixlegg copper-smelting works in the bottom of the Inn valley dominates the local emission situation. the prevailing wind blows parallel to the valley, but the high frequency of calms leads to extremely short-term (0.5-1 hour) pollutant concentrations, especially on the lee side of the works. Emissions from a neighbouring motorway increase the pollution intensity. Prior to 1986 short-term sulphur dioxide recordings were far in excess of the statutory thresholds, with rapid post-calm falls, resulting in an annual average of less than 0.09 mg/m^3. With additional environmental protection measures concentrations improved but still exceeded thresholds in 1988, with the highest peak concentrations in Spring and Summer. Dust precipitation close to the works increased during 1984-1988, but overall a virtually constant average rate of 0.10-0.20 g/m^3/day was maintained. All stations continually reported contents of one or more heavy metals far in excess of threshold limits, leading to high heavy-metal concentrations in the soil. (Hojesky, Helmut; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 192-210 [in German]. 3-85457-060-0)

0572 CONSEQUENCES OF HARMFUL EMISSIONS FROM THE BRIXLEGG SMELTING WORKS FOR THE VEGETATION. (FOLGEN DER SCHADSTOFFEMISSIONEN DER HUETTE BRIXLEG FUER DIE VEGETATION) [BIB-UBAA000073]

In a survey of the damage sustained by pine forests surrounding Brixlegg from sulphur dioxide and heavy metals emissions from the Brixlegg copper-smelting works during 1975-1985, five investigations are summarily described: (i) colour infra-red photography of zones exposed to different pollution levels, accompanied by needle analyses; (ii) effects on mycorrhiza and fungi; (iii) killing of trees by soil and air pollution; (iv) effects of heavy-metal soil pollution on pinetree growth; (v) needle analyses. Current investigations on the effects of the Brixlegg emissions on the growth capacity of pinetrees and scatter electron-microscopic studies of pathomorphological changes in pine needles are also reported. Comparison of two maps of lichens in five zones of varying degrees of pollution in 1975 and 1986 shows that the total extent of the effects around the Brixlegg and Rattenberg had not increased, but that the intensity of pollution rose sharply, which fact is attributable mainly to industrial gases and motorway traffic. These investigations show clearly the progressive damage to soil and vegetation due directly to the Brixlegg emissions. Huge clean-up operations before possible reforestation and the potential financial losses due to depletion render minimisation of these emissions essential. (Hackl, J.; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 211-225 [in German]. 3-85457-060-0)

0573 GEOGENOUS AND ANTHROPOGENOUS STRESSING OF SOILS. (GEOGENE UND ANTHROPOGENE BELASTUNG DER BOEDEN) [BIB-UBAA000074]

In a comprehensive review of past geological surveys of the Inn valley and its surroundings, the tetrahydrite, barite and chalcopyrites deposits characterising the Brixlegg zoners are reported as containing sizable concentrations of heavy metals. Air-pollutant emissions during four centuries of copper mining and smelting have involved hot waste gases, steam, combustion products of sulphur and carbon, volatile metals and their compounds (arsenic, arsenic trioxide, mercury and its compounds) and oxido-silicate compounds from slag and tailings. Investigations into the deleterious effects of these emissions, and particularly the heavy metals, on local agricultural and forest soils and humus and on the growth of vegetation, especially pinetrees, are reported in some detail. (Kasperowski, Elfriede; Nowak, H.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 226-265 [in German]. 3-85457-060-0)

0574 DIOXINE STUDIES IN THE BRIXLEGG DISTRICT. (DIOXINUNTERSUCHUNGEN IM RAUM BRIXLEG.) [BIB-UBAA000075]

An introductory survey of the chemical structure of polychlorinated dibenzodioxines (PCDD) and polychlorinated dibenzofuranes (PCDF) includes a discussion on the viability of tetrachlorinated dibenzodioxine equivalence factors as indicators of PCDD/PCDF toxicity. A number of investigations into the emission of PCDD/PCDF from the Brixlegg copper-smelting works and their effects on soil and air pollution are described in considerable detail. These involve determination of PCDD/PCDF concentrations in the local soils, pine needles, the atmosphere, cow's milk and animal fodder and PCDD/PCDF bio-accumulation in soil organisms. The entirely positive results obtained revealed concentrations of 4-420 pg/g in soils within 1 km of the Brixlegg works, with the highest values close to the works and in the prevailing-wind directions. Since concentrations of greater than 40 pg/g prohibit the utilisation of land for food and fodder production, a narrow strip of some 2 km can no longer be exploited agriculturally. Official measures must be introduced therefore to drastically reduce such soil contamination in this area. (Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 266-329 [in German]. 3-85457-060-0)

0575 FURTHER STUDIES BY THE FEDERAL ENVIRONMENT BUREAU. (WEITERE UNTERSUCHUNGEN DES UMWELTBUNDESAMTES) [BIB-UBAA000076]

Investigations of heavy-metal concentrations in soils and vegetation in the vicinity of the Brixlegg copper-smelting works and results of analyses by atom-absorption or plasma-emission spectrometry are reported. Soil concentrations of cadmium, copper, lead and zinc were far in excess of threshold limits and those of antimony, arsenic, mercury and tin only slightly so and all depended on the sampling-point distance from the works; nickel and thallium concentrations were only slightly in excess, whilst those of chromium, cobalt and vanadium were tolerable, with little or no traces of molybdenum, selenium and tellurium. Whilst meadow soils showed pH 6-7 the acidic forest-soil pH 3.3 threatened damage to vegetation and high risk of leaching into ground water. Grass samples showed high concentrations of antimony, arsenic, copper and lead, whilst soil-organism populations of forest soils were far less than those for meadow soils. Although Brixlegg works' emissions account largely for these results historical factors must be held responsible to some extent. (Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 330-347 [in German]. 3-85457-060-0)

0576 IN-WORKS PROJECTS AND FUTURE POLLUTION OF THE ATMOSPHERE. (BETRIEBSINTERNE VORHABEN UND ZUKUENFTIGE LUFTBELASTUNGEN) [BIB-UBAA000077]

Recent and projected upgrading operations on the pyrometallurgical plants of the Brixlegg copper-smelting works relate to materials and power supply, plant reconstruction and extension and environmental protection. Their effects on downstream ancillary plants are reviewed in terms of ultimate air-pollutant emissions. Data on present and future annual production rates of the individual pyrometallurgical and downstream ancillary plants are tabulated, together with their yields of slag, metal scrap and waste products, flue dust etc. Improvements to the pyrometallurgical plants and primary steam generators e.g. after-burning plant, reduced sulphur content of charge materials and heating oils, waste heat recovery boilers, will reduce the total emission of organic carbons by some 80 percent and of polychlorinated dibenzodioxines and polychlorinated dibenzofuranes to 675 mg/a. The possible sources of error in the data forecasts are discussed. (Spindelbalker, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Juni 1990), Appears in: *Montanwerke Brixlegg-Wirkungen auf die Umwelt*, Vol. 25, pp. 348-380 [in German]. 3-85457-060-0)

0577 GENE- AND BIOTECHNOLOGY (GEN- AND BIOTECHNOLOGIE) [BIB-UBAA000078]

This study describes the benefits and potential risks associated with the use of gene and biotechnology. It also describes the legal action required to protect human life and the environment. While research and its economic uses are legally protected by the Austrian Constitution, there is no comparable protection for human beings against possible dangers and undesirable consequences as a result of increased use of gene technology. The guidelines and laws concerning gene technological applications which already exist in other countries are described. The possibility of using some aspects in future Austrian law is considered. The American NIH guidelines provide a reasonable model for research laboratory safety while the international OECD guidelines are better for industrial applications. It is considered that regulations for closed systems should not be too difficult whereas, those for systems involving the deliberate release of genetically modified organisms will be much more serious. The latter includes the use of gene technology in agriculture, the breakdown of pesticides, toxic wastes, etc. Such releases of genetically modified organisms could-result in destabilization of the ecological balance. Discussions on these subjects should result in a better informed public and in the provision and approval of far-reaching Austrian gene technology law. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Vol. 28, pp. 499 [in German]. 3-85457-069-4)

0578 THE RANGE OF APPLICATION OF ENVIRONMENTAL BIO-TECHNOLOGY (ANWENDUNGSBEREICHE DER UMWELTBIOTECHNOLOGIE) [BIB-UBAA000079]

As a result of increasing industrialization and the consequent use of modern technologies, there has been a great increase in global environmental problems. Hence environmental biotechnology has become the major area for application of biotechnological techniques. This first section describes the status of industrial effluent purification and communal sewage treatment plants in Austria. Data is also given on the various types of plant for purification of the industrial effluent from more than 20 industries. Both aerobic and anaerobic plants are described. New developments include bioreactor methods for N and P removal, treatment of so-called xenobiotica, etc. A section is included on waste management with new development work, followed by a statement on ground water purification. Data is also provided on the various types of contaminants and new methods of dealing with them. Treatment of exhaust gases is also described in detail. (Braun, Rudolf; Fuchs, Werner; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Gen- und Biotechnologie*, Vol. 28, pp. 4-30 [in German]. 3-85457-069-4)

0579 INNOVATION IN ENVIRONMENTAL BIOTECHNOLOGY (INNOVATION IN DER UMWELTBIOTECHNOLOGIE) [BIB-UBAA000080]

The development of techniques and methods for waste reduction and pollution prevention instead of attempting to handle ever-increasing quantities of waste are considered. This includes composting, energy recovery from waste and ordered dumping. Production of chemicals ranging from alcohol and organic acids to pesticides by the treatment of bio-waste is described. Biotechnology processes using microorganisms are increasing rapidly. Improved treatment of xenobiotics is considered as well as nitrogen fixation and biopesticide production. The greater use of bioleaching, particularly in the copper mining industry is also proposed. (Braun, Rudolf; Fuchs, Werner; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Gen- und Biotechnologie*, Vol. 28, pp. 31-44 [in German]. 3-85457-069-4)

0580 THE POTENTIAL RISKS ASSOCIATED WITH THE USE OF GENETICALLY MODIFIED ORGANISMS IN ENVIRONMENTAL BIOTECHNOLOGY. (POTENTIELLE RISIKEN BEIM EINSATZ REKOMBINANTER MIKROORGANISMEN IN DER UMWELTBIOTECHNOLOGIE) [BIB-UBAA000081]

While the use of genetically modified organisms can reduce the use of pesticides and herbicides, the possible risk involved by their use may be considerable. Similarly, in the case of industrial effluents and sewage treatment, the effect of releasing genetically modified organisms into the environment needs very careful examination in order to avoid destabilising the ecological balance. Both general and laboratory experience in handling genetically modified organisms is described in detail. Positive and negative aspects for their usage are discussed and an assessment based on present knowledge is given. (Braun, Rudolf; Fuchs, Werner; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Gen- und Biotechnologie*, Vol. 28, pp. 45-66 [in German]. 3-85457-069-4)

0581 BIOTECHNOLOGY-ACTIONS REQUIRED. (BIOTECHNOLOGIE-HANDLUNGSBEDARF) [BIB-UBAA000082]

The consequences of the present development programme are outlined; these are - firstly, a reinforcement of political ideas by demonstrating the environmental problems and then to improve environmental awareness by training and education. The political, social and legal prerequisites need to be considered in addition to economic prerequisites and the possibility of foreign aid. The availability of process engineering and biological basics is outlined. A hierarchy of precautionary measures is given including the technology of waste management. Further process improvement by means of gene technology is considered and the consequent prerequisites on using genetically modified organisms in the environmental biotechnology are discussed. (Braun, Rudolf; Fuchs, Werner; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Gen- und Biotechnologie*, Vol. 28, pp. 67-80 [in German]. 3-85457-069-4)

0582 INDUSTRIAL PRODUCTION AND SAFETY. (INDUSTRIELLE PRODUKTION UND SICHERHEIT) [BIB-UBAA000083]

Details are given in the inter-disciplinary collaboration and methods in biotechnology. Further information is provided on the use of genetic technology for modifying organisms in industry; particularly in the production of pharmaceuticals. The risks associated with the release of genetically modified organisms from production plants are assessed and the possibility of minimizing these risks is considered. This leads to a discussion on some aspects of physical and biological containment and to problems associated with the sterilization of large plants. Details are given on plant design and operation. Specific technical measures required to achieve plant safety are described and tabulated. A comparison and assessment of existing guidelines and regulations in various countries is made and an overview given on the situation in Austria. (Schwab, Helmut; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Gen- und Biotechnologie*, Vol. 28, pp. 81-118 [in German]. 3-85457-069-4)

0583 LABORATORY SAFETY (LABORSICHERHEIT) [BIB-UBAA000084]

A very detailed account is given on laboratory design and of the apparatus and plant used in them. The various classes of organism are listed and the methods used in handling them are described. It is considered that, when working with large volumes, it is not possible to carry out the process in such a way that the escape of biological agents can be avoided. In addition, irreversible damage to the environment and the human beings may be caused by proliferating organisms released by these processes. This is particularly important with genetically modified organisms as there is little practical knowledge on their behavior in the natural environment, hence, the importance of physical and biological containment. Sections are included on decontamination and disinfection and also on the handling of radioactive material. A risk classification is given for more than 700 organisms. (Doblhof- Dier, Otto; Plail, Regina; Reiter, Manfred; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Gen- und Biotechnologie*, Vol. 28, pp. 119-189 [in German]. 3-85457-069-4)

0584 GENE TECHNOLOGY AND PRODUCTS OF GENE TECHNOLOGY IN AGRICULTURE. (GENTECHNIK UND GENETISCH HERGESTELLTE PRODUKTE IM BEREICH DER LANDWIRTSCHAFT) [BIB-UBAA000085]

In contrast with industrial operations, in which the release of biological agents is accidental, the release of genetically modified organisms in agriculture is deliberate. Genetic manipulation in plants is used to increase yield, to improve resistance to pesticides, aridity, salt concentration, etc. Similarly, there is a deliberate release of genetically modified organisms in the case of so-called transgenetic animals. It is considered that this behavior is irresponsible inasmuch as the possible outcomes are not clearly understood. The effects may be long term and impossible to rectify when they are detected. Some examples of this are given. These aspects and many others are presented in considerable detail. Questions such as the impact on developing countries are also considered. The regulations in a number of countries are discussed. Plants and animals which have been treated are listed. (Idel, Anita; Katzek, Jan; Kamphausen, Rolf; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Gen- und Biotechnologie*, Vol. 28, pp. 191-370 [in German]. 3-85457-069-4)

0585 LEGAL REGULATION REQUIREMENTS (DARSTELLUNG DES RECHTLICHEN REGELUNGSBEDARFS) [BIB-UBAA000086]

The applicability of existing Austrian laws on gene technology is examined and it is shown that, in all areas affected by gene technology, there are only isolated regulations. The reason for this is that gene technology was not established at the time when these laws were promulgated. Hence, new technological laws in the area of gene technology are required. Weak points in the system are examined and criteria are established for adequate legal regulations. Potential deficits in amended laws and in gene technology laws are discussed. It is emphasized again that the release of genetically modified organisms will have completely unpredictable effects in the present state of knowledge. Any release should only be approved after the strictest examination. (Spangenberg, Joachim; Leskien, Dan; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Gen- und Biotechnologie*, Vol. 28, pp. 371-422 [in German]. 3-85457-069-4)

0586 MODEL REGULATIONS IN EUROPE (REGELUNGSMODELLE IN EUROPA) [BIB-UBAA000087]

A legal model for regulations relating to gene technology is introduced. The EC guidelines are discussed and areas of agreement and need for changes are established. It is noted that, in Austria, laws can be introduced which depart from the EEC guidelines. The gene technology laws in the Germany are presented and discussed. Their uncritical use is rejected as deficiencies are revealed with respect to the EC guidelines. In particular, it is considered that products produced by means of genetically modified organisms should be marked even if they do not contain the said organisms. Other European regulations considered are from Denmark and the United Kingdom. It is concluded that special laws on gene technology should be established rather than attempting to amend existing laws. (Spangenberg, Joachim; Leskien, Dan; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Gen- und Biotechnologie*, Vol. 28, pp. 422-450 [in German]. 3-85457-069-4)

0587 REGULATION MODELS AND POSSIBLE CONSEQUENCES FOR AUSTRIA. (REGELUNGSMODELLE UND MOEGLICHE AUSWIRKUNGEN AUF OESTERREICH) [BIB-UBAA000088]

It is agreed that gene technology in both research and industry is sufficiently developed to require specific legislation for the protection of human health and to maintain an ecologically balanced environment. The evaluation of technological ramifications are essential in the formulation of comprehensive laws. A greater public awareness of the relevant issues is also of great importance. As the legal situation in other countries is constantly developing and the technology is also developing rapidly the legislators are in a difficult position. A common working group of UNIDO, UNEP, WHO and FAO has meanwhile laid down a "Code of Conduct". Pending the implementation of an Austrian gene technology law the Federal Environmental Agency has proposed that this "Code of Conduct" should be applied in Austria. (Spangenberg, Joachim; Leskien, Dan; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Gen- und Biotechnologie*, Vol. 28, pp. 451-490 [in German]. 3-85457-069-4)

0588 ARNOLDSTEIN (ARNOLDSTEIN) [BIB-UBAA000090]

The industrial area of Arnoldstein is briefly described, including geology, hydrology, climate, transportation links and population. The structure and activities of the Bleiberg Bergwerksunion (BBU), are outlined, and the environmental situation in the area is discussed. Air emissions from the BBU and in the surrounding area are examined, comparing the amounts of Zn, Cd, Pb, SO_2 and total dust emissions in 1989 and 1990, and discussing limits. The sources of waste water effluents from the BBU are listed. A number of studies into wastewater have been carried out, and regulations set. The overall wastewater situation in Arnoldstein is discussed, including the quality of surface and ground water. Studies of soil and vegetation show the distribution of heavy metals and sulphur, and their effects. The effects on animal life are also examined. The amount of toxic waste produced by the BBU is shown, and recommendations for restorative and precautionary measures are outlined. (Berger, Berthold;

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0589 BRIXLEGG (BRIXLEGG) [BIB-UBAA000091]

The industrial area of Brixlegg is briefly described. Cu working has been carried out at Brixlegg since the Middle Ages. Air pollution from the Montanwerke Cu foundry was extensively surveyed in 1987, and some reductions in SO_2 and dioxins have been achieved since then. waste water and water pollution residue levels are also examined. The emission of air-borne pollutants, particularly SO_2 and heavy metals, as deposited on surface water, ground water and soil, are studied. A report on the heavy metal content of soil around the Cu foundry is discussed. This defines an area in which agricultural and horticultural activities should be limited, and precautions taken to avoid harmful effects. Contamination of pasture with heavy metals and dioxins, and the concentrations in cows' milk are studied. The effects of heavy metal contamination on microbiological processes in the area are examined, and recommendations for further action for pollution control or to avoid contamination are suggested. (Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; V; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1992), Appears in: *Bericht ueber die Umweltsituation an ausgewaehlten langjaehrigen Industriestandorten*, pp. 24 [in German]. 3-85457-094-5)

0590 BRUECKL (BRUECKL) [BIB-UBAA000092]

The location of the Donau Chemie chemical works in Brueckl, and its development, are briefly described, and the activities of each of its plants, and the products made, are listed. Emissions to the air and in waste water, and the amounts of toxic and non-toxic wastes are analysed. Environmental contamination in the Brueckl area are discussed, including emmissions of chlorinated hydrocarbons, HCl, Cl_2 and Hg, surface water and ground water pollution with heavy metals, chlorinated hydrocarbons and Ca deposits, and effects on the soil and vegetation. Recommendations for further studies and action are made. (Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; V; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1992), Appears in: *Bericht ueber die Umweltsituation an ausgewaehlten langjaehrigen Industriestandorten*, pp. 18 [in German]. 3-85457-094-5)

0591 DONAWITZ (DONAWITZ) [BIB-UBAA000093]

The climate and industrial history of the Leoben-Donawitz area are discussed, and the plants and products of the Voest-Alpine Donawitz works are described. Peak air emission values for SO_2, dust and NO_x, emissions levels of dust, NO_x,SO_2,HF and CO since 1983, reduction measures being taken, and action required, are discussed. The waste water situation in each plant is explained, comparing the recommended parameters with actual levels. Environmental contamination is discussed, including air emmission levels of groundwater and surface water, and the effects on vegetation. Levels of toxic and non-toxic waste are shown, and recommend actions for further emission reductions and monitoring are suggested. (Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; V; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1992), Appears in: *Bericht ueber die Umweltsituation an ausgewaehlten langjaehrigen Industriestandorten*, pp. 26 [in German]. 3-85457-094-5)

0592 LEND (LEND) [BIB-UBAA000094]

The climatic conditions and industrial history of the Lend area are described, together with the plants and production data of the Salzburg Aluminium Company at its Lend site. Air emissions from the Al-electrolysis plant and the furnaces are detailed, comparing the amounts of emissions of pollutants such as dust SO_2, fluorides and organic compounds in recent years. Reductions have been achieved in many areas. Recommendations for waste water amounts and pollutant levels are discussed. Environmental contamination of the air, soil, water and vegetation in the Lend area are studied, comparing pollutant levels with recommended values. Waste disposal measures at each plant are outlined, and recommendations for further action to improve emission levels are suggested. (Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; V; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1992), Appears in: *Bericht ueber die Umweltsituation an ausgewaehlten langjaehrigen Industriestandorten*, pp. 18 [in German]. 3-85457-094-5)

0593 LENZING (LENZING) [BIB-UBAA000095]

The climatic conditions and industrial history of the Lenzing area, and the activities of the Lenzing AG, primarily fibre and paper production, are briefly described. Effluents from the wood pulp, viscose and paper plants, and purification measures in place, are discussed. Studies of the River Ager show that contamination levels have dropped since the introduction of a vent condenser extraction plant and water purification plant. The ground water situation in the area and the effects of waste dumps are also studied. The sources and types of pollutants emitted from viscose production and from the boiler plants and wood pulp production are discussed, including measures for the reduction and treatment of emissions. Emmissions of SO_2,NO, H_2S and CS_2 are significant. Studies of vegetation in the area are described, and the amounts of waste material disposed of internally and externally are shown. Recommendations for further action are suggested. (Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; V; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1992), Appears in: *Bericht ueber die Umweltsituation an ausgewaehlten langjaehrigen Industriestandorten*, pp. 31 [in German]. 3-85457-094-5)

0594 LINZ (LINZ) [BIB-UBAA000096]

The location and climatic conditions of the industrial area of Linz are described. The two major industries are the VOEST Alpine Stahl Linz GesmbH and Chemie Holding AG. Their development is traced and levels of environmental protection investment are tabulated. Levels of emissions to the air, including SO_2, dust, NO, NH_3 and HF, from both industries between 1985-1995 are compared, and preventative measures taken by each plant are outlined. The origins of waste water from VOEST Alpine Stahl are explained. Studies of environmental contamination in the Linz area are discussed. Results of air measurements show

that air quality is improving, particularly regarding SO_2, dust and H_2S levels, but further reductions in pollutants are required. Levels of heavy metals and organic pollutants in three locations are compared. Groundwater and surface water contamination, and the results of studies of vegetation, are also discussed. Waste disposal procedures of the two industries are explained, and recommendations for further action are suggested. (Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; V; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1992), Appears in: *Bericht ueber die Umweltsituation an ausgewaehlten langjaehrigen Industriestandorten*, pp. 45 [in German]. 3-85457-094-5)

0595 TANKLAGER LOBAU (TANK STORAGE DEPOT LOBAU) [BIB-UBAA000097]

The location of the tank storage depot at Lobau, near Vienna, its development and the main activities carried out, are described. The sources of hydrocarbon emissions to the air, amounts of emissions, and reduction measures taken by the major petroleum companies, are discussed, together with emissions from boiler plants and transportation. Effluents from OeMV, the largest storage depot at Lobau, do not exceed the permitted levels. Levels of SO_2,NO_2 and hydrocarbons in the air, need to be reduced in the near future. The causes of groundwater and surface water pollution are studied, indicating the precautionary measures taken. The effects of the construction of the Freudenau power station are also considered. Little information is available about soil and vegetation contamination. Waste disposal data from the OeMV plant are shown. Recommendations for further action are made. (Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; V; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1992), Appears in: *Bericht ueber die Umweltsituation an ausgewaehlten langjaehrigen Industriestandorten*, pp. 15 [in German]. 3-85457-094-5)

0596 RAFFINERIE SCHWECHAT (SCHWECHAT REFINERY) [BIB-UBAA000098]

The location of Schwechat refinery, near Vienna, the industrial activities there and climatic conditions, are described, and OeMV's production areas and their capacities are listed. Sources of air pollution include boilers and furnaces, separators, convertors and purification plants. Emission levels of SO_2,NO_x,CO, dust and hydrocarbons from 1980-1991 are compared, and existing and planned measures for their reduction are discussed. Water treatment processes include the separation of wastewater into streams with different contamination levels, and appropriate processing of each. The amounts of toxic waste disposed of are analyses. Levels of SO_2,NO_2,CO, hydrocarbons and H_2S in the air around the OeMV refinery are discussed, together with contamination of ground water and soil, and recommendations for further action are made. (Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; V; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1992), Appears in: *Bericht ueber die Umweltsituation an ausgewaehlten langjaehrigen Industriestandorten*, pp. 26 [in German]. 3-85457-094-5)

0597 TREIBACH-ALTHOFEN (TREIBACH-ALTHOFEN) [BIB-UBAA000099]

The location of the Treibach-Althofen industrial site, its climate and industrial history are described, and the plants and production areas of the Treibach Chemical Works (TCW) are listed. Air emissions from the TCW from 1987-1992 are compared, discussing the reductions achieved and those still required. The recommended waste water levels are put forward. Air pollution levels, including airborne and precipitated dust with heavy metals content, Cl and Fl compounds, polycyclic aromatic hydrocarbons, SO_2 and NO_2 are studied. Much reductions in heavy metal emmissions have been achieved. Studies of agricultural, garden and woodland soils, ground water, surface water and vegetation, are also discussed. The high levels of Ni found in vegetation in 1988 have been reduced to an acceptable level. Waste disposal data are shown, and recommendations for further action are made. (Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; V; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1992), Appears in: *Bericht ueber die Umweltsituation an ausgewaehlten langjaehrigen Industriestandorten*, pp. 22 [in German]. 3-85457-094-5)

0598 EXPLANATION OF THE TERM "ALTLAST" (OLD WASTE POLLUTION, LANDFILL)-APPENDIX 1 (ERLAEUTERUNGEN ZUM TERM ALTLAST-APPENDIX 1) [BIB-UBAA000100]

The term Altlast (old waste pollution) as defined in the legislation on old pollution (ALSAG) which came into force on 1 July 1989, is explained. The procedure for designating, recording and treating areas where contamination exists due to previous industrial activity, is outlined. Such areas include former waste disposal sites (i.e. landfills), used industrial plants and equipment, pipes and canals. Large scale or diffuse contamination is excluded. (Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; V; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1992), Appears in: *Bericht ueber die Umweltsituation an ausgewaehlten langjaehrigen Industriestandorten*, pp. 3 [in German]. 3-85457-094-5)

0599 ASSESSMENT OF METAL CONTAMINATION IN SOIL-APPENDIX 2 (BEWERTUNG VON METALLBELASTUNGEN IN BOEDEN-APPENDIX 2) [BIB-UBAA000101]

Methods of setting tolerance levels for heavy metals in soils are explained. Firstly the designation of standard values and limits, such as those set by Kloke (1978, 1980). Kloke values form the basis of regulations in Austria. Limits set by Austrian provinces, and by selected European countries, are compared. Secondly, the Three-Area-System, developed by Eikmann and Kloke, which sets levels of tolerance depending on the type of situation and its usage. The criteria for designating area type, and the levels set for individual elements within the different areas, are listed. (Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; V; Berger, Berthold; Brandstetter, Kurt; Chovanec, Andreas; Grath, Johannes; Hackl, J.; Hammer-Kossina, Isabella; Hojesky, Helmut; Kasperowski, Elfriede; Kienzl, Karl; König, Ursula; Radunsky, Klaus; Riss, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria,

(September 1992), Appears in: *Bericht ueber die Umweltsituation an ausgewaehlten langjaehrigen Industriestandorten*, pp. 11 [in German]. 3-85457-094-5)

0600 AIR (LUFT) [BIB-UBAA000103]

The levels of the main air pollutants SO_2, dust particles, NO_x, volatile organic compounds, (VOCs), CO, O_3 and CO_2 are examined. The reductions so far achieved, and further action necessary to reach desired levels are discussed. Sources of emissions are compared, including deposition caused by emissions from other countries. Substantial reductions have been achieved in the case of SO_2 and dust particles, but other pollutant levels are not satisfactory. In particular, CO_2 emissions are a cause for concern, with increased levels predicted. Some reduction measures are suggested. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 1-23 [in German].)

0601 WATER (WATER) [BIB-UBAA000104]

The pollution problems that exist regarding ground water, surface water in lakes and rivers, waste water and sewage sludge are examined. Determination and monitoring of water quality, the types and sources of pollution, regulations governing water quality, and measures being taken or proposed to improve quality are considered. Particular problem areas include nitrates from herbicides and pesticides, algal growth in lakes, phosphates in urban wastes, and chlorinated hydrocarbons, heavy metals and organochlorines from industrial emissions. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 24-36 [in German].)

0602 SOIL (BODEN) [BIB-UBAA000105]

Changes in land use in recent years are examined, pointing out the decrease in agricultural land, leading to more intensive production. Pollution hazards can be classified into chemical hazards, physical hazards and land loss through building. On agricultural land, the use of synthetic pesticides and fertilizers are particular causes of pollution, together with the effects of increased mechanization. Other sources of contamination are air emissions containing pollutants such as SO_2 and NO, heavy metals, sewage sludge, organic contaminants and radionuclides. The effects of land loss through building and the concentration of industrial activity on pollution deposits, and the significance of soil erosion, are discussed. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 37-46 [in German].)

0603 FOREST (WALD) [BIB-UBAA000106]

The significance of the forest areas in Austria is discussed, pointing out their importance in terms of protection, recreation, climate regulation, and wood processing. There is a tradition of sustainability in forestry. The damage caused to forests by air pollution is examined. The main pollutants are SO_2,NO_x and O_3. The Bioindicator Network Classification of regional concentrations of sulphur emmissions are shown. A drastic reduction of all air pollutants is needed, together with international agreements on reduction measures. The effects of pollution are examined, comparing the damage on various species of trees, and in different locations. Damage caused by deer and grazing cattle, and by storms and tree felling, are also discussed. The condition of forests with protected status is considered. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 47-55 [in German].)

0604 COUNTRYSIDE AND LANDSCAPE (NATUR UND LANDSCHAFT) [BIB-UBAA000107]

National parks in Austria and other areas protected by national legislation or international agreements are shown, and the significance of their status is considered. The numbers of endangered species of animals and plants in the country, and the sources of danger to them are examined. The protection of moorland areas is also discussed. Biotope mapping is explained, and the extent to which it has so far been achieved is shown. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 56-70 [in German].)

0605 PROTECTION AGAINST HAZARDOUS CHEMICALS (SCHUTZ VOR GEFAERHLICHEN CHEMIKALEN) [BIB-UBAA000108]

The scale of chemical usage in Austria is examined. Legislation covering the registration, notification and identification of chemicals, and existing and planned prohibitions and restriction on the use of hazardous substances are discussed. Restricted substances include halogenated fluorochlorohydrocarbons, asbestos, formaldehyde, halogenate and pentachlorophenol (PCP). The main points of the new pesticides legislation are outlined. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 71-76 [in German].)

0606 WASTE (ABFALL) [BIB-UBAA000109]

The aim of waste policy in Austria is to reduce as far as possible the amount of waste deposited, either by utilizing or processing (i.e recycling) it. The amounts of household and other non-hazardous industrial wastes currently produced, and their treatment, are analyzed. 90 percent of such waste is now deposited in a landfill. Other sources of waste, such as building debris, food waste, sewage, wood, fibre, paper and metal scraps, also need to be examined with a view to reducing the amounts produced. Hazardous materials found in household waste are identified, and disposal methods are discussed. Many sites of old waste dumps and sources of contamination exist. The scale of the problem, and treatment approaches are considered. The main points of the legislation on the avoidance and treatment of waste (1 July 1990) are outlined. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 77-87 [in German].)

0607 NOISE (LAERM) [BIB-UBAA000110]

Surveys of the noise situation in Austria show that since 1970 the number of people claiming that noise causes them disturbance has fallen. Traffic is causing an increasing proportion of noise pollution. The results of studies measuring noise levels caused by road, rail and aircraft traffic are shown and discussed. Strategies for the reduction of noise have moved from immission reduction to emission reduction. Guidelines brought in 1989 allow restrictions on the use of "high-noise" lorries. Certain categories of aircraft have, since 1990, not been allowed to take off or land in Austria. Rail traffic is still a problem area. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 88-93 [in German].)

0608 ENERGY (ENERGIE) [BIB-UBAA000111]

Energy services are the provision of heating and the carrying out of mechanical or chemical processes. An energy flow diagram shows how the total primary energy used is converted into ultimate energy and then to useful energy, with energy loss at each conversion stage. Data for power generation and energy consumption in Austria from 1970 - 1989 are shown, comparing the use of different energy sources. The amounts of coal and oil used has decreased, while hydro electric power, electrical energy and others such as biomass have increased. Environmental contamination due to energy generation is examined, comparing emissions of SO_2,NO_x, hydrocarbons, CA and dust, from different types of fossil fuel, and considering sources of emissions. Emissions from the burning of wood and straw, and the reductions achieved, are discussed. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 94-110 [in German].)

0609 FIBRE, PAPER AND WOOD INDUSTRIES (ZELLSTOFF-, PAPIER- UND HOLZINDUSTRIE) [BIB-UBAA000112]

The extent of the problem of contamination of surface water by the Austrian fibre and paper industries is examined. Despite pollution control measures taken, there is still a substantial problem. Production data for the industry are shown, together with the results of pollution measurements for the main outlets, the rivers Pols, Mur, Ager and Traun, comparing the amounts of dissolved organic carbon, adsorbable organic halogens, and Zn, and the chemical oxygen (COD) demand at different locations. Examples of pollutant measurement and control in St. Magdalen, Kematin, Schrauing and Echsenbach are described and discussed. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna,

Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 113-136 [in German].)

0610 METAL INDUSTRY (METALLINDUSTRIE) [BIB-UBAA000113]

The extent of dioxin and heavy metal contamination around the copper-working industry in Brixlegg is discussed. Studies of dioxin levels in the soil, the atmosphere and in vegetation were carried out in 1987 and 1988 in an area up to 3 km from the emitting plant. Levels of dioxin in hay and vegetation growth, in cow's milk, and in the needles of fir trees, were monitored from 1988 -1991. Results show that dioxin is transmitted from fodder to cow's milk. The effects of measures taken to reduce emissions are discussed. The results of studies of heavy metal contamination of soil and vegetation in the Brixlegg area are shown, and sources of the contamination considered. The physiological performance of the common alder in air containing F1 pollutants is examined. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 137-154 [in German].)

0611 CHEMICAL INDUSTRY (CHEMISCHE INDUSTRIE) [BIB-UBAA000114]

Pollution in the area surrounding the Treibach Chemical Works is examined, discussing the results of studies of air, soil and vegetation. Problems include polycyclic aromatic hydrocarbons in air; heavy metals deposition; the contamination of agricultural land and crops and garden soil with heavy metals; heavy metal contamination of forests, including the forest floor, trees, fungus and animals; dioxin contamination of soils and trees; and heavy metals in the sediment of the River Gurk. The potential hazards of the associated dumping site (i.e. landfill) (Rosswiese), are discussed, examining the content of the waste, and the contamination of ground water. Measures for sealing the surface and monitoring ground water are proposed. The emissions from a plastics factory in Innsbruck are discussed, and effluent from a viscose factory and its effects on the River Traiser are analyzed. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 155-174 [in German].)

0612 BUILDING INDUSTRY AND QUARRIES (BAUSTOFFINDUSTRIE UND STEINBRUECHE) [BIB-UBAA000115]

Three examples of studies carried out are outlined, including the reasons for the investigation and the organizations involved. Measurements of fluoride depositions and concentrations around a bricks factory in Mauthausen showed a marked decrease with distance from the plants. A quarry and gravel works in Bad Deutsch Altenburg was shown to be the cause of increased contamination by dust deposits. A study of the deposition of the heavy metals Pb, Cd, Zn and Ti around a cement works in Gmunden produced no conclusive results, with no patterns emerging in the concentration measurements, and no significant maxima. The measurement results are shown. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 175-179 [in German].)

0613 TRANSPORT (VERKEHRSUNTERNEHMEN) [BIB-UBAA000116]

Soil tests were carried out at various sites along Austrian railway lines to measure levels of mineral oil (petroleum) contamination. Particularly high levels were found in the vicinity of stations. A study of noise levels was undertaken at the Seebach railway bridge in St. Magdalen, to test the efficiency of a new low-noise construction method. The existing rails were replaced with plastic-coated bars, and steel plates replaced with wood. Measurements showed a decrease in energy equivalent continuous noise of 4-9 dB, with 30-40 percent decrease in volume. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 180-182 [in German].)

0614 OTHER ACTIVITIES (SONSTIGE BETRIEBE) [BIB-UBAA000117]

An accident in December 1988 led to the outlet of 200 l of fuel oil from a textile finishing factory at Gross-Sieghart into the nearby river. Studies were carried out on the water pollution content of the river, and on the composition of effluent from the factory. Some results are shown. Studies of underground streams showed some organic and inorganic contamination near to the factory. Pollution levels decreased after the introduction of in-house measures to reduce emissions. Emissions of Fl and heavy metals from gas-fired furnaces at an enamel works in Vienna were measured, together with treated gas emitted from a purification system. Results showed a high content of fine particles of most elements, but levels in the treated emission gas were below limit values. Constant monitoring of dust emission levels was recommended. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 183-192 [in German].)

0615 ENVIRONMENTAL CONTROL IN REGIONAL AND LOCAL AREAS (UMWELTKONTROLLE IM REGIONALEN UND LOKALEN BEREICH) [BIB-UBAA000118]

A number of case studies are described, covering the determination of pollution levels and their effects in various areas of Austria. Air pollutants including ozone and other photooxidants, NO_2,HCB and asbestos particles are measured, and the movement of pollutants, and their effects on buildings, are studied. Analyses of ground water in a number of locations are shown, also surface water in the forms of sewage works, rivers, glaciers and snow. Contamination of land with heavy metals and organic pollutants, and the effects of traffic emissions and pesticides, are examined. The effects of pollution on forest growth, the protection of countryside areas, and problems such as erosion, are discussed. A number of old waste dump sites (i.e. landfills) are analyzed to determine their effect on the environment, and the levels of radionuclides in forest and agricultural ecosystems are studied. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 193-294 [in German].)

0616 NATIONAL ENVIRONMENTAL CONTROL AND PLANNED WORK (BUNDESWEITE UMWELTKONTROLLE UND KONZEPTIVE ARBEITEN) [BIB-UBAA000119]

Measures being taken or planned for the monitoring and control of various forms of pollution at a national level are discussed. These include the setting up of registers and data collecting regarding emissions, waste sites (i.e. landfills), protected areas, automobiles, noise, water sources and alternative energy sources; the measurement and reporting of air quality; monitoring and control of radioactivity; registration of chemicals. Also included are control and waste treatment of hazardous waste; the protection of countryside areas including ski runs and forests; the monitoring of contaminants in consumer goods such as motor oils (lubricants), household cleaning materials,detergents, petroleum and cosmetics; and the measurement of noise from railway traffic. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 295-362 [in German].)

0617 INTERNATIONAL COOPERATION IN ENVIRONMENTAL CONTROL (INTERNATIONALE ZUSAMMENARBEIT IN DER UMWELTKONTROLLE) [BIB-UBAA000120]

A number of international projects, their aims, the studies carried out, and their findings, particularly as relevant to Austria, are discussed. Regarding air quality and climate protection, agreements made under the auspices of the UN Economic Commission for Europe (ECE), measurements of the widespread movement of air pollution, and the OECD programme for measuring ozone contamination, are considered. The programmes of the UN-ECE Task Force on By-product Utilization and Waste Management from Fuel Treatment and Combustion, and the Working Group on Effects are outlined. The control of woodland areas, the Alps convention, and the protection of the cultural landscape in the Europe Region are discussed. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (September 1991), Appears in: *Zweiter Umweltkontrollbericht*, pp. 363-386 [in German].)

0618 STATE OF THE ENVIRONMENT IN AUSTRIA [BIB-UBAA000122]

This section contains several papers which give details of facts and data provided by the Austrian Federal Environmental Agency. They cover a wide range of environmental subjects, such as air pollution, water resources, forests, nature and landscape protection and hazardous waste management. A particularly interesting part summaries the effects of the 1986 Chernobyl accident on Austria generally. This was the first major work carried out by the Federal Environmental Agency. This Part contains a great deal of details concerning all manner of types of pollution - not only in Austria. There are interesting details concerning

both plants and animals and specially preserved areas for them. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Aspects of Environment and Education*, Vol. 9, pp. 3-40 [in English]. 3-85457-134-8)

0619 ASPECTS OF THE LOCAL ENVIRONMENT. [BIB-UBAA000123]

Tourism is a main source of revenue in the Gastein valley, Austria. This Part describes the activities of "Ecomarketing", a concept of combining tourism with compatible ecological management. It describes efforts by the lift operators to minimize the effects of mass "invasions" of ski enthusiasts. The general organization used in Austria to combine the needs of ecology and tourism are detailed. The overall results of developing tourism are given, as are the protective measures adopted accordingly. The matters involved include air pollution, degradation of soil surfaces and vegetation and effects produced by artificial snow and additional waste disposal resulting from tourism. (Lausenhammer, Christa; Schafflinger, Franz; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Aspects of Environment and Education*, Vol. 9, pp. 41-56 [in English]. 3-85457-134-8)

0620 ENVIRONMENTAL EDUCATION. [BIB-UBAA000124]

This Part covers some of the (mainly theoretical) aspects of education in connection with environmental matters. It covers the situations in Austria, France, Albania, Romania and Portugal. A description is given of some of the technologies developed to match increasing industrial development. These include reducing both the production and discharge of wastes (i.e. pollution prevention and waste minimization or clean technology). Environmental education policy adopted in Austria is described,with emphasis on ensuring that it continues into succeeding generations. Some details are given of practical experience with Austrian schools and youth groups and in France and Albania. An annex gives details of contacts and organizations interested in the subject generally. (Winter, E.F.; Thonhauser, J.; Schuster, H.; Soares, José Brito; Maluka, E.; Qirjo, M.; Måndrut, Ana Marilena; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Aspects of Environment and Education*, Vol. 9, pp. 57-94 [in English]. 3-85457-134-8)

0621 BY-PRODUCT UTILISATION AND WASTE MANAGEMENT FROM FUEL TREATMENT AND COMBUSTION. [BIB-UBAA000125]

This publication is a very comprehensive account of matters concerning the use and disposal of by products arising from both fuel treatment and combustion of all types. It details many of the forms of combustion in use, the nature of the damaging products which can result, methods of dealing with them and final disposal of the products. It follows a decision made at Geneva in 1987 that Austria should remain the lead country for preparing a status report on by product utilisation and waste disposal. Notes are given on various meetings since 1987, leading to this 1991 report covering member countries. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Vol. 4, pp. 370 [in English]. 3-85457-063-5)

0622 FORMATION AND ANNUAL QUANTITIES [BIB-UBAA000126]

This paper gives the main sources of generation of by products from combustion and dealing with them - by fuel cleaning, low emissions combustion, flue gas treatment increasing conversion efficiency and change in fuel mix. Details are given of coal burning by some 10 countries, and gas consumption and waste disposal by incineration figures and similar information. Consideration is given to the attractiveness of the possible options for cleaning up emissions from fuel burning. Physical processes, for coal, can help to reduce ash content. Low emission combustion produces less contaminating substances and flue gas treatment results in fly ash precipitation and elimination of sulphur, nitrogen and halogens from the flue gas. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 15-32 [in English]. 3-85457-063-5)

0623 UTILISATION. [BIB-UBAA000127]

The use of by-products from combustion is very important, particularly if viewed in the long term. By using them it is possible to save natural resources and waste disposal sites. Possible use depends on physical properties and chemical behavior and a list is given of the main properties concerned. Variations in by-product properties are important as is shown by some examples of end products from coal combustion. Other factors have also to be considered and include incentives available from different grades of authorities, needs of standards to be met, competition, matching supply and demand, attitudes of potential users. In cold climates, winter operations can cause difficulties. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 33-37 [in English]. 3-85457-063-5)

0624 DISPOSAL. [BIB-UBAA000128]

Disposal of combustion residues is necessary if the residue cannot be otherwise used. Disposal is usually affected by some local laws or regulations, and these limit the number of types which can be used, some examples are given. The criteria affecting choice of site (i.e. landfills), are listed. Effects of deposit on local health and environment have to be considered and an important factor is that of polluting surface and underground water. The latter is enlarged upon at length. Disposal comes under four main headings - removal from vicinity of boilers, transport to disposal site, processing (before or after transport), and final emplacement at the chosen site. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 38-58 [in English]. 3-85457-063-5)

0625 FUEL TREATMENT. [BIB-UBAA000129]

Fuel treatment for reducing environmental pollution has long been employed. Such processes are commonly used for hard coal, oil, petroleum and natural gas. The main reasons for treatment are economic and technical, such as increasing heating value/unit and decreasing transport costs. Environmental advantages also follow. Fuel treatment usually reduces the ash content and So_2 emissions have also to be reduced. Descriptions are given of the main processes used. Chemical processes are available for reducing sulphur compounds and some of these are described. It is also possible to use some types of bacteria to reduce organic or inorganic sulphur, but to date this has not been done commercially. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 59-72 [in English]. 3-85457-063-5)

0626 OIL. [BIB-UBAA000130]

Desulphurization of oil is usually done with a hydrodesulphurization process within the petroleum refinery and a diagram shows the flow system employed. The sulphur content of light and middle distillates is thus changed into H_2S gas at high pressure (using catalysts). No residuals are left - other than the catalysts. A Canadian study in 1983 showed a possible reduction of 800 tons/year of sulphur in light fuel oil with investment costs of 52.4 million dollars. Desulphurization of heavy residues from distillation is done in Japan, and the United States of America, but not yet in Europe. Some figures are given of estimated amounts of sulphur to be extracted in some 10 countries. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 73-77 [in English]. 3-85457-063-5)

0627 GAS. [BIB-UBAA000131]

Different types of natural gas vary greatly in their properties. The majority require treatment before they can be pipelined to the consumer. The most common of the impurities found are CO_2,H_2S, COS and mercaptanes. In the case of H_2S its concentration should not exceed a few ppm or corrosion troubles arise in the pipeline. The most common treatment is washing, which can be either physical or chemical. A flow sheet is shown of a typical gas cleaning process. After the separation of H_2S pure sulphur can be produced by a Claus plant. Sulphur is marketable in the chemical industry. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 78-79 [in English]. 3-85457-063-5)

0628 BY-PRODUCTS AND WASTE FROM CONVENTIONAL COMBUSTION OF FUEL. [BIB-UBAA000132]

During normal combustion of solid fuel or liquid fuels, apart from gas, the main by product is a type of ash. Ash can be a variety of by products but its two main varieties are bottom ash (which falls by gravity to the base of the furnace and fly ash. The latter is light enough to be carried in the flue gas until a form of separator stops it. Other categories of ash take their name from the part of the equipment from which they are collected. Figures are given for estimated production of ash in 11 countries in the year 2000, with the latest available totals. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 80-81 [in English]. 3-85457-063-5)

0629 HARD COAL AND BROWN COAL. [BIB-UBAA000133]

The by-product ash cannot be avoided in the combustion of coal.For each tonne of coal consumed there will be between 40 and 300kg of ash. The amount of ash is determined by the mineral composition of the coal, its treatment and the operating conditions. Full details of features affecting the type of ash produced are given. The decision as to whether the ash should be used or disposed of depends on several factors, particularly the quality and type of ash. Other features are suitable outlets for use and availability of waste disposal sites. Many of these factors are considered in detail. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 82-101 [in English]. 3-85457-063-5)

0630 BIOMASS AND PEAT. [BIB-UBAA000134]

Biomass, being renewable, has become of renewed interest. In this term are included wood, wood residuals, straw and other agricultural products and peat. Peat has similar characteristics to coal. These fuels contain small quantities of sulphur and their main by-product is ash. Modern combustion plants for these fuels have either electrostatic precipitation or bag filters. The ash content varies considerably between different types of wood and the make up is different from that of coal ash. Experience of burning wood and peat is limited and the uses of their ash are rather limited. Much is used in landfill. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 102-110 [in English]. 3-85457-063-5)

0631 HEAVY OIL FRACTIONS. [BIB-UBAA000135]

The amount of oil ashes produced in an oil-fired power plant is about one thousandth per unit of produced energy of that produced in a coal plant.They are, however, acidic and have high metal contamination, which can cause difficulties, particularly in usage or disposal. The metal concentration does, however, make recovery of some of these an economic proposition and such recovery is now taking place in one Austrian plant. As might be expected, the varieties and amounts of these metal contents are considerably different for different types of fuel oil. Considerable data is given in regard to the composition of these types of ash. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 111-114 [in English]. 3-85457-063-5)

0632 WET PROCESSES. [BIB-UBAA000136]

The paper outlines the most common processes and also applied wet FGD systems. Examples are lime/limestone sludge for flue gases of lignite and oil (petroleum). Many other systems of this type are also described. The many uses of sludge are also described and considerable data is given concerning them. Methods employing sodium compounds are described as are those employing magnesia compounds, sulphur, sulphur dioxide and sulphuric acid. Details are given of typical by-product production from a UK 2000MW power plant - which is surprisingly high. Waste water from these processes can be cleaned and then re-used (recycling). (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 119-149 [in English]. 3-85457-063-5)

0633 SPRAY DRYING. [BIB-UBAA000137]

During spray drying an aqueous suspension of the absorbent (with high solid content) is injected into the hot flue gas and a dry, powdery, product is made. A diagram shows a typical plant arrangement of this type. The by-product varies according to the materials used in the spray and typical analyses are given. Continuous research is being made into methods of making the by-products of process spraying more attractive to potential customers. One possible outlet is for building materials and details are given of some work in this area. Some have been found not to be frost proof. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 150-166 [in English]. 3-85457-063-5)

0634 DRY PROCESSES. [BIB-UBAA000138]

A detailed description is given of dry desulphurization processes, which work with the addition of a dry sorbent, causing naturally dry products. There are two main modes of operation. (1) Powdered limestone is injected above the burners and its calcination is followed by sorption of SO_2. (2) The second method injects the sorbent, usually lime, after the furnace and with water or injected steam. Another method uses activated carbon to adsorb SO_2 out of the flue gas. Full details are given of these processes and the products which they produce and the main uses to which they are applied. Some typical analyses are also given. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 167-176 [in English]. 3-85457-063-5)

0635 BY PRODUCTS AND WASTE FROM DENO$_X$ PROCESSES. [BIB-UBAA000139]

Measures to limit emissions of NO_x can be divided into two groups, primary and secondary measures. The primary measures tend to decrease the formation of NO_x whereas the secondary ones have to remove from the flue gas NO_x already generated from it. Primary technologies are available for all fossil fuels and most types of firing. They are, however, unable to meet many existing regulations. Comparatively few types of secondary measures are at present available. The most common of them is selective catalytic reduction, which is described. Another type, non selective catalytic reduction is also described. Flow and other diagrams are given of all these processes. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 177-185 [in English]. 3-85457-063-5)

0636 BY-PRODUCTS AND WASTE FROM SIMULTANEOUS AND COMBINED SYSTEMS [BIB-UBAA000140]

Some processes offer the possibility of removing SO_2 as well as NO_x. These integrated systems work with the same agent for both DeSO$_x$ and DeNO$_x$ reaction or others work with two different agents. Most of these systems are only in a development or pilot stage. Diagrams are given of an ammonia-ozone process and of one employing desulphurization and denitrification and its general mode of functioning is explained. The activated carbon process employs ammonia as the reacting agent and is a dry working system and uses a moving bed of activated carbon, loaded with sulphuric acid. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 186-188 [in English]. 3-85457-063-5)

0637 BY-PRODUCTS AND WASTE FROM FLUIDISED BED COMBUSTION. [BIB-UBAA000141]

Fluidised bed combustion is now recognized as acceptable for a wide range of fuels and the number of plants is increasing. Figures are given for 10 countries of present tonnages of by-products and those expected in 2000. The general principles of the process are explained and a survey is given of several alternatives which are available. The types of by-products produced are described and some typical analyses of them are given. Details are also given of possible uses for the by products from fluidised bed combustion (and they are considerable). Some of the particular advantages and disadvantages of these by products are given. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From*

Fuel Treatment and Combustion., Vol. 4, pp. 189-213 [in English]. 3-85457-063-5)

0638 BY-PRODUCTS AND WASTE FROM GASIFICATION PROCESSES. [BIB-UBAA000142]

Figures are given, for 10 countries, of by-product amounts from gasification projects now, and in the year 2000. Germany is the sole present producer and only Italy and the Netherlands are likely to join them by 2000. The present state of this technology is described, with details of possible effluents. These effluents can be complex and full details are given of those known to date. They come as solids, liquids and sludges. Details are given for some possible uses for by-products of the processes, and they are considerable. A detailed comparison is given of the Lurgi, Catalytic wet air oxidation and conventional processes. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 214-233 [in English]. 3-85457-063-5)

0639 BY-PRODUCTS FROM MUNICIPAL WASTE COMBUSTION. [BIB-UBAA000143]

This is a very comprehensive paper which covers most aspects of products from municipal waste combustion. The first part covers flue gas treatment, wet, quasi wet, and dry. The flow of the waste combustion is outlined and its general nature is described. Detailed analyses are given of some typical by-products from these activities and a separate treatment is given to residues from the treatment of flue gas, their analyses and uses. The differences in residues from dry and quasi dry processes are given. Comparisons are made between the environmental impact of municipal incineration and that from industry and the outlets for by products. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 234-272 [in English]. 3-85457-063-5)

0640 LEGAL INSTRUMENTS. [BIB-UBAA000144]

This paper summarizes the more important legislation in force in a number of countries in regard to emissions from plants of many types. The countries concerned are Austria, Canada, Germany, Finland, Italy, Netherlands, Sweden. United Kingdom, United States of America. There are considerable variations in many of the standards established. The future output of by-products is difficult to forecast. As standards of cleanliness increase, their amount will also increase, but efforts will also be made to avoid waste being created, and requiring dumping. Further uses may be found for products at present dumped. There is also need for further international co-operation. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 273-300 [in English]. 3-85457-063-5)

0641 CONCLUSIONS AND RECOMMENDATIONS. [BIB-UBAA000145]

The important future feature is the fact that increasing standards for combustion wastes also increase their quantity. Up to the year 2000, estimates are for increases of 15 percent from oil (petroleum) and gas treatment, 200 percent from FGD, 50 percent from conventional combustion, 60 percent from FBC and 20 percent from urban wastes. Adequate by-product management will be increasingly important and this should result in greater use of by-products and less dumping. The future is also bound up somewhat with development of existing processes and the possible development of new ones. An integrated approach to all these matters is recommended and the effects of long term possibilities of pollution (leaching) need watching. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1991), Appears in: *By-Product Utilisation and Waste Management From Fuel Treatment and Combustion.*, Vol. 4, pp. 301-307 [in English]. 3-85457-063-5)

0642 CONTRIBUTIONS OF WASTEWATER AND RECYCLING TECHNOLOGY TO LOW-POLLUTION PLATING TECHNOLOGY AND METAL CHEMISTRY. [BIB-UBAA000150]

Relevant aspects of the Water Conservation Regulations 1986, the advisory regulations H 765, H 752 and H 758 produced by the Wastewater Engineering Union ATV, and Appendix 40 of the Waste water Management Regulations, are outlined, discussing their coverage and application. The requirements and possibilities for recycling of process chemicals and materials are discussed. Particular problem areas are the treatment of AOX compounds, metal precipitation from concentrated solutions, and EDTA elimination. Suggestions for meeting the strict guidelines are made, and the types of processing equipment available are considered. (Hartinger, Ludwig; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Fachtagung zum Branchenkonzept Galvanik*, Vol. 7, pp. 13-24 [in German]. 3-85457-103-8)

0643 CURRENT DEVELOPMENTS IN WASTEWATER-FREE AND LOW-WASTE PROCESSES IN METAL FINISHING AND METAL CHEMISTRY - THE ANSWER OF MARKET ECONOMICS TO ENVIRONMENTAL REQUIREMENTS. [BIB-UBAA000151]

The use of optimized metal finishing processes, involving regeneration of process chemicals, and the reduction of water usage, leads to lower costs as well as reducing waste and pollution. Recent developments in techniques for water and chemical saving, increasing the useful life of process solutions by reclaiming chemicals, and the reduction and treatment of waste water, are described. Areas for potential future developments include energy saving and water saving measures, development of new types of electrolyte, and heat conservation, prompted by rising costs and increased legislation. (Lieber, Hans-Wilhelm; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Fachtagung zum Branchenkonzept Galvanik*, Vol. 7, pp. 25-32 [in German]. 3-85457-103-8)

0644 CURRENT DIRECTIVES FOR THE AVOIDANCE AND DISPOSAL OF WASTE FROM METAL FINISHING PROCESSES. [BIB-UBAA000152]

Possible methods of dealing with waste are discussed, with examples of techniques, and indications of suitable processes and recoverable substances. The amount of waste can be reduced by preventing loss of process fluid from the bath, and by extending the working life of the bath. Waste treatment within the process includes concentration and regeneration of partial streams. Outside the process, nonferrous metals can be recovered from the process bath. Electrolyte recovery of non-ferrous metals, and recovery of usable concentrates and sediments are also possible. The conditions required, such as composition of the process bath, are discussed. (Bosse, Klaus; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Fachtagung zum Branchenkonzept Galvanik*, Vol. 7, pp. 33-44 [in German]. 3-85457-103-8)

0645 AVOIDANCE - THE ALTERNATIVE TO WASTEWATER TREATMENT PART A: THE CURRENT STATUS OF WASTEWATER TREATMENT IN METAL PROCESSING. [BIB-UBAA000153]

The current techniques of wastewater processing in the metal finishing industry are described, explaining their operation, applications, advantages and limitations. Measures for reducing drag-out from the rinsing bath, water-saving rinse processes including ion-exchange cycles and cascade processes, recycling processes such as ultrafiltration, ion-exchange for the regeneration of certain metal ions, vaporization, volatilization and electrolysis, are discussed. An example of a Zn plating operation is used to explain the possibilities offered by a combination of water-saving rinsing and recycling processes. (Hasler, J.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Fachtagung zum Branchenkonzept Galvanik*, Vol. 7, pp. 45-64 [in German]. 3-85457-103-8)

0646 AVOIDANCE - THE ALTERNATIVE TO WASTEWATER TREATMENT PART B WHAT DO METAL FINISHING COMPANIES ACHIEVE IN THE WAY OF FINISHING QUALITY, ENVIRONMENTAL-FRIENDLINESS AND ECONOMY? [BIB-UBAA000154]

Electroplating to produce a protective layer on surfaces, is an important part of the manufacturing process. The process is economical with plating materials as only a very thin layer is deposited, so environmental improvements are concentrated on reducing emissions in order to conform to the new regulations. The first step is the selection of a suitable electrolyte for optimum functioning. Contamination of the plating bath, and drag-out of the contents must be minimized. A rinsing system should enable recovery of the electrolyte, and equilibrium of the water balance. Water quality is an important factor. Chemical rinsing,

such as the Cyanide-Lancy system, produces good results. Improvements in techniques are discussed, with examples of processes and their applications. (Hasler, J.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Fachtagung zum Branchenkonzept Galvanik*, Vol. 7, pp. 65-84 [in German]. 3-85457-103-8)

0647 THE CONTRIBUTION OF SPECIALIST FIRMS TO METAL FINISHING AND METAL CHEMISTRY LOW IN HARMFUL SUBSTANCE PRODUCTION. [BIB-UBAA000155]

Legislation such as the Water Conservation Act requires the metal finishing industry to address the problems of avoiding and reducing waste. Processes and techniques for recovering bath contents, improving rinsing methods, waste concentration, utilization of non-restorable substances, and waste disposal are explained, with examples of applications. Suggestions for approaches to the problems are made. (Meyer, Walter; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Fachtagung zum Branchenkonzept Galvanik*, Vol. 7, pp. 85-102 [in German]. 3-85457-103-8)

0648 CURRENT SITUATION IN SWITZERLAND FOR THE AVOIDANCE, UTILIZATION AND DISPOSAL OF EMISSIONS AND WASTE FROM PLATING PROCESSES. [BIB-UBAA000156]

An estimated 250 firms use electroplating processes in Switzerland, belonging to a variety of professional associations. The aims and tasks of the PUK (Commission for Equality of Environmental Protection)/ are set out, and Swiss legislation for waste management is outlined, covering regulations on environmental protection, air quality, transport of waste, water pollution and treatment of hazardous materials. The main findings of studies investigating waste management in Switzerland are reported, giving a picture of political, scientific, technical and economic principles and aims and waste treatment. Examples of case studies are shown. A working group also investigated waste produced by the electroplating industry, and the protective measures being taken. The trend of future legislation and the current situation, are discussed. (Tschiri, Anna; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Fachtagung zum Branchenkonzept Galvanik*, Vol. 7, pp. 103-120 [in German]. 3-85457-103-8)

0649 GUIDELINES FOR THE METAL FINISHING INDUSTRY. [BIB-UBAA000157]

Reductions in waste water pollution levels are being called for, but should not lead to increases in other types of waste. The problem is determining the permissible concentration limits. Computer models have been used to calculate costs and results of wastewater treatments in various situations. These show that metal finishing operations can achieve wastewater levels of 50 kg/year (200 g/day) or less total heavy metals. (Ros, J.P.M; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Fachtagung zum Branchenkonzept Galvanik*, Vol. 7, pp. 121-122 [in German]. 3-85457-103-8)

0650 PROGRESSIVE CASE STUDIES FROM INDUSTRIES AND FACTORIES IN HOLLAND. [BIB-UBAA000158]

Projects initiated by VOM, the Netherlands association for surface technology, concerned with environmental management, are discussed. The Prisma project 'Prepare', is a research and demonstration project to develop a methodical approach to waste minimisation. The advantages and disadvantages of the process are listed. A project on the control of environmental problems in the metal finishing industry aimed to develop and test a process for establishing preventative measures and internal environmental protection measures, starting from a technological standpoint, and involving the use of check lists and flow diagrams. Two projects concerned partial stream purification, firstly a study to explore the possibilities, and secondly a study of the deposition and reuse of Zn (mono) (zinc) sludge. (Motier, J.W.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Fachtagung zum Branchenkonzept Galvanik*, Vol. 7, pp. 123-134 [in German]. 3-85457-103-8)

0651 RECYCLING TECHNOLOGIES AND MEASURES FOR THE INTRODUCTION OF A WASTE BATTERY UTILIZATION SCHEME IN AUSTRIA [BIB-UBAA000159]

This problem has been discussed both publicly and by experts for a considerable time. It is estimated that, at least, 76 million batteries or 2,600 tons are sold per year in Austria i.e. some 10 per head per year. The heavy metals components in 1988 amount to 6 - 8.5 t of Hg, 38 t of Cd and 335-440 t of Zn. The Hg component will decrease with time but probably not for Cd and Zn. Only some 20 percent of these batteries are collected voluntarily and exported to the (former) East Germany the rest is deposed of by landfill, incineration or composting. The use of waste batteries by recycling is environmentally desirable as present practices cannot continue. Guidelines on waste management state that utilization should have priority over disposal. This, however, needs to be supported by a high collection rate. Processing of waste batteries would not be self-financing. The aim of this report is to analyze the technical possibilities of waste battery utilization and establish measures in draft form for a recycling plant in Austria in accordance with the principles in the "Guidelines for Waste Management in Austria" 1988. This has resulted in the development of the ECO-Deposit Model for batteries which is described in outline. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Vol. 16, pp. 139 [in German]. 3-85457-041-4)

0652 THE MATERIALS CONTAINED IN APPLIANCE BATTERIES AND THEIR FUNCTION [BIB-UBAA000160]

The following types of batteries are listed and the basic chemical reactions occurring in them are outlined: Zn-C, Alkali-Mn, Ni-Cd, HgO, AgO, Zn-air and Li batteries. Some of these cells contain small quantities of K and trace amounts of Pb. It should be noted that Zn-air batteries are only used when a fairly small continuous supply of power is required, such as hearing aids. Once these cells are put into operation they continue to discharge even if they are supplying no power. There is some discussion of the processes occurring in these batteries. (Müllebner, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. iii-vi [in German]. 3-85457-041-4)

0653 PRESENT MEASURES FOR REDUCING THE RELEASE OF HARMFUL SUBSTANCES FROM BATTERIES AND REDUCING THE CONTAMINATION OF HOUSEHOLD RUBBISH BY BATTERIES [BIB-UBAA000161]

The endeavour to reduce the Hg content of batteries has led to the development of a new generation of batteries with reduced Hg content e.g. the alkali-Mn, AgO, Zn-air and Li cells. In addition to this development work the organization effort involved is given in the voluntary Austrian "Agreement on the reduction of dangerous materials and the management of waste batteries", the "Agreement on the waste management of waste batteries from Germany", from Switzerland the decree on materials and the European Community "Proposal for guideline advice on the hazardous materials content of batteries and accumulators". These agreements and guidelines are tabulated and discussed. (Müllebner, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. vii-x [in German]. 3-85457-041-4)

0654 FUTURE DEVELOPMENTS (ZUKUNFTIGE ENTWICKLUNG) [BIB-UBAA000162]

An increase in the use of batteries is expected but with the following changes: an increase in the proportion of alkali-Mn cells at the expense of Zn-C cells; an increase in the proportion of Ni-Cd rechargeable cells at the expense of the primary cells and an increase in the proportion of AgO, Zn/O_2 - and Li/X - systems with respect to the HgO cells. The Hg content in all batteries will be reduced. It is considered that the use of Zn will remain steady or increase, the use of Hg will decrease strongly and the use of Cd will increase strongly. In addition, it is recommended that the Li-based batteries should not be disposed of in household rubbish as Li reacts vigorously with water and may lead to a fire

hazard. (Müllebner, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. xi-xii [in German]. 3-85457-041-4)

0655 THE WASTE MANAGEMENT POSSIBILITIES FOR BATTERIES AND THE ENVIRONMENTAL CONSEQUENCES. [BIB-UBAA000163]

Two scenarios are discussed; firstly, the case when the waste batteries are mixed in with the household rubbish and, secondly, when they are treated separately. The content of hazardous materials in household rubbish is listed; this includes paints and varnishes, lacquers, dyes, discharge lamps, Hg thermometers, UV lamps, dentists materials, household chemicals, etc. Figures are given for Germany and also for Vienna, Austria in particular. The total heavy metals content in household rubbish is quoted as: Zn, Hg, Cd and Ni as 2000, 2.5, 10 and 320 gm/ton respectively. The behavior of waste batteries when dumped with household rubbish is compared with that when the rubbish is burned (incineration) and when composted (landfill/composting). When batteries are treated separately the following cases are considered: the deposition of conditioned and untreated batteries in special dumps and the recycling of the waste batteries. Figures are tabulated for recycling costs and quantities involved at units in six countries. (Müllebner, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. xiii-xxii [in German]. 3-85457-041-4)

0656 MEASURES FOR THE ENVIRONMENTALLY FRIENDLY MANAGEMENT OF WASTE BATTERIES [BIB-UBAA000164]

The basic aims are: reduction in the absolute quantity of waste; recycling of waste materials; a reduction of the problem materials in the waste and a return of the unusable waste to the environment in a form having little or no effect. The measures include the characterization of all batteries with information to the user on the battery content; an obligation on the customer to return the batteries and an obligation for the trade to accept the return. Measures for assuring a high return quota are considered. The way in which these measures can be controlled are outlined and the relevant public relations work is discussed. (Müllebner, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. xxiii-xxvi [in German]. 3-85457-041-4)

0657 THE SHAPE AND CHEMICAL SYSTEMS OF BATTERIES [BIB-UBAA000165]

The possible subdivision of battery types is outlined. The main sections are the primary or dry batteries which are non-rechargeable and the secondary batteries or accumulators which are all rechargeable. Batteries can also be divided into sections relating to their application as follows: appliance batteries, use primary and secondary batteries; starter batteries in motor vehicles; nearly all Pb-acid accumulators; traction batteries, electrically driven vehicles, exclusively Pb-acid accumulators; stationary batteries, e.g. in emergency power supplies, Pb-acid or Ni-Cd accumulators. The internal construction of a typical cylindrical appliance battery and a typical flat battery are illustrated. The naming of battery types is briefly considered. (Goldschmid, Gerald; Mayr, Johann; Vogel, Gerhard; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. 3-7 [in German]. 3-85457-041-4)

0658 THE CHEMICAL SYSTEM OF BATTERIES. [BIB-UBAA000166]

The shape, capacity in Ah, energy density in mWh/gm, the voltage per cell and the operating temperature range are tabulated for eight types of battery. Construction details with materials are illustrated for the cylindrical C-Zn (Leclanche) battery, the Alkali-Mn battery, and also for the HgO, AgO and Zn-air button batteries. Various types of Li battery, some of which are not particularly well known, are briefly described. The discharge characteristics of a number of these primary batteries are given. The Ni-Cd secondary battery is described more fully and its discharge characteristics compared with the Alkali-Mn battery. The Pb-acid accumulator is very briefly mentioned and other little known primary and secondary batteries are listed. (Goldschmid, Gerald; Mayr, Johann; Vogel, Gerhard; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. 9-20 [in German]. 3-85457-041-4)

0659 NEW DEVELOPMENTS IN APPLIANCE BATTERIES [BIB-UBAA000167]

The further development of appliance batteries is concentrated particularly on the reduction of Hg in Alkali-Mn batteries and the production of a Hg-free C-Zn battery in the area of Li batteries a 1.5 V cylindrical cell will be made. Five of the largest battery manufacturers have the following new products for 1989: Alkali-Mn batteries with greatly reduced Hg content and Hg-free C-Zn batteries. Duracell and Ucar have produced a 1.5 V Li-battery for 1989. A Ni-hydride secondary battery system is being developed by Varta and Panasonic. There is a special development in the U S Department of Energy on synthetic material batteries. (Goldschmid, Gerald; Mayr, Johann; Vogel, Gerhard; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. 21-23 [in German]. 3-85457-041-4)

0660 AN INTERNATIONAL COMPARISON OF THE MARKET FOR BATTERIES [BIB-UBAA000168]

Information is given on market volume, market share and the development tendencies in Austria, Germany, Netherlands, Switzerland, Denmark, Sweden, United States of America and Japan. The consumption in batteries per person per year in 1987/88 range from 7.6 in the BRD to 8.8 in Switzerland and 29 in Japan. Details are given for the total number and total weight and cost/kg in Austria for primary batteries in the years 1985-87 under the headings of import, export and domestic consumption. Some details are also given for the various types of battery in 1988. Similar, but less detailed information, is given for Germany, Switzerland, Netherlands, Denmark, Sweden, Japan and the USA. The development tendencies of the international market are briefly discussed. The main points being the increasing share of the Alkali-Mn batteries at the expense of the C-Zn batteries and the reducing cost of the Ni-Cd accumulators. This is leading to an increase in the Ni-Cd share at the expense of the primary batteries. In the case of button batteries the Zn-air and Li systems share is increasing at the expense of the Zn-AgO systems and Zn-HgO systems. (Goldschmid, Gerald; Mayr, Johann; Vogel, Gerhard; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. 24-36 [in German]. 3-85457-041-4)

0661 THE MATERIALS IN BATTERIES AND THEIR HEAVY METAL CONTENT. [BIB-UBAA000169]

Details are tabulated for 1984 in Austria with respect to 10 types of batteries giving numbers and weights in tonnes for Zn,Hg, Pd and Cd. The total weights for these metals are 302, 3.81, 1.05 and 19 respectively. A more detailed comparison is made for the Ni-Cd and Alkali-Mn batteries in 1988. Information is given on Hg, Cd, Ni and Zn content for 1988 in Austria and a limited comparison is made between 1984 and 1988 for these metals. (Goldschmid, Gerald; Mayr, Johann; Vogel, Gerhard; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. 37-42 [in German]. 3-85457-041-4)

0662 AN INTERNATIONAL COMPARISON OF THE BASIC LAWS AND VOLUNTARY AGREEMENTS FOR THE WASTE MANAGEMENT OF BATTERIES [BIB-UBAA000170]

The section on Austria is treated in considerable detail. The present legal position can be summarized in that, for the particular regions where the laws apply, waste battery management is covered by: key numbers 35323 Ni-Cd-accumulators, key numbers 35324 Hg-batteries, key numbers 35325 dry batteries (containing Hg and Ag). The voluntary agreements are quite far reaching and include the development of low levels of harmful materials in batteries by the manufacturer and a reduction of Hg content in Alkali-M batteries to less than 0.1 percent by 1993; marking of batteries with a recycling symbol, 150:7 000 Reg No.1135 and other restrictions including separate collection of waste batteries. A further set

of regulations for Vienna itself are detailed. The regulations in Germany, Switzerland, Netherlands, Denmark and Sweden all have essentially the same objectives. The EEC Commission for European Environmental Developments has also laid down similar guidelines. In Japan there are no legal obligations on collection or usage of batteries but there are voluntary agreements. Similarly in the United States of America there are no legal guidelines by the state but there are some local regulations. (Goldschmid, Gerald; Mayr, Johann; Vogel, Gerhard; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. 43-62 [in German]. 3-85457-041-4)

0663 AN INTERNATIONAL COMPARISON OF COLLECTION SYSTEMS [BIB-UBAA000171]

Recycling began in Austria in 1981 for button batteries. Total weights of batteries collected between 1980 and 1986 are tabulated the overall weight being 478.8 tons. The collections in Vienna alone rose from 1 t in 1985 to 144 t in 1988. For the whole of Austria it rose to 507 t in 1988. In Germany, collections in the years 1980 to 1983 were somewhat variable. In Switzerland, since the Swiss materials regulations, there has been an obligation to return button cells. The collection quota is now 20 percent for C-Zn, Alkali-Mn and Ni-Cd batteries and 80 percent for button cells. In the Netherlands 10 percent of equipment batteries are collected, 40 percent, burned (incineration) with household rubbish (urban wastes) and 50 percent deposited (landfill) with household rubbish. In Denmark, the collection quota for Copenhagen is 20-25 percent. For the whole country it is estimated to be 70-90 percent for button cells and 10-15 percent for cylindrical and flat batteries. In Sweden, the return quota is 20 percent for Alkali-Mn and 90 percent for HgO batteries in 1988. In Japan, with its voluntary system, the return quota is some 20 percent. (Goldschmid, Gerald; Mayr, Johann; Vogel, Gerhard; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. 63-76 [in German]. 3-85457-041-4)

0664 AN INTERNATIONAL COMPARISON OF PROCESSING SYSTEMS FOR BATTERIES [BIB-UBAA000172]

Studies on sorting and processing systems for batteries have been carried out in Switzerland, Netherlands and Sweden. Flow charts are given for the sorting into size and type and the outline processes for primary and secondary batteries. Processing plants in Austria, Germany, Sweden, France, and Japan are described in reasonable detail. The Austrian plant by VOEST is described with flow charts showing the initial segregation into button cells and consumer batteries which are then processed separately. Operational problems and future developments are considered. The German plant by Aloin and Frankenbach GMBH is very briefly described. The ETH plant in Sweden is for button cells and small batteries. Rudimentary flow charts are given. The MRT mercury recovery technology system in Sweden is essentially a distillation plant. The SAB-NIFE plant is for the processing of Ni-Cd batteries including button cells. The French firm SNAM has a plant for processing Cd from the waste produced by Ni-Cd battery manufacture as well as waste Ni Cd batteries. Japan has a plant by CJC for processing Hg-containing waste and, also, another by Sumitome for Hg batteries. It is noted that there are no plants in Europe for the processing of Hg batteries in continuous operation. There are two plants for processing Ni-Cd batteries, one in Sweden and in France. Both are operational. (Goldschmid, Gerald; Mayr, Johann; Vogel, Gerhard; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. 79-119 [in German]. 3-85457-041-4)

0665 AN ASSESSMENT OF THE COLLECTED DATA AS A BASIS FOR A PROPOSED SOLUTION OF THE BATTERY PROBLEM IN AUSTRIA [BIB-UBAA000173]

Appliance batteries with the same appearance may have different electrochemical systems. While identification of the battery system is possible it may be difficult for the lay person. New developments are concentrated on removing Hg from the C-Zn batteries and greatly reducing it in the Alkali-Mn batteries as well as improving the Li systems. Austria uses 76 millions batteries per year or 2,600 tons. Other relevant factors are the increase in market share by Alkali-Mn and Ni-Cd batteries at the expense of C-Zn batteries and the HgO button cells are being replaced by Li, Ag and Zn-air systems. There is a waste battery collection system either by law or voluntary agreement in all the countries considered. A deposit system is being considered in most of these countries. There is restricted import of dangerous batteries in Sweden and Denmark. Collection systems are discussed and also return systems. There is no large processing plant for Hg batteries in Europe operating at the moment. There are two plants for Ni-Cd. It is suggested, from an examination of this data, that a solution to this environmental problem should be approached by a study of the ECO-DEPOSIT Model for batteries and appliances with built-in batteries which has already been outlined in this report. (Goldschmid, Gerald; Mayr, Johann; Vogel, Gerhard; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1989), Appears in: *Recyclingtechnologien fuer Altbatterienverwertungsverfahrens in Oesterreich*, Vol. 16, pp. 120-125 [in German]. 3-85457-041-4)

0666 BELASTUNG VON FLIESSGEWAESSERN DURCH DIE ZELLSTOFF- UND PAPIERINDUSTRIE INOESTERREICH [BIB-UBAA000174]

This work is a result of the Austrian Parliament's request for a study to be carried out on the influence of the Austrian pulp and paper industries on aquatic ecosystems by the Federal Environmental Agency. This section, PtA, deals with "Technology and Emissions". Detailed descriptions are given on the international status of the technology for reducing the pollution by the paper and pulp industries. The main thrust of the review is on the various methods of bleaching, including the sulphite and sulphate processes, the chlorine based bleaches and the oxygen, ozone and nitrogen dioxide alternatives. Biological methods, both aerobic and anaerobic, are described. Details are given by 38 Austrian companies on the quantities and quality of their effluents and their abatement strategies for 1988 and predictions up to 1993. Emissions should be reduced by the use of oxygen delignification and biological treatment. The latest technology is not considered. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (December 1989), Vol. 17a, pp. 240 [in German]. 3-85457-045-7)

0667 STATISTICAL OVERVIEW OF THE EFFECTS OF THE PULP AND PAPER INDUSTRY IN EFFLUENTS [BIB-UBAA000175]

The most important parameters characterizing the effluents are: filterable material, for all fibre residues; BSB_5, the biological oxygen requirements (BOD) of microorganisms with the breakdown of organic substances in five days; CSB, the chemical oxygen requirements (COD) with a strong oxidizing medium; AOX, an active charcoal absorber organically bound halogens, e.g. chlorine. The cellulose and paper production in Austria and the total effluent is described. In 1988 2,650,000 t of paper, machine cartons, (boxes) and cardboard were produced in Austria and 75 percent was exported. Production and effluent emission from all Austrian firms for 1988 are shown in detail on bar charts as well as predictions for 1993. Measures for reducing the effluents are outlined. (Danzer, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. iii-xviii [in German]. 3-85457-045-7)

0668 MEASURES WITH CELLULOSE PRODUCTION. [BIB-UBAA000176]

Measures taken to reduce the contamination with cellulose and paper production are described in reasonable detail. This includes the reduction of the lignin content by bleaching processes, the so-called "cooking" process, the acid sulphite process and alkaline sulphate process. Recycling of the chemicals used is discussed and a flow chart is given. Processing of the cellulose is described, in particular, the washing, drying and sorting processes and the criteria involved. Details are given on the effects of bark removal from the wood. (Danzer, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 1-30 [in German]. 3-85457-045-7)

0669 PRODUCTION OF WOOD PULPS [BIB-UBAA000177]

There are two main processes used in the production of wood pulps; firstly, by the use of a rotating grindstone, producing the so-called "groundwood" and, secondly, a new process producing "pressurized groundwood". Refining proc-

esses are described, producing refined mechanical pulp and thermomechanical pulp as well as chemi-thermomechanical pulp. Energy consumption requirements are given and a section on bleaching. The contamination produced by each of these processes is tabulated in terms of BSB and CSB in kg/t. The bleached pulps produce appreciably more effluent than the unbleached. (Danzer, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 31-37 [in German]. 3-85457-045-7)

0670 HALFCELLULOSE [BIB-UBAA000178]

Halfcellulose takes a median position between mechanical woodpulp and cellulose. It can be divided into groups with different yields: highyield cellulose (yield 50-65 percent) after the bisulphite or sulphate processing, used for newspaper printing; halfcellulose (yield 65-85 percent) after the bisulphite or neutral sulphite process, used for cartons, (boxes), cardboard, etc.; highest yield cellulose (yield 85-90 percent) after the bisulphite, neutral sulphite or cold alkali-processes, used for woody printing paper. The neutral sulphite semi-chemical process is discussed and integration of the various processes for paper and cardboard production can produce a tolerable level of water pollution particularly if waste paper is incorporated. (Danzer, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 38-39 [in German]. 3-85457-045-7)

0671 WASTE PAPER [BIB-UBAA000179]

The reuse of waste paper is shown to be a very worthwhile procedure. It has been done for at least 10 years and it is noted that toilet paper and newspaper contain some 50 percent waste paper. An accompanying development with the use of waste paper is in the recycling of adhesives, coloured printing inks lacquers and films, etc. In 1988 about 1 million tons of waste paper was used in Austria, 56 percent being imported and 44 percent from domestic collection. The actual processing of the waste paper is outlined, the main stages being suspension, cleaning and improving. The last process is bleaching. (Danzer, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 40-43 [in German]. 3-85457-045-7)

0672 PAPER PRODUCTION EFFLUENT LOAD [BIB-UBAA000180]

Paper is produced from raw fibre material and auxiliary materials such as lime, filling materials, colouring and various chemical reagents. The fillers are kaolin, $CaCO_3$ and talcum. The main processes and the water circulation in paper production are outlined. The fibro-material is normally held in aqueous suspension and the wood pulp is mixed with the processed waste paper. The material is passed through various sieves which separate the materials for particular applications. The separated materials pass into the pressing sections, producing sheets which are then dried. Flow charts are included. The effluent load produced by each type of paper is tabulated. (Danzer, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 44-59 [in German]. 3-85457-045-7)

0673 CELLULOSE BLEACHING [BIB-UBAA000181]

The basis of cellulose bleaching is outlined. The fibres, as described in section 1, are coloured ranging from a light cream for mechanical wood pulp to dark brown for sulphate cellulose. A large part of the production goes into unbleached usage for cardboard, corrugated cardboard, paper sacks, packing paper, etc A larger part is bleached for producing white paper and cardboard products. Lignin removal bleaches are Cl_2, QCl^-, ClO_2, O_2 and O_3. Lignin modifying bleaches are: reduction bleaches with SO_3^- - and $S_2O_4^-$-; oxidative bleaches with H_2O_2; organic peroxides. Two criteria are introduced: the Roe number, the quantity of Cl_2 gas in grams absorbed by 100 g of wet cellulose in 15 mins at 20 °C and the Kappa number being the number of millilitres of 0.1 N permanganate solution which will reduce 1 g of cellulose under standard conditions. The degree of bleaching is obtained from a measurement of light reflection. A short history of the development of the chlorine bleach is included. (Hruschka, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 65-71 [in German]. 3-85457-045-7)

0674 CELLULOSE BLEACH CONTAMINATED EFFLUENTS [BIB-UBAA000182]

A general picture of the effect of chloro-organic compounds is outlined. Cellulose bleach is the main source of contamination with heavy decomposition compounds, especially by the chlorine in the latter. The quantities of these compounds will depend on the residual lignin content of the cellulose. It appears that the number of organic compounds in the bleach effluent which have been identified to date is about 300. The various fractions of this are discussed. Some 75 percent of the effluent from the conventional sulphate-cellulose bleach contains organic chlorine with molecular weights over 1000. This is followed by some clarification of the AOX.TOCl parameters which refer to the absorption of organically bound chlorine and the total organic chlorine. A section is included on chlorinated dioxine and furane and another on the colour of the effluent. (Hruschka, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 72-80 [in German]. 3-85457-045-7)

0675 REDUCING CHLORINE CONTENTS [BIB-UBAA000183]

The main reason for using chlorine and chlorine compounds for bleaching is largely because they are highly selective against lignin and are cheap. Their usage can be reduced in three ways: (1) by reducing the lignin content by means of so-called "soft cooking"; (2) replacement of chlorine and hypochlorite by chlorine dioxide; (3) by the use of oxygen bleaching agents (elementary oxygen, peroxide and ozone). With the introduction of an alkaline extraction-oxygen step, one part of the bleaching operation can be moved to the extraction area, thus removing one bleaching step. (Hruschka, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 81-91 [in German]. 3-85457-045-7)

0676 NEW DEVELOPMENTS AND PILOT PROJECTS [BIB-UBAA000184]

Ozone and nitrogen dioxide are discussed briefly. Ozone has been used since the end of the 18th century, particularly in the textile industry. Since 1981 in the Austrian Wood Research Institute and other places it has been shown that, with a suitably fast flow of ozone over the fibres, a reaction can be established at low material density. A process has been developed and patented by Waagner-Biro. Similarly, a process has been developed for nitrogen dioxide under the name "PRENOX" by the firm SUND. Various pilot projects in Austria are described together with the work undertaken by a consortium of eight Austrian firms. A pilot plant has been proposed for the oxygen, peroxide, ozone and nitrogen dioxide bleaching techniques. The project costs are 121.1 M.ÖS Operation was planned for the end of 1990. (Hruschka, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 92-94 [in German]. 3-85457-045-7)

0677 REDUCING ORGANIC CHLODIDE COMPOUNDS [BIB-UBAA000185]

Developments are described particularly in Germany, Sweden, Finland, Norway and Canada. In Germany there are 24 recommendations for reducing emissions. The Swedish section shows the huge reduction in TOCl/t of pulp from 8 kg/t in 1975 to 1.6 - 2.0 kg/t by 1990-92. Similarly, in Finland large reductions had been achieved by 1992 and further improvements are scheduled for 1995. Norway emissions were reduced by 80-90 percent between 1974 and 84. Further reductions are planned. In Canada, which has an especially high production of wood pulp and cellulose, there were no state regulations in 1988. The provinces had so-called "Control Orders". The relevant fisheries law 1971 is revised and, in June 1988, infringement carried severe penalties. The emissions in Austria are tabulated and presented in graphs. (Hruschka, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 96-116 [in German]. 3-85457-045-7)

0678 REDUCING EFFLUENT LOADS [BIB-UBAA000186]

General comments are made on defining internal and external measures. Internal relates to processes directly coupled to production and quality. External measures are not coupled to production processes. The general division of the types of external purification relates to whether the purification is by microorganisms or by chemical—physical methods. Details are given on the properties of the effluents from cellulose and paper production. (Fleckseder, H.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 117-119 [in German]. 3-85457-045-7)

0679 EFFLUENT TREATMENT [BIB-UBAA000187]

Methods of separating the solid effluent content are outlined; these include separation by support methods i.e. by the use of flock, deposition under gravity and flotation aided by small air bubbles and, finally, by filtration. In addition, methods of precipitating colloidal solutions are discussed. This is followed by a section on adsorption and on membrane processes. Wet oxidation is also considered. (Fleckseder, H.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 120-123 [in German]. 3-85457-045-7)

0680 BIOLOGICAL EFFLUENT PURIFICATION. [BIB-UBAA000188]

Aerobic purification has been used in North America since the end of the 1950s, in central Europe since the middle of the 1950s and in Germany, Austria and Scandinavia since the middle of the 1980s. Various aspects of aerobic purification are considered, such as conditions for optimum growth of the microorganisms, optimum exchange rates, etc. Two variations of this process are described followed by plant layouts and discharge conditions. Anaerobic purification is discussed in reasonable detail and some comparison is made with aerobic purification. For instance the anaerobic process requires a narrower band of operating conditions than the aerobic. (Fleckseder, H.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 124-143 [in German]. 3-85457-045-7)

0681 INDIVIDUAL APPLICATIONS AND THE RESULTS OBTAINED. [BIB-UBAA000189]

Firstly, the work by Cellulose Attisholz AG, Switzerland is described. They have used an external biological effluent purification since the mid 1970s. This firm also produces cellulose from spruce and beech, using the classical Ca-sulphate method, and is the only cellulose producer in Switzerland. The output and other information is discussed in detail. The production and results for Oy Schauman AB, Jakobstad/Pietarsaari in Finland and of Hylte Bruks Sweden are also considered in detail. A shorter account is given on the performance of Gruppenklarwerk Eerbeek, Netherlands. (Fleckseder, H.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 144-150 [in German]. 3-85457-045-7)

0682 CELLULOSE AND PAPER PRODUCTION IN AUSTRIA. THE 1988 STATUS AND SHORT TERM PREDICTIONS FOR 1993. [BIB-UBAA000190]

A questionnaire on the "Effluent Situation in Austrian Cellulose, Paper, Cardboard and Carton (boxes) Industries" is presented together with an explanation. Detailed information is given on 38 Austrian firms, particularly with respect to their total production and effluent load. (Fleckseder, H.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 154-217 [in German]. 3-85457-045-7)

0683 EFFLUENT TREATMENT METHODS AND HOW THEY RELATE [BIB-UBAA000191]

A list of the production of paper cellulose, wood; pulp and paper and cartons is given for 15 Europe region countries plus Japan and the United States of America. The output of paper and cartons by the USA is some 70M t/a compared with 24.6M t/a for Japan and 57M t/a total for Europe. European production is dominated by Germany at 10.5M t/a, Finland at 8.65 M t/a and Sweden 8.16M t/a compared with Austria at 2.65M t/a. Additional sections are included on Germany and the Scandinavian countries. A final note is given on developments in and predictions for Austria. (Fleckseder, H.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (Dezember 1989), Appears in: *Belastung von Fliessgewaessern durch die Zellstoff- und Papierindustrie in Oesterreich*, Vol. 17a, pp. 218-238 [in German]. 3-85457-045-7)

0684 LAWS AND REGULATIONS IN FLUID AND SOLID WASTE TREATMENT. (GESETZE UND RICHTLINIEN FUER DEN ABWASSER- UND ABFALLBEREICH.) [BIB-UBAA000193]

Laws and regulations for liquid waste and solid waste treatment in Austria, Germany and Switzerland are presented and discussed. A differentiation between the recovery of liquid waste of surface treating plants and the deposition of waste is made. Essential indices are mentioned. (Danzer, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1991), Appears in: *Verwertung und Behandlung von Abfaellen aus der Galvanotechnik*, Vols. A and B, pp. A1-A18 [in German]. 3-85457-071-6)

0685 ELECTROPLATING WASTE IN THE AUSTRIAN WASTE DATA ASSOCIATION. (ABFAELLE AUS DER GALVANOTECHNIK IM OESTERREICHISCHEN ABFALLDATENVERBUND.) [BIB-UBAA000194]

The Austrian Waste Data Association was founded in 1990 to monitor the location of hazardous waste. It is headed by the Federal Environment Office and based on the waybill system for dangerous waste. In February 1991 the range of dangerous waste was widened. From this time all electroplating sludges have had to be registered by waybill. The key numbers of electroplating waste, the corresponding amount from 1986 to 1991 and the export figures are given in figures and tables. (Danzer, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1991), Appears in: *Verwertung und Behandlung von Abfaellen aus der Galvanotechnik*, Vols. A and B, pp. A19-A30 [in German]. 3-85457-071-6)

0686 SURVEY OF ENVIRONMENTAL MEASURES AT ELECTROPLATING WORKS. (UMFRAGE ZU UMWELTSCHUTZMASSNAHMEN BEI GALVANIKBETRIEBEN.) [BIB-UBAA000195]

In 1987 Austrian companies were surveyed about their environmental measures. The survey was initiated by the Federal Guild of Metallurgical Professions in cooperation with the Austrian Ecology Fund. The answers were only partly evaluated and passed on to the Federal Environment Office. These answers are the only source of information on the structure of Austrian companies and the recycling and waste disposal measures employed in them. (Danzer, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1991), Appears in: *Verwertung und Behandlung von Abfaellen aus der Galvanotechnik*, Vols. A and B, pp. A31-A36 [in German]. 3-85457-071-6)

0687 SMELTING AND REFINING OF ELECTROPLATING RESIDUES BY NON-FERROUS METALLURGY. (VERHUETTUNG UND RAFFINATION VON RUECKSTAENDEN AUS DER GALVANIK DURCH DIE NICHTEISEN(NE)-METALLURGIE.) [BIB-UBAA000196]

The smelting processes of non-ferrous metallurgy, especially in the Cu, Zn and Pb industries, have a long tradition of reprocessing and recycling waste materials from intermediate products. The toxicity of the elements such as Pb, Cd and Hg is known and it is possible that residues may have high metal contents (higher than in basic mineral materials) which can be made useable by classical secondary raw material recycling. Non-ferrous metal waste belongs to the traditional secondary raw materials with significant price dependence. Optimized material recycling as a common objective of smelting, reprocessing and recycling should increase in importance. Accordingly the extractable metals such as Al, Cu, Zn, Pb and Sn can be recovered from metal-containing solid or dust or sludge residues of all kinds including slags, ashes, filter dusts, salts, sands and other process residuals, thus sparing the environment, saving dumping space and conserving natural resources. (Fōrster, H.L.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1991), Appears in: *Verwertung und Behandlung von Abfaellen aus der Galvanotechnik*, Vols. A and B, pp. B19-B60 [in German]. 3-85457-071-6)

0688 EXTERNAL REPROCESSING OF LIQUID WASTE FROM ELECTROPLATING. (EXTERNE AUFARBEITUNG VON FLUESSIGEN ABFAELLEN AUS DER GALVANIK.) [BIB-UBAA000197]

The position of external disposal of liquid waste from electroplating in Austria is described. An external waste disposal policy is generally pursued by all electroplating concerns which do not possess sufficient waste treatment plant, but also when recycling is not used to its full scope. Precious metals have always been recycled, but nonferrous metals only in small quantities. Water for example has only recently been seen as a raw material. Under difficult circumstances, data were sampled and conclusions were made about the type, condition, concentration and the average amount of galvanic waste in Austria. In summary it is estimated that a change is going on with regard to waste treatment and disposal policy and signs of a drastic disposal facilities shortfall are already recognizable. Disposal costs, which have increased in the last few years by some 100 percent should be invested in reducing the amount of the resulting sludge or changing its quality to allow for easier methods of recycling the non-ferrous metals from the sludge. (Förster, H.L.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1991), Appears in: *Verwertung und Behandlung von Abfaellen aus der Galvanotechnik*, Vols. A and B, pp. B61-B90 [in German]. 3-85457-071-6)

0689 CONSOLIDATION OF ELECTROPLATING SLUDGES. (VERFESTIGUNG VON GALVANIKSCHLAMMEN.) [BIB-UBAA000198]

Avoidance and reduction of waste have priority over waste processing in the context of waste treatment and waste disposal measures. That is the reason why conventional consolidation is important and often necessary, but always the final possibility for disposal of hazardous waste, because the pollution potential is long-lasting. The solubility of an inorganic material is always a question of boundary conditions or time. Differences in the treatment of this topic in Austria, Switzerland and Germany are discussed, but a direct comparison of the legislation bases in these countries is only possible if the different starting conditions (type, amount, composition of the waste, disposal space) are taken into consideration and may be problematic or impossible in the case of the boundary data. Further the objectives and guidelines of the three countries are completely different. Some consolidation processes which use different additives are explained and their advantages and disadvantages are assessed. (Förster, H.L.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1991), Appears in: *Verwertung und Behandlung von Abfaellen aus der Galvanotechnik*, Vols. A and B, pp. B91-B149 [in German]. 3-85457-071-6)

0690 EXTERNAL REPROCESSING OF ELECTROPLATING SLUDGES BY LIQUID EXTRACTION. (EXTERNE WIEDERAUFARBEITUNG VON GALVANIK- UND AEHNLICHEN SCHLAEMMEN - RUECKGEWINNUNG VON WERTSTOFFEN.) [BIB-UBAA000199]

In conventional waste treatment and chemical physical waste treatment in all companies neutralization sludges and galvanic sludges are produced after wet-chemical or other surface treatments such as galvanization, zinc coatings, pickling, hardening, anodizing, phosphating and enamelling. These end products of surface treatment are mostly very complex, inhomogeneous sludges with very different compositions, varying metal contents, high water content and unpleasant toxic properties; however, they may also contain high value material. Disposal of these sludges would mean the loss of these materials. The study investigates different sludges for recyclability, in particular their composition (the more complex, inhomogeneous and contaminated, the more complicated and expensive are the cleaning and recycling processes), their valuable material content, their toxicity in the case of waste disposal, and the costs of disposal, reprocessing and recycling. Different technologies and processes for recycling and reprocessing are presented, new solutions are suggested and the costs of such reprocessing are estimated. (Förster, H.L.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (November 1991), Appears in: *Verwertung und Behandlung von Abfaellen aus der Galvanotechnik*, Vols. A and B, pp. B150-B265 [in German]. 3-85457-071-6)

0691 PROSPECTS FOR THE APPLICATION OF THE RECYCLING PROCESSES IN AUSTRIA. (EINSATZCHANCEN VON RUECKGEWINNUNGSVERFAHREN IN OESTERREICH.) [BIB-UBAA000200]

This chapter assesses the optimum combination of waste treatment solutions for Austria on the basis of data supplied by the Special Waste Association. An attempt is also made to estimate the treatment costs. It is shown that the costs of recycling galvanic sludges for refining nonferrous metals are already economically competitive with the costs of common extraction processes for obtaining such materials. It is suggested that there is an urgent requirement for decisions and actions to be made in Austria. At present the reprocessing and treatment options are too little used, especially the processing of solid waste from electroplating. (Förster, H.L.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (19911101), Appears in: *Verwertung und Behandlung von Abfaellen aus der Galvanotechnik*, Vols.A and B, pp. B266-B292 [in German]. 3-85457-071-6)

0692 SO_2 AND NO_X EMISSION LIMITATION IN MEDIUM SIZED FIRING INSTALLATIONS IN THE FEDERAL REPUBLIC OF GERMANY. [BIB-UBAA000202]

The requirements for limiting SO_2 and NO_x emissions in medium sized (1-50MW heat capacity) Power plants are subject to Federal German legislation and are laid out in a bulletin for the achievement of clean air (TA air). The laws distinguish between emissions for old and new plants, and the limits must be met by 1.3.94, except in the case of the newly federated eastern provinces which have until 1.7.99 to reach these limits. Eventually, the more stringent emission levels of the new plants will have to be met by the old ones. The author outlines in detail the SO_2 and NO_x figures which are presently being emitted from the different kinds of power station (gas turbines, gas, oil, petroleum and solid fuel), the measures being taken to control these toxic gases, and the pollution effects of the 5 contents of the solid fuel and heavy, light, and other oils used. In conclusion, he discussed the successes of the governments anti-pollution efforts, and concepts of how the legally set goals of TA air can be achieved. (Beckers, R.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 1-13. [in German]. 3-85457-104-6)

0693 LEGAL EMISSION LIMITS FOR FIRING INSTALLATIONS IN SWITZERLAND. [BIB-UBAA000203]

Although Switzerland has had up to date environmental laws (LRV) since the mid eighties as well as rigorous exhaust emission limits on motor cars, the condition of air pollution in the environment is such that the health of the inhabitants can no longer be taken for granted. It is therefore necessary that Swiss legislators take appropriate updating measures to improve air quality, and this it has done within the embracing framework of a national air purity concept. At the end of 1991, an amendment was enacted to the air purity laws whose aim was to adapt the emission limits of power plants to the latest state-of-the-art technology. In this presentation, the author concerns himself with the impact of the 1991 amendment and how it affects power station emissions, with particular reference to SO_2,CO, and oxides of nitrogen. The limiting values of these pollutants arising from the combustion of extra light heating oil, gas, and heavy oil are discussed and tabulated, as well as the reclamation obligations for old installations. For small firing installations, the amendment provides for the concept of type testing. After 31.12.92 under this rule, installations burning extra light oil and gas and having heat performance up to 350 KW cannot be brought into commission unless it has been approved by type testing. (Jansen, U.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 15-24. [in German]. 3-85457-104-6)

0694 ADAPTING A DISTANCE HEAT POWER STATION AS A CONTRIBUTION TO EMISSION REDUCTION. [BIB-UBAA000204]

The author recommends the use of natural gas burning, distance heat power generation as a means of economic and low pollution energy. In the combustion of natural gas, pollutants such as SO_2, and smoke are not produced, small scale nitrogen oxide formation does occur even though natural gas contains no combined N_2. The EVN company has operated such a distance heat power installation for 25 years at Mödling, using 4 kettles heated by natural gas burners, at a capacity of 48 M, supplying the local inhabitants with clean power. The secret of the low N oxide emission is in the special adaptation of the burners, and the operating conditions. The mechanism of NO_x production is discussed as well as the economics of power generation. Full specifications of the Mödling plant are tabulated, and plant and burner diagrams as well as emission graphs are presented. (Kemeter, F.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 25-40 [in German]. 3-85457-104-6)

0695 VIEWPOINT OF THE AUSTRIAN BROWN COAL INDUSTRY. [BIB-UBAA000205]

At the present time, the Austrian brown coal (ABC) industry produces around 2 million tonnes per annum which is utilized as follows; steam and distance thermal power plants- 80 percent, industry- 14 percent, and as domestic house fuel- 6 percent. Economic and market conditions are leading to a rationalization and loss of jobs in order to reduce production costs. Emissions of oxides of N and S as a result of ABC combustion at the present time are (tonnes/year); NO_x 190K (1980 - 230K), and SO_2 100K (1980 - 388K), amounting to 2.3 and 4.3 percent of the total emission of these pollutants from all sources. If the emissions from ABC burning in power plants of 3-50 M capacity are taken as a proportion of overall emissions then the figures fall to just 0.03 and 0.05 percent respectively. The content of N in ABC is 0.3-0.4 percent , and since it is organically bound there is no prospect of removing it. The S content of ABC is lower than the worldwide average of 1.5 percent , ranging from 0.35 to less than 1.1 percent , part of this S is organic and part inorganically bound, so the latter can in theory be removed. The inorganic S exists as pyrites, so crushing the ABC with subsequent segregation is possible, but since the content is so low it is uneconomic. Liquid ABC desulphurisation processes such as leaching and wet micro-organism attack are still in the experimental stages. The author argues that at present some 60 percent of the S burned in power stations remains in the ash, and improved combustion technology in modernized plants could improve the S removal to greater than 90 percent . (Pibernig, K.; Schimek, O.E.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 41-44 [in German]. 3-85457-104-6)

0696 DEVELOPMENT AND STATE OF FUEL TECHNOLOGY. [BIB-UBAA000206]

The ÖMV AG is concerned with the discovery, recovery, and processing of petroleum and natural gas, and operates Austria's sole petroleum refinery at its Schwechat facility. In recent years, great strides have been taken in limiting of SO_2 emissions in Austria, and the mineral oil petroleum industry has done much pioneering work in desulphurising its products. The maximum permissible S contents of various heating oils sold in Austria at present are (percent); heavy oil 1.0, middle oil 0.6, light oil 0.2, and extra light oil (ELO) 0.1. Out of these products only ELO is a distillate, the others contain residues. Already Austria is well ahead of schedule according to the proposed phased reductions of S content limits, indeed the ELO sulphur content in the Europe region must be 0.1 percent by 1998, and this is already operating in Austria. The author can see no way at present that further reductions in the S content of ELO can be achieved. Taking up the topic of N oxide emissions, he claims that denitrification of oils, in view of their low N content, is not an economic proposition. The way forward in this field lies in kettle and burner design and operating conditions. Graphs and histograms are presented which illustrate the points made and include among others; the fall of the S content of various oils over the period 1981 - 1992, the European limits of S in various oils of Austria's neighbours, and the import/export of pollutants in tonnes of N or S per annum of Austria, showing Austria as a major importer on both counts. (Tauscher, Walter; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 45-56. [in German]. 3-85457-104-6)

0697 VIEWPOINT OF THE AUSTRIAN BURNER CONTRACTOR. [BIB-UBAA000207]

Quoting the theme of the conference on the emission reduction of NO_x and SO_2, in firing installations the author reviews the progressive tightening of Austrian legal limits from 1980 to the present day. The general methods of attacking the problem have been; 1) use of specially developed burners known as $NO_{x\text{-}low}$ burners , 2) recirculation of a crude gas stream, 3) staged burning, and 4) reduced air preheat temperature. Developments in the field from the viewpoint of the burner manufacturers are discussed, and disappointment expressed that domestic developments have been made which solve Austria's problems only to find that foreign burners or oils have been imported. As Austria has the most stringent laws in Europe, the problem is more international rather than national. (Gabriel, P.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 57-65. [in German]. 3-85457-104-6)

0698 EMISSIONS FROM BIOMASS FIRINGS. [BIB-UBAA000208]

The author discusses the toxic gas emissions arising from the combustion of biofuels such as spruce wood and bark, cereals straw, intensive grasses, and amaranth, the latter two being well above the proscribed limit for S (0.01 percent) being 0.15 percent S and 2.01 percent N, and 0.25 percent S and 2.13 percent N respectively. Experiments in the temperature range 800-1300 °C showed that NO_x emissions rose with increasing temperature and were almost entirely dependent on the N content in the biofuel; furthermore there was a link between the formations of CO and NO_x. The Institute of the Land Department has been making measurements since 1991 on wood burning power installations up to 120 KW and the results for NO_x and CO emissions presented and discussed in comparison with the experiences of similar Swiss installations. Interesting and promising results were reported from Switzerland for emission reduction in burning biofuels when the following technology was used; 1) two stage burning with a separate reduction zone in the gas phase (CO emission reduction); 2) selective non-catalytic reduction with injection of NH_3 or urea into the secondary combustion chamber; and 3) selective catalytic reduction via NH_3 injection. Substantial reduction of NO_x (greater than 90 percent) emission was reported at the expense of some residual NH_3 and N_2O in the exhaust gases. The process is expensive. The author summarizes his conclusions, hopes for more developments, and makes recommendations for future emission reductions in biofuel combustion. (Wörgetter, Manfred; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 67-75. [in German]. 3-85457-104-6)

0699 THE SAACKE TERMINOX - SYSTEM. LOW NO_X BURNER WITH TARGETTED FLOW REGULATION FOR TEMPERATURE PEAK REDUCTION. [BIB-UBAA000209]

The SAACKE Co. since 1990 has developed a new generation of burners for extra light oil (ELO) and natural gas which gives greatly reduced NO_x emissions. The TERMINOX system was developed for power plants in the performance range 3-10.S M, and for those in the range 10-100 M a steam pressure sprayer. The TERMINOX system is explained and diagrams show how the low emissions come about and meet the pollution requirements of Germany and Switzerland. The TERMINOX system (marketed 1993) gives NO_x values for the combustion of natural gas and ELO which were hitherto only attainable at considerable expense on plant and without the use of an external crude gas recirculation. A modified steam pressure sprayer is available for stations of 10-100 M performance which gives NO_x figures of 100 mg/m^3 (natural gas) and 150 mg/m^3 (ELO) without external circulation. For NO_x reduced heavy oil combustion, SAACKE offers alternative apparatus with a rotary sprayer which attains levels of solid

emission below 80 mg/m^3 and NO_x less than 450 mg/m^3. If NO_x values below 300 mg/m^3 are needed, catalyst technology will be required. (Schopf, N.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 79-85. [in German]. 3-85457-104-6)

0700 CHEMICAL PROCESS ACCESSORY MATERIALS FOR CHECKING EMISSION LIMIT VALUES. [BIB-UBAA000210]

The author reviewed the increasing problem of environmental pollution resulting from power generation. His company has developed a system of reducing the arising of damaging materials from fuel combustion by using chemical additives. This system is divided into two sections: Primary - adding oil soluble agents to the heating oil, and Secondary - the SAT-BL low NO_x or SNCR process which involves pumping into the combustion chamber, a special additive SATAMIN. The average potential reduction in emissions achieved by this treatment is as follows: dust 70-90 percent, NO_x 20 percent, SO_3 50 percent and CO 60 percent. The effects of these additives in the combustion process include: ionization - which leads to coagulation and dust emission control; formation of OH^- ions which favorably affects dust emission and helps oxidize residual hydrocarbons, and catalyzed oxidation - which aids NO_x control. Aspects of using SAT technology are described including the environmental relevance of the additives (e.g. they cause slight evolution of N_2O and NH_3), the economics, and the special features of SAT systems are discussed with reference to use in actual installations. (Reynolds, T.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 86-100 [in German]. 3-85457-104-6)

0701 CONSIDERATIONS FOR THE ESTABLISHING OF LIMITING EMISSION VALUES FOR BURNER POWERS GREATER THAN 1 M. [BIB-UBAA000211]

The necessity of fixing emission limits for burner powers above 1 M is no longer in question. Fuel burning leads to harmful combustion products such as CO, C_xH_y,NO_x and soot which are predominantly dependent on the fuel burned and the combustion process. In the case of the nitrogen oxide emission it is necessary to distinguish between the NO formed from thermal reaction and the NO from the fuel. The former can be controlled by plant conditions whilst the latter depends only on the fuel N content and the conversion rate, and is much less capable of manipulation. The author enumerates and discusses the role of other parameters which are essential in fixing the limiting emission values, including those specific to the burner: heat flow density, mixing rate, O_2 content etc; boilers - firebox temperature, firebox geometry, wall temperature etc, plant - control range, switch cycle etc, safety - flame stability, disposability etc; as well as the economics e.g. price and life duration. (Marx, E.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 101-110 [in German]. 3-85457-104-6)

0702 LEAN FIRING SYSTEMS FOR BOILER PLANTS WITH AVERAGE POWERS. [BIB-UBAA000212]

Since the 1985 legislation specifying emission limits for TA air, equipment manufacturers have been gearing up in the expectation of ever tightening emission standards, as has been the case with Germany's neighbours. Against this background, the author's company has set out to develop a specific solution for further reducing the NO_x emissions arising from the combustion of natural gas and extra light heating oil (ELO). He sets out the foundations of the combustion technology for achieving this aim as being (for the purely thermal NO) as 1) the partial pressure in the flame ; 2) the combustion temperature, and recommends 1) close to stoichiometric management of the firing and 2) sub-stoichiometric conditions in the flame zone. Furthermore, leading the flue gasses back into the combustion air (which is O_2 depleted) tends to reduce the maximum burning temperature, which also favors low NO_x emission. Still another method is to inject steam into the exhaust gases, at a rate of 3-5 kg steam/ M - this can bring down the emission by up to 30 percent. The commercial burners and equipment for this technology are illustrated and explained with reference to an 8 M installation made in Switzerland by Korting, and having both blasting back of the exit gases and steam injection facilities. Tabulated data are produced proving that this power station comfortably meets its limits of 150 mg/m^3 and 100 mg/m^3NO_x when burning ELO and natural gas respectively. (Wiedmann, U.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 111-119 [in German]. 3-85457-104-6)

0703 EMISSIONS OF GAS AND OIL FIRINGS WITH POWER GREATER THAN 3 MW. [BIB-UBAA000213]

The present state of technology for expulsion of NO_x from the combustion of natural gas and extra light oil (ELO) in power installations of the range in question (with respect to TA air legislation) are 200 mg/m^3 (gas) and 250 mg/m^3 (ELO) reckoned as NO_2 along with 3 percent O_2 in the flue gases. Normally, these figures are achieved comfortably. The author describes efforts to further minimize NO_x emissions, and his measures fall into two groups, primary and secondary, which he illustrates diagrammatically. The primary measures consist of multistage combustion and leading back the effluent gases, whilst the secondary are catalytic processes such as 3-route catalyst, and catalyst with NH_3 injection. A detailed discussion of these measures is made which concluded that the catalytic processes, effective though they are, are chosen much less frequently that the primary means due to much greater cost and slight secondary pollution (N_2O and NH_3). The processes he recommends should be capable of reducing the ELO figures by 40 percent to 150 mg/m^3 and the gas figures by 50 percent to 100 mg/m^3. A schematic diagram of his proposals is presented. (Ahmadi, B.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 121-127 [in German]. 3-85457-104-6)

0704 POSSIBILITY OF EMISSION LIMITING IN BERTSCH INDUSTRIAL STEAM GENERATORS. [BIB-UBAA000214]

In the last three years, the Bertsch Co. has developed a range of steam boilers with integrated catalyst, and offers the possibility of operating industrial steam boilers which burn the cost-effective fuel - heating oil S. The new technology provides reduced emissions e.g. for boiler sizes 10-30 M (eventually 50W) the NO_x emission is 300 mg/m^3 compared with the hitherto obtained figure of 450. The process gives rise to slight NH_3 'slippage', and this point is discussed with respect to odour pollution, along with the SO_2 component in the flue gas, and how to combat this problem. The cost advantages of burning the cheaper heating oil S and the reduced pollution levels of the Bertsch technology are highlighted as plus points. The Bertsch system of steam boiler with integrated catalyst and crude gas washer is illustrated diagrammatically with reference to an actual installation whose emission data are fully shown on graphs. (Kolbitsch, A.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 129-137. [in German]. 3-85457-104-6)

0705 PRIMARY MEASURES FOR AVOIDING NO_X EMISSION IN GASEOUS AND LIQUID FUELS. [BIB-UBAA000215]

The author considers the primary measures for avoiding NO_x emissions in old installations are: perfecting and installing gas lances and the corresponding gas receivers; improving the oil nozzles in relation to angle, number, and diameter of the nozzle bore; crude gas recirculation into the combustion air in the flame zone; air and fuel staging; cold air operation; spent air in proportion with close to stoichiometric burning. These recommended measures are considered in relation to an actual old facility which burned oil or gas or a mixture of these, which had been reconstructed in line with the proscribed improvements. Tabulated data are presented for the many tests carried out on this rebuilt thermal power plant under many different conditions of burning gas, oil (percent N 0.15 l) and low N oil (percent N 0.25 l). The measurements showed that the improvements had been successful and the legal limits of NO_x emission had

been met. (Vale, W.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 139-147. [in German]. 3-85457-104-6)

0706 NO_X AND SO_2 AVOIDANCE IN FIRING INSTALLATIONS (3-50 M). [BIB-UBAA000216]

The speaker presents evidence that SCR technology used in firing installations to reduce emissions of noxious products can be applied equally well to small plants as the large ones, it is however appreciably more expensive to do so. Nevertheless, use of this technology in plants less than 10 M the standard DENOX 3-10 M module is considerably cheaper in plant outlay. This can lead to easy achievement of the legal emission level of 100 $mg/m^3 NO_X$ independently of the fuel used. The NH_3 source for this module is a system of pressure bottles to supply the agent as a vapour (NH_3 solution is an alternative). Both, module and NH_3 direct vapourisation system, are illustrated photographically. It is more difficult to apply SCR technology to installations in the range 10-50 M, in this system the catalyst and boilers system must be integrated. If heavy oil (petroleum) or coal is burned NH_3 or its solution cannot be sprayed in directly and must be evaporated externally with hot air. In this case a suitable electrically heated NH_3 generator can be used (photograph supplied), the NH_3 requirement can be determined from a calibration graph, and in general it is not difficult to achieve the legal limit of NO_x in the flue gas. (Budin, R.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 148-156. [in German]. 3-85457-104-6)

0707 SCR-$DENO_X$ CATALYSTS FOR SMALL FIRING INSTALLATIONS. [BIB-UBAA000217]

The authoress puts the case for catalytic gas purification from the viewpoint of the catalyst manufacturer. Frauenthal Keramik (FK) is one of four major manufacturers of DENOX catalysts and has supplied them to major firing installations for some time. Attention is placed on DENOX systems for small firing plants. In this connection, one thermal power plant has been operating this system using an FK catalyst for six years. The normal catalyst life expectancy is in the range 16-24K plant operating hours, and the catalyst has a high resistance to poisoning and abrasion with fly ash or other mechanical forces. The catalyst's most important properties are; activity, selectivity, and poisoning resistance, and these are discussed with reference to the 20 types of catalyst presently offered by FK. The spectrum of applications e.g. NO_x reduction, SO_2 oxidation and pressure loss of catalysts of all types are demonstrated using graphs, and a map is presented which illustrates all the principal sites in Europe where SCR/FK technology is operating. The company is presently developing the following new catalyst types; 1) with thinner walls - for smaller pressure loss; 2) with smaller channels - for volume saving; and 3) with cross shaped channels - for volume saving and reducing NH_3 slippage. (Binder-Begsteiger, I.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 157-166- [in German]. 3-85457-104-6)

0708 OPERATING EXPERIENCE WITH THE SNCR-PROCESS FOR NITROGEN OXIDE REDUCTION IN DIFFERENT FIRING SYSTEMS [BIB-UBAA000218]

The speaker outlines the legal requirements for removing NOX from the flue gas of firing installations with special reference to the SNCR (selective non-catalytic reduction) process. The reduction is done using NH_3 (gaseous or solution) or urea, and the basic desired reaction is: $4NH_3 + 4NO_2 + O_2\ 4N_2 + 6H_2O$. The advantages, disadvantages, and economics of using the SNCR process are outlined. The minimum capacity for using SNCR is said to be 15 M (generation of about 15K m^3/ hour gas), and the problems involved in scale-up of this technology to large capacity (300 M +) plants are discussed. Some dozen or so medium and large sized installations in Austria and other countries of the Europe region are now operating SNCR using lignite, hard coal, gas, oil (petroleum), clear slurry and segregated refuse as fuels. Results are tabulated for these plants showing the dates of experimental SNCR and installation of full equipment, the fuel used, and the extent of NO_x reduction achieved. Diagrams and photographs of the plants are presented and graphs are drawn representing the influence of plant parameters on NO_x reduction, NH_3 slippage, etc. (Gruber, K.H.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 167-189. [in German]. 3-85457-104-6)

0709 OPERATING EXPERIENCE WITH THE CALCIUM DRY ADDITIVE PROCESS (CTAV) FOR DESULPHURISATION. [BIB-UBAA000219]

The CTAV process is a dry variant of the well known lime washing methods of desulphurising flue gases, which whilst not achieving a high degree of efficiency (max. SO_2 removal 50-60 percent), has the advantage of not having an end effluent water problem. It is most suited to power plants with limited plant space, lower operating hours, and a lesser legal requirements for desulphurisation. In the process, the desulphurisation takes place above the combustion zone where a dry Ca additive ($CaCO_3.Ca(OH)_2$) is sprayed in to give $CaSO_4$, and Ca salts of other harmful acids,(CaF_2,$CaCl_2$), as well as CaO and unreacted $CaCO_3$. This dry residue merges with the fly ash and is separated off in solid filters. The author discusses process technology and the effect of operating parameters, the economics, and safe ways of disposing of the solid waste arising. Reference is made to seven Austrian plants using CTAV and fuelled by coal/oil (1) and lignite (6) and their experience of the method. Graphs and diagrams illustrate process technology, plant layouts, the effect of stoichiometry etc. (Gruber, K.H.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 190-204. [in German]. 3-85457-104-6)

0710 LOW-NO_X FIRING SYSTEMS-STATE OF THE TECHNOLOGY IN SWITZERLAND. [BIB-UBAA000220]

Historically, the Swiss law of 1986, LRV-86, established NO_x limits for the combustion of extra light oil (ELO) and natural gas as 250 and 200 mg/m^3 respectively. The progressive tightening of these limits is traced by the author up to the passing of law LRV-92. Measures adopted for achieving these limits by OERTLI comprise the following primary effects; 1-staged combustion, 2-internal crude gas recirculation, 3-external crude gas recirculation, and 4-water or steam injection. These effects are designed to reduce the flame temperature and thus the formation of thermal NO_x For small plants up to 2 M it is usual to install equipment for staged combustion + internal recirculation, whereas this is insufficient for larger plants which require staged combustion + internal recirculation + external recirculation. As a specific example, a fully automatic OERTLI - LOW - NO_x heavy oil plant was installed in a paper factory in Netstal (Glarus Canton) and has been running for two years now. The results of measurements at this plant are given and discussed. Many diagrams are presented illustrating OERTLI equipment, especially design of burners (with reference to the super-low-NO_x burner), as well as graphs and tables which indicate the efficiency of OERTLI technology in helping to comply with Swiss legislation. (Hauswirth, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 205-233. [in German]. 3-85457-104-6)

0711 GEA HEAT AND ENVIRONMENTAL TECHNOLOGY. [BIB-UBAA000221]

The author discusses the legal position in Germany as regards SO_2 emissions and two processes used by firing installations to comply with the legislation - a dry desulphurisation (DD) and - a wet desulphurisation (WD). DD consists of injecting a lime additive into the combustion chamber and collecting the $CaSO_4$ rich residue along with fly ash in the solids filters. The method gives rise to 50-60 percent desulphurisation, and its basic chemistry is illustrated with equations and diagrams. The feature of the paper is the WD whose principal reaction is: $SO_2 + CaCO_3 + 0.5\ O_2 CaSO_4 + 2H_2O + CO_2$. The GEA technology for WD is dealt with in detail and revolves around the plant GEA CT-121. In this, the gas

first passes through a pre-washer where it is cooled and saturated with water. The cornerstone of GEA CT-121 is the Jet Blast Reactor (JBR), in which there are two zones, the JBR and the reactor, and they combine the following: absorption, oxidation, $CaSO_4$ formation, $CaSO_4$ crystal growth, and neutralization. Schematic diagrams are presented for the CT-121, JBR, a flow scheme for DD, and graphs of the dependence of degree of desulphurisation on temperature, stoichiometry, etc. Also, a photograph shows a 32 M power installation which burns hard coal in which a GEA CT-121 has been installed, it achieves desulphurisation at a rate between 90-98 percent. (Chugtai, Y.H.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50MW.*, Vol. 8, pp. 235-257. [in German]. 3-85457-104-6)

0712 EFFLUENT GAS DESULPHURISATION TECHNOLOGY AT ML IN THE EXAMPLE OF REA FELDMUHLE [BIB-UBAA000222]

The basic processes of Mab-Lentjes Energy and Environmental Technology GesmbH REA technology for large crude gas desulphurisation plants for power plants consists of using a limestone suspension additive, and besides efficient desulphurisation the plant produces saleable gypsum for reuse. The author introduces the technology with reference to a flow chart of the REA plant. The first REA plant was installed for a carton (boxes) factory (Feldmühle) in Arnsburg. It was integrated into the two boilers system (48.5 M), and in 1991 it was commissioned and handed over to the customer. Experience from this plant is discussed in some detail with reference to diagrams for each stage of the process and also measurement data. Basically, crude gas (SO_2 1630 mg/m^3) is treated to give a 'clean' gas ($SO_2$66 mg/m^3) with a degree of desulphurisation of 97 percent. Among the problems considered are how to reach the specification requirements (especially colour) of gypsum, and those involved in scale down of the technology for smaller desulphurisation units. (Braß, Helmut; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50MW.*, Vol. 8, pp. 259-275. [in German]. 3-85457-104-6)

0713 PROCESSES OF FHW. [BIB-UBAA000223]

The author begins by outlining the links between the concepts of environmental protection, reducing emissions of noxious gases, and prevailing legislation. FHW Combustion Technology has been active in the field of firing installations and emission suppression for 12 years, and began with a coal dust fired facility heating ceramics ovens for the bricks industry. The principles of dry desulphurisation are discussed along with the concepts for its use as practiced by FWH. The FWH crude gas purification plant for noxious gas removal and dust separation is a dry process using slaked lime additive and working on the principle of deep bed filtration. Full description of the process is given illustrated by diagrams (especially the cornerstone - the deep bed filters and its operation), flow charts etc., the special features and advantages are also highlighted. Reference is made to an operating plant in which crude gas of 1200-1400 mg/m^3 is stripped of S to give a 'clean' gas, almost 90 percent desulphurised. Use of the effluent stream of $CaSO_4$ produced is said to be feasible in cement (recycling) etc. (Andorfer, E.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50MW.*, Vol. 8, pp. 277-294. [in German]. 3-85457-104-6)

0714 SEMI-DRY, HIGH EFFICIENCY EFFLUENT GAS DESULPHURISATION IN THE BACK FLOWING, CIRCULATING, VORTEX LAYER. [BIB-UBAA000224]

The author presents the Wulff approach to desulphurisation technology as embodied in its semi-dry reverse flowing fluid bed technology (SDRF).The special features of SDRF which lead to the high efficiency are the intensive and prolonged contact of the crude gas and the fluid bed. Plants using this method are suitable for integration in boiler systems in the power range 10-600 M. There are two possible variants of SDRF - 1) using lime suspension in the fluid bed, and - 2) dry process with water and lime suspension conditioning. The plants are illustrated with flow charts and diagrams and are fully explained. Between 1988 and 1991, a total of five SDRF plants were installed in Germany (full data tabulated) - the first, at Geilenkirchen has its performance and optimization over a three year period analyzed and discussed in detail. The process is low on consumption of materials, high in efficiency (percent desulphurisation 90-96 percent), and the $CaSO_4$ rich by-product can be used in the cement or coal mining industries. (Graf, R.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50MW.*, Vol. 8, pp. 295-311. [in German]. 3-85457-104-6)

0715 PURIFICATION OF EFFLUENT GAS - COMBINED DESULPHURISATION AND DENITRIFICATION IN THE EXPANDED CIRCULATING VORTEX LAYER. [BIB-UBAA000225]

Sulphur dioxide emissions in Germany have been falling steadily since 1970, thanks to the installation of desulphurisation plants at firing installations. However, despite the introduction of several measures the past years have seen a rise in NO_x emission. The author presents the Lurgi circulating fluid bed (CFB) plants as a means of combatting noxious gas emission. In particular, the newly developed combined desulphurisation-denitrification plant which embraces the CFB principle is a highly novel and effective anti-pollution measure. The advantages of this new concept are: small space requirements, desulphurisation above 97 percent, made in normal inexpensive steel, no moving parts, suspension nozzles nor pumps, all treated solids are dry, low on investment costs and personnel requirements. The desulphurisation (1) and denitrification (2) both take place in the same combined CFB reactor at about 400 °C and using a (1) catalyst of $FeO/FeSO_4$ or $MnO/MnSO_4$, and a (2) catalyst of V_2O_5,MoO_3, or WO_3 on a TiO_2 support. Full details of the process are given and discussed backed up with flow charts of a pilot plant operation at a power station of the RWE at Dettingen. The newest developments of this technology and joint studies with the University of Karlsruhe are outlined. (Sauer, H.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50MW.*, Vol. 8, pp. 313-319. [in German]. 3-85457-104-6)

0716 CRUDE GAS DESULPHURISATION IN HEAVY OIL HEATED STEAM BOILERS IN THE RANGE 3-50 M BY WET METHODS. [BIB-UBAA000226]

In heavy oil heated boilers practically all the fuel's sulphur content is converted to SO_2 leading to acid rain and associated pollution problems, and must thus be avoided. The author reviews combative measures for this problem, and his main thrust is elimination of SO_2 in firing installations burning S rich heavy oil and using equipment and technology suited for small plants which cannot easily be scaled down from method used in large power stations. He separates the processes used into 1) effluent water free, 2) effluent water creating, and 3) using hard or buffered waters. In the first case $CaSO_4$ is the by-product, and the problems of marketing it are discussed, in the second case $(NH_4)2SO_4$, a known fertilizer, arises but must compete in a saturated market, whilst in the third case the SO_2 merely displaces CO_2 and leaves the gypsum in solution. All of these processes work for heavy oil burning small installations and are catered for by Sulzer's range of standard plant, many of which have operated successfully for several years - full details, diagrams, and performance data are presented. The use of hard water and seawater for SO_2 absorption [variant 3)] is highlighted, the latter is said to have a better absorptive capacity. (Bader, C.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 321-332. [in German]. 3-85457-104-6)

0717 EMISSION REDUCTION OF SULPHUR OXIDES FROM FIRING INSTALLATIONS WITH POWER IN THE RANGE OF 3-50 M. [BIB-UBAA000227]

In order to avoid further air pollution, the emissions of SO_2 from small plants must be reduced drastically. This can be done easily by desulphurising the oil

fuels or substituting natural gas, but the current article concentrates on small installations where these are not economic options. The author reviews REA variants (with the aid of plant diagrams) where 1) dry and semi-dry and 2) wet processes involving limestone give rise to $CaSO_4$ by-product. He discusses at length the means of dealing with the gypsum either by sale to the cement industry, briquetting in situ, or where a small plant cannot deal with the problem, shipping the waste to be dealt with at in a large plant's product stream. Also reviewed is the Chemico-In-situ process where the crude gas is desulphurised in a spray column as it is passed counter current to a wash liquor of limestone suspension - the problem here is that a gas pollution problem is converted to a liquid one. In conclusion, the author gives his overview of the situation and the developments he would like to see to keep pace with the ever tightening legal emission limits. (Weitzer, M.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 333-336. [in German]. 3-85457-104-6)

0718 STATE OF DEVELOPMENT AND TECHNOLOGY OF NO_X AND SO_2 REDUCTION IN FIRING INSTALLATIONS. [BIB-UBAA000228]

The author reviews the legislative position on air purity and its development since 1989, tabulating the legal limits of SO_2 emission for all power installations up to more than 300 M, and the requirements in S content for all the various fuels. He goes on to discuss the measures taken to combat emissions, classifying them as primary and secondary. Primary consists of choosing fuels low in S and N, and low temperature combustion, whilst secondary measures are more numerous and need to be further sub-divided. Secondary S measures: a) crude gas washing with wet alkaline media, b) quasi-dry washing of the crude gas with alkaline suspensions and c) dry adsorption using active charcoal (AC). Secondary N measures: a) selective non-catalytic reduction (SNCR), b) selective catalytic reduction (SCR), and c) dry adsorption using AC. Each of these processes are described and discussed. In conclusion, he claims that AC methods are becoming more popular and gaining ground, particularly in Germany. In the case of AC desulphurisation, the process is carried out at 100-150 °C and the AC can accumulate up to 8 percent S. The spent AC can then be mixed with low S fuel and burned (with the obvious reservations). AC denitrification is done in conjunction with NH_3 injection, and the deactivated AC is a useful fuel with calorific value 7000 cal/g. (Maierhofer, R.; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 337-343. [in German]. 3-85457-104-6)

0719 PROCESSES OF DUMAG [BIB-UBAA000229]

The author features as the only Austrian burner manufacturer to address the conference, and describes the contribution of DUMAG's products to the reduction of noxious gas emissions. The DUMAG burner is characterized by a simple, robust, and safe operating design and features fuel spray by means of ultrasound and can be used for liquid, high viscosity, or solid fuels or even residues, a diagram is presented. DUMAG has also developed, in conjunction with a foreign manufacturer, an experimental plant for disposing of high S content liquid waste. In the field of crude gas recirculation, DUMAG has successful experience with the burners in the Donaustadt power station, as has been claimed at an earlier conference in 1988. DUMAG has been engaged in intensive research into the link between the S and N contents of fuels and how they interact to affect emission levels and how burner design can favorably influence this. Data and conclusions are presented. In recommendations, he emphasizes the need for NO_x emission reduction, and reaffirms the commitment of both the burner maker and the boilers manufacturer to spare no effort to develop innovative products to this end. (Landauf,; Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 345-353. [in German]. 3-85457-104-6)

0720 CLOSING REMARKS OF THE ENVIRONMENTAL AGENCY AND CONCLUSIONS ON THE RECOMMENDATIONS WITH REGARD TO THE PLANNED AMENDMENT TO THE AIR PURITY DECREES FOR BOILER INSTALLATIONS. [BIB-UBAA000230]

Following the end of the conference, a final summing up together with recommendations for establishing limiting values corresponding to the state of technology was put together by the Environmental Agency and Prof. A. Hackl. The principal headings were as follows: 1. The starting situation: this summed up the situation in Austria from the start of 1980 up to the present day with reference to international obligations according to the protocols of Helsinki and Sofia. 2. Strategies for emission reduction: this lays down Austria's approach in respect to the state of technology as embodied in the papers presented at the conference. 3. Recommendations for limits, for example S content of fuels (percent) heavy oil 1.0, middle oil 0.6, light oil 0.2, extra light oil 0.1. Limits of emissions of NO_x were established for firing installations depending on power range, and the diverse fuels they may use such as oil, gas, coal, wood, peat, bark, straw, or wood residues. Limits were also set for dust, SO_2 and CO. (Umweltbundesamt; Publisher: Umweltbundesamt (UBA), Vienna, Austria, (1993), Appears in: *Entwicklung und fortschrittlicher Stand der Technik zur Emissionsminderung von Stickoxiden und Schwefeloxiden aus Feuerungsanlagen im Leistungsbereich von 3 bis 50 MW.*, Vol. 8, pp. 359-367 [in German]. 3-85457-104-6)

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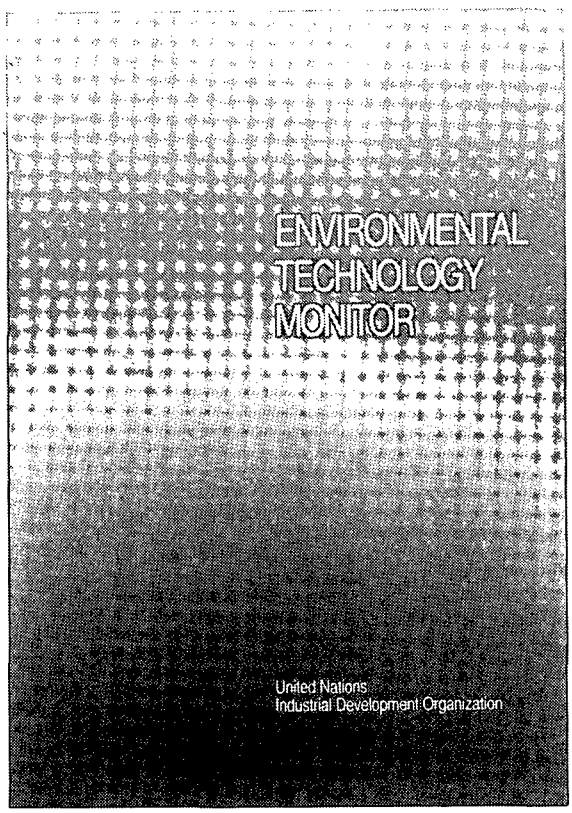

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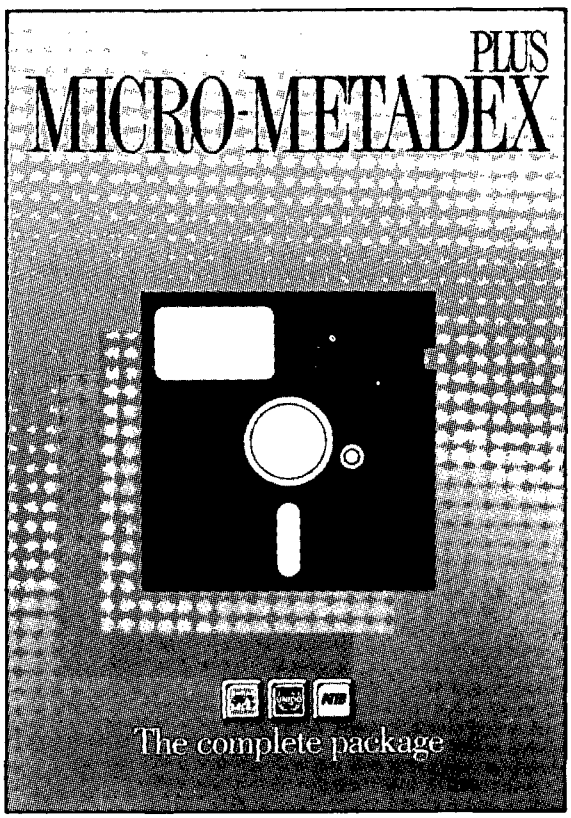

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