OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

18466

Distr.
LIMITED

IO.46 (SPEC.)
27 June 1990

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

ORIGINAL: ENGLISH

METALLURGICAL INDUSTRIES BRANCH

PORTFOLIO OF PROJECT CONCEPTS*

---

* Mention of company names and commercial products does not imply the endorsement of UNIDO.

This document has not been edited.

V.90-86008

METALLURGICAL INDUSTRIES BRANCH

The special mandate of the Metallurgical Industries Branch of UNIDO is the acceleration of the tempo of exploitation and processing of local ore resources of developing countries to yield higher added value metals and other products for home use and export. The Branch has a well distributed project portfolio, covering all developing regions. The following main areas of mineral and metallurgical industries in developing countries are covered:

1. Development and strengthening of non-ferrous metals industries

Particular emphasis is on bauxite processing, alumina and aluminium production and processing of low grade ores, e.g. alunites. In the heavy non-ferrous metals sector, bacterial leaching of copper ores and small-size gold winning operations are of significant interest to developing countries.

2. Development and strengthening of iron and steel industries

Projects in this field are characterized by recent advanced technological processes, e.g. continuous casting, production of special steels and alloys; emphasis is also placed on projects related to direct reduction of iron ores for production of sponge iron and various small scale smelting processes.

3. Development and strengthening of foundry and other metal forming transformation industries and products including casting, forging, rolling, extrusion, stamping, heat treatment, welding, etc.

Most projects aim at assisting least or lesser developed countries, particularly in Africa, in improving foundry operations to enable the manufacturing of essential tools, agricultural implements, etc.; activities also cover the establishment of pilot and demonstration foundry forge shops and modern technologies such as investment or precision casting.

4. Establishment and strengthening of centres for metallurgical technology and corrosion protection

Activities cover mineral and metallurgical research and development, pilot plant investigations and setting up of demonstration plants designed to promote an indigenous technical base and capabilities.

5. Industrial processes for utilization of metallurgical wastes, promotion of environmental and pollution control measures and processing of metallurgical scrap to produce added value products

Apart from utilization of metallurgical wastes, e.g. utilization of red mud from bauxite processing, energy saving projects which also have a direct impact on the environment are promoted.

6. Introduction of rationalization and computerized systems in production processes, maintenance and related fields

Projects aim at introducing computerized production and process control as well as managed maintenance systems in metallurgical plants. Apart from productivity increase and production and inventory cost savings, uniform quality and timely deliveries can be achieved. Most innovative production technologies require computer control as an indispensable pre-condition.

7. Development of new advanced metals, alloys and composite materials

The programme covers the requirement by the more advanced developing countries for more sophisticated technology, such as production of raw material for the electronic industries, e.g. silicon, gallium arsenide, etc.

Project Concepts for possible technical assistance projects
in selected developing countries
(to be promoted through missions, etc.)

SUMMARY

1. Development and strengthening of non-ferrous metals industries

2. Development and strengthening of iron and steel industries

3. <u>Development and strengthening of foundry and other metal forming/ transformation industries and products</u>(including casting, forging, rolling, extrusion, stamping, heat treatment, welding, etc.)

4. <u>Establishment and strengthening of centres for metallurgical technology and corrosion protection</u>

5. <u>Industrial processes for utilization of metallurgical wastes, promotion of environmental and pollution control measures and processing of metallurgical scrap to produce added value products</u>

6. Introduction of rationalization and computerized systems in production processes, maintenance and related fields

7. Development of new advanced metals, alloys and composite materials

1. DEVELOPMENT AND STRENGTHENING OF NON-FERROUS METALS INDUSTRIES

1. Development and strengthening of non-ferrous metals industries

Particular emphasis is placed on bauxite processing, alumina and aluminium production and processing of low grade ores, e.g. alunites. In the heavy non-ferrous metals sector, bacterial leaching of copper ores and small size gold winning operations are of significant interest to developing countries.

Future perspectives:

As regards future development, it is expected that the investigation and testing of ores, with particular emphasis on the utilization of low-grade ores, complex ores (for extraction of rare earths and other valuable elements) and tailings (inter alia for production of gold) will continue to play an important role in UNIDO's technical assistance programme. Likewise, the development of semi-fabrication industries will be promoted to increase the production of higher added value products as against the lower value products which often are exported by developing countries in the form of ores, concentrates, primary metal, etc. while the processed products have to be imported and thereby entrain a heavy drain on hard currency.

Project Concepts for possible technical assistance projects in selected developing countries
(to be promoted through missions, etc.)

No.	Title
1.1	Introduction of bacterial leaching followed by solvent extraction and electro-winning of copper and other non-ferrous and precious metals
1.2	Upgrading of small scale gold industries
1.3	Assistance in the identification of investment opportunities for new products in the aluminium downstream industries

PROJECT CONCEPT 1.1

Title: Introduction of bacterial leaching followed by solvent extraction and electrowinning of copper and other non-ferrous and precious metals

Project objective:

To develop the indigenous potential of the non-ferrous metals industry in the country as part of the overall industrial development strategy of using locally available ore deposits with maximum metal recovery.

Background information and justification:

Copper ores are nearly always a mixture of oxide and sulphide materials, however stocks of oxide material are gradually diminishing and the more complex, difficult to process sulphide ores will remain. Such ores are found in many countries. Therefore an extraction process needs to be applied which works economically on these lower grade insoluble sulphide ores. Bacterial leaching is a natural occurring process whereby certain microorganisms, notably thiobacillus ferrooxidans, catalyse the conversion of normally insoluble sulphide minerals into water soluble forms, thus freeing the associated metal ions for subsequent recovery. The bacteria obtain the energy they need for functioning and growth from the oxidation of inorganic compounds of iron and sulfur. Thiobacillus ferrooxidans can enhance the dissolution of the present sulphides either by catalysing the oxidation of ferrous iron in solution leading to indirect dissolution of sulphides or any sulfide subproduct formed during the process. Industrial practice of bacterial leaching involves the treatment of the ore under different configurations such as heaps, dumps, in-situ or in-place, whereby copper (and other nonferrous and precious metals) is extracted through periodical irrigation with sulphuric acid solutions. Copper is then precipitated with scrap iron or delivered as cathodes via solvent extraction-electrowinning.

A comprehensive programme of basic and applied research on bacterial leaching started in 1983 for Chile, under a UNDP financed and UNIDO executed project which has since made considerable progress. The three initial years of the programme have enabled the development of a local interdisciplinary group in bacterial leaching with an expertise comparable to that existing in the international community. In the Chilean context, where the availability of cheap sulphuric acid is combined with a relatively good water supply in the mining region, bacterial leaching processes pose a concrete alternative for the economical recovery of large reserves of marginal copper ores.

Based on international and Chilean experience the process will also be of significant interest to other developing countries and UNIDO assistance is presently being provided to India. With the limited ore resources of copper in that and other countries, it would be essential to ensure optimum exploitation/utilization of the resources by maximizing metal recoveries. In this context, recoveries of copper from the low grade sulphide ores and oxide/oxidized ores, which is not economically feasible through the conventional beneficiation route, by adopting alternate process routes of leaching, solvent extraction and electro-winning is specifically significant and relevant.

Project Outputs:

This project may be carried out in various stages, depending on the level of development of the developing country involved. The outputs will differ accordingly. Essentially, activities should cover testing of bacterial leaching processes in the laboratory, pilot plants and eventually on an industrial scale.

For Phase 1 (initial stage)

Output:

(a) National experts with enhanced knowledge on the technology of bacterial leaching (obtained through study tours, e.g. to Chile and visits of international experts to the country concerned).

(b) A techno-economic project report evaluating the existing proposals for development activities of the process in the country (mines, R and D aspects, etc.) with conclusions and recommendations on further action to be taken.

(c) Development of a research programme, its organization and equipment

For Phase 2

After successful completion of phase 1 the formulation of a project for establishment of a pilot plant (R and D Centre) for bacterial leaching operations should be considered under Phase 2:

Output 2:

Techno-economic opportunity or feasibility study for the establishment of a pilot plant for heap leaching operations of the copper ore deposits of the country.

Formulated interdisciplinary programme for R and D work on bacterial leaching in the country

For Phase 3

Output:

Physical facilities of pilot plant for bacterial leaching, established by local experts in collaboration with UNDP/UNIDO financed consultants.

Biological processes and their industrial application in the bacterial oxidation of ores and their concentrates, developed through the project; results of pilot scale investigations

Control and optimization of the bacterial leaching process

Participation of local copper producers in the R and D programme (interdisciplinary programme)

Project Activities:

For Phase I:

Study tour by a team of national specialists to countries practising bacterial leaching, incl. Chile

Provision of experts (1 practical metallurgist with heap leaching experience, one expert with experience in R and D or process development knowledge for assessimg membrane particle reactions and a microbiologist with experience in genetic engineering related to microbiology) to undertake an assessment study and elaborate an initial programme for development of bacterial leaching.

Project duration: 4 months

Estimated costs: about $ 60,000

Activities for Phase II:

Expertise (individual experts or consulting firm) for elaboration of a feasibility study for the establishment of a pilot plant for heap leaching operations of the copper ore deposits of the country

Formulation of an interdisciplinary programme for R and D work on bacterial leaching in the country

Duration: 6 months

Estimated cost: $ 200,000

Activities for Phase III:

UNDP/UNIDO expertise during the establishment of the physical facilities of pilot plant for bacterial leaching, in co-operation with local experts

Development of biological processes and their industrial application in the bacterial oxidation of ores and their concentrates;

Interpretation of test results, control and optimization of the bacterial leaching process

Participation of local copper producers in the R and D programme (interdisciplinary programme)

Duration: 3 years

Estimated cost: Depending on the local contribution in kind and in cash (infrastructure, buildings, equipment, local experts, etc.)

?

Project Concept 1.2

Title: Upgrading of small scale gold industries

Project Objective:

To assist the Government authorities in formulating a programme to upgrade the small scale gold industry.

Background Information and Justification:

Gold is a major metallurgical activity in many countries. The fast growth during recent years however created large and small ventures in mining and processing, spreading sometimes over a large area of the country. The typical problems the country is now facing are:

1. How to improve the metal recovery and avoid waste of gold during processing.

2. How to avoid pollution by mercury and cyanide used in small operations.

3. How to ensure that the metal extracted is actually channelled to the Central Bank.

In cases where a large number of small miners are exploiting over a large area, most of the operations are performed under extremely difficult conditions of transport, weather, technical support, housing, social conditions, etc.

The use of mercury or cyanide to recover gold from ores require the correct and constant application of recycling technologies to avoid pollution by these fatal substances. Disseminating these techniques among the operators becomes therefore crucial for improving the metal recovery and controlling pollution.

Ensuring that the metal extracted is actually channelled to the Central Bank requires a clear pricing policy and an institutional framework prepared to test, purchase, transport the metal. In order to develop its pricing and institutional arrangements, a possible improvement might be the organization of an extension service to assist the small miners. In some cases, for instance, the installation of a central gold processing plant serving several miners is highly effective.

Different countries have followed different ways in dealing with these challenges. The examples of Chile, China, Canada, USA, and Zimbabwe, among others, are worthwhile looking at.

Project Outputs:

a. A diagnostic report on the status of the technology being used by the small miners of the country.

b. Assessed information on the new and appropriate technologies to upgrade operations and protect the environment (testing, processing, refining).

c. Advice on how to upgrade the existing institutions to better assist the small miners. Eventually establishment of a mobile gold processing unit.

d. Assessed information on the existing pricing and purchasing mechanism for gold in the country.

Project Activities:

The main project activities are the assessment of the gold industry; the formulation of a development plan including institutional strengthening and technological advice; creation of an extension service; establishment of a pilot plant mounted on a truck/barge.

International experts can collaborate with the national experts in assessing the present situation of ore processing, metal refining, metal transforming, pollution control. The expert can also advise on institutional, pricing and policy formulation, depending on the specific needs.

- Study tours can be organized to countries where new and appropriate technologies are being adopted.

- Organization of a training course on appropriate technologies, to update the knowledge of national experts.

- Pilot plants to run R&D projects or to demonstrate technologies can also be supplied and installed; pilot plant can be mounted on mobile units such as a truck or a barge.

The schedule of activities will depend on the kind of assistance required.

Tentative Budget Estimate:

	m/m	US$
International experts	2-5	20-50,000
Study tours and training course		20,000
Procurement of pilot plant (mobile unit)		200-300,000
Miscellaneous		5,000
Total approximately		245,000-375,000

PROJECT CONCEPT 1.3

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Title: Assistance in the identification of investment opportunities for new products in the aluminium downstream industries.

Duration: 9 months   Sector: Industry

Government Implementing Agency: Consulting company as designated by the Government

Estimated Cost: US$ 250,000

Brief description:

The aim of the project is to enable the manufacturer to select the most appropriate investment possibilities to upgrade their efficiency and improve the utilization of comparative advantages, by embarking on the production of some aluminium based "semis" and finished products new for the domestic aluminium industry.

The project addresses the following Government priorities:

- Development of export-oriented industries to increase foreign exchange earnings and realize savings through import substitution.

- Optimum utilization of natural resources.

- Diversification of manufactured products.

- Strengthening of saml1 and medium size industrial enterprises.

- Creation of new employment possibilities.

Part A. CONTEXT

In most countries the aluminium downstream industry consists of a large number of medium and small scale private enterprises. These companies are producing "semis" (rolled, extruded, drawn etc.), castings and some finished products mainly for domestic use. The efficiency of the downstream sector is lagging behind the primary aluminium production because the product-mix of the enterprises in this sector is rather limited and diversification seems to be problematic and slow, due to lack of research and development capabilities in the country. New technologies, know-how for the manufacturing of new products, as well as the main technological equipment are mostly imported from industrialized countries. The optimal utilization of the country's comparative advantages in the field of aluminium industry (e.g. raw material and energy resources), the growing and diversifying market and the creation of new employment possibilities demand diversification and the strengthening of the aluminium downstream industry and the increase of the added value of the aluminium products.

The project deals with 4 groups of products which could attract the interest of the various sectors of industry.

These product groups are as follows:

1. Aluminium pastes, pigments, tinsels, powders: The foil scrap generated in the foil rolling mills and chips from the casting shops can be utilized for the production of the above items. The pastes, pigments, tinsels and powders are widely used in the different areas of the chemical, building material, defense and other industries.

2. Hot-forged aluminium parts: Forged parts produced from special aluminium alloys are used in almost all branches of industry where the combination of low weight and high strength is an asset, e.g.: aerospace, automotive mining etc. industries.

3. Aluminium discs and slugs: Disc and slugs manufactured from aluminium strips and sheets are the important raw material of the growing household utensil, collapsible tube and other industrial sectors demanding light weight, corrosion resistant malleable raw material.

4. High strength aluminium bolts, nuts, screws, rivets: The joining elements manufactured from special aluminium alloys offer various fields of application in the aerospace, vehicle, chemical, electrical and other industries due to their very favourable mechanical and physical properties.

Other details regarding the manufacturing technologies, production and use of the suggested new products can be found in Attachment 1.

The strategy of the Government is to optimize the utilization of all the country's resources in terms of increasing export earnings, replacing imports by local production and create new employment possibilities. Embarking on the production of some aluminium-based semis and finished products, new for the domestic aluminium industry, would greatly contribute to the above.

Part B. PROJECT JUSTIFICATION

The problem to be addressed by the project is that the local downstream aluminium industry due to the lack of Research and Development facilities cannot fully utilize its resources and, furthermore, some companies are operating with inadequate efficiency due to technical constraints and the limited range of products of their product mix. The result is that very large added value economic benefits realizable through further processing of aluminium are lost for the country.

It is expected that at the end of the project the local downstream aluminium industry will be able to select the most appropriate investment possibility(ies) to upgrade its efficiency and improve the utilization of national comparative advantages.

The target beneficiaries are the member companies of the relevant associations of the aluminium manufacturers.

The strategy of the project is to implement it through an international consulting company whose experts will visit the country and together with the team of the national counterpart hold discussions with the associations of producers and users of aluminium product, with the relevant manufacturers and authorities.

The joint team will collect the domestic market informations, possible investment project site data, relevant information on infrastructure, manpower, construction costs etc. based on which a report will be prepared on new investment possiblities in the national downstream aluminium industry mainly (but not exlusively) in the following areas:

a) hot forged aluminium parts for automative, aerospace, gas-bottle and other industries

b) aluminium powder and paste

c) aluminium slugs and circles for the production of household utensils, gas-bottles and other products

d) high-strength aluminium screw, bolts and nuts.

The reason for UNDP/UNIDO assistance is that UNIDO has wide experience in the field of aluminium industry, and maintains contacts with a large number of experts on its roster, including specialists and institutions from the developing countries, which faced the same problems and went through and gained experience during the establishment and operating of similar production facilities.

No co-ordination arrangements are required, beyond those needed between the parties involved in the realization of the project, since the respective industrial associations are well organised and able to effectively assist in the data collection.

Part C. DEVELOPMENT OBJECTIVE

The project will contribute to the development of export oriented industries, to import substitution, to the strengthening and deepening of the industrial structure, particularly activities with strong industrial linkages, promote employment generation.

Part D. IMMEDIATE OBJECTIVE, OUTPUTS AND ACTIVITIES

The immediate objective of the project is to provide the basis for the industrial sector to take investment decisions for expanding the aluminium downstream industry through the introduction of new technologies and products.

D.1 Outputs

A report on the identification and techno-economic viability of investment opportunities for new products in the aluminium downstream industry. The report will contain market information, techno-economic data and human resource requirement of the identified minimum 4 investment opportunities and recommendation for the follow-up activities.

D.2 Activities

The essential main project activities will be as follows:

(i) data collection and market research within the country, and obtaining essential information on export market possibilities.

(ii) Identification of the most advantageous investment opportunities for aluminium downstream industries.

(iii) Preparation of the report containing all the informations described in the output for each of the minimum 4 investment opportunities as well as recommendations.

Part E INPUTS

(a) Government/National counterpart inputs.

The Government will assign a National counterpart and a Project director who will collect and provide information, data, organizational help in making the necessary arrangement with the institutions, authorities, associations, production companies etc. as required for the successful implementation of the project. The Government will also provide on site accommodation if needed, logistic local transportation and language support office and secretarial services for the international experts.

(b) UNDP/UNIDO inputs

i)	International consultant (sub-contractor)	US$ 200,000
ii)	National counterpart	US$ 40,000
iii)	Other	US$ 10,000
		US$ 250,000

ATTACHMENT 1

A.1 Production of aluminium pastes, pigments, tinsels, powders

The thin and the small size scrap from the foil rolling mills and casting shops are recycled in several countries, including Indonesia by remelting for ingots or billets. During this operation considerable amount of metal is burned and wasted as slag and drosses. In order to avoid the high amount of metal losses, new form of recycling has been introduced in some industrialized countries, i.e. the foil scrap, generated in the foil rolling mill and chips from the casting shops are utilized to make pigments, pastes and tinsels.

There are no aluminium pigment-, paste- and tinsel plants in the ASEAN countries, so not only the raw material but the market is also provided.
The aluminium pigment is of flake-type, grain size under 250 micron. It is produced from aluminium scraps (foil, chip), with minimum purity of 99.3 %, by mechanical crushing. The dry pigment is generally processed into pastes of various quality. The crushed, annealed ground material is called aluminium tinsel. The aluminium paste is manufactured from pigment by crushing, filtering and mixing with solvents, antioxidants and other additives.

Generally, pastes contain 70-75 % of metal and besides this 20 % of solvents as well as 5 % of additives which promote crushing. Considering the basic properties, there are two main types of pastes such as leafing and non-leafing ones. In the leafing type pigments float on the surface of binding lacquer so the coatings produced with this type will have a metallic appearance. In non-leafing types, the pigment does not float in solvent but sinks down. Besides these different pastes for special purposes are produced by varying the solvents and additives. In the manufacture of pigmented paints the pigment paste and colouring material are mixed with stock solution made by different recepies. The paints contain 5-20 % of aluminium pigments.

Aluminium powders are produced from molten aluminium by high velocity cooling, grinding and classifying.

Application of aluminium, tinsel, pastes and powder products

In pharmaceutical and chemical industries the aluminium tinsel is the base material for producing organic aluminium compounds, aluminium alcoholates, aloxides, aluminium alkyls and "sterile" hydrogen.
Pastes are used in different fields of application like:

- As a coating additive utilizing the corrosion resistant, heat resistant, radiation reducing, light reflecting or decorative properties of aluminium.

- Reflective-type pastes are used for coating of ferrous and non-ferous metal structure.

- Bituminous pastes can be mixed to bituminized lacquer and this mixture may be utilized for protecting and isolating paints of depots, refrigerated warehouses, fences, tanks, wall surfaces, flat roofs of buildings.

- The architectural pastes are applied for producing light concrete (gas concrete). In this case the pigment generates hydrogen under the influence of lime and this makes the cast panels porous.

- For airplanes, cars, motorcycles, electric equipment, etc. the mixture of nitro-type paste and nitro-lacquer can be used as protecting and decorative paints.

- Water emulsifying pastes serve to paint walls, papers, cartoons and wall-papers.

- The non-leafing types are to be used for protective painting of walls and intermediate cover of metal surfaces as well as for lacquering with different effects.

- In connection with painting of P.V.C., polyethylene, and other plastic, metal, wood, glass and paper materials pigmented synthetic is applied.

The major field of applications of aluminium powders are as follows:

- The enamelling process in car industry needs special aluminium pastes for producing surfaces with pearl glittering. The base material of pastes having metallized effect can be foil scrap or chip of 99,99 % purity. Due to the very high requirements for these products aluminium powder is preferred as a raw material.

- Aluminium powders are widely used for pyrotechnical purposes, in industrial explosives, in defense and other applications where the favourable chemical properties of aluminium is utilized.

A.2 Hot-forged aluminium parts production

Aluminium alloy forged parts are used in almost all branches of industry. Their application is favoured where good strength/mass ratio, small mass and corrosion resistance are required.

The forged products have uniform, pore-free microstructure, high strength, smooth and uniform surface which needs only a few machining to achieve final dimensions.

In the leading industrial countries the greatest consumer is the aircraft industry, where forged parts are used for supporting elements and mounting bases.

The decrease of energy consumption has also led to an increasing usage of aluminium forged parts in motor and car industry. More and more moving parts, wheel suspension, transverse brace, foot lever, brake and bumper structure parts are produced by forging of aluminium alloys.

The machine industry shows a wide-range of applications, too, where hydraulic cylinders and components, pistons, hoists and supporting elements as well as parts of textile machines are made by forging.

In fixture production the aluminium forged components are applied mainly for armatures, castings, devices under pressure and elements of fastening structures. The electronic industry uses also a great amount of these making best use of high strength and good conductivity (for clamping and connecting elements).

As a consequence of modern architectural technology an increasing quantity of forged aluminium elements can be found in this field in addition to doors, windows and other aluminium parts. Forged aluminium parts find an ever increasing application in the mining industry as parts of mine props and supporting structures.

There is a field of applications which is especially important for some countries - namely the production of aluminium-gas-bottles. These products are maufactured in several countries. The bottleneck is produced by hot forging so the growing bottle production could provide for a stable, increasing market.

In case of aluminium and its alloys open and die forging methods are used. The open forging is applied in the aluminium industry for preforming (upsetting) and reforging first of all. In this case the starting material is cast ingot.

In the majority of cases, however, the finished product is a die-forged one for which the raw material is a semi-finished product (extruded part or rolled plate).

In view of the existing aluminium industry in the country the necessary raw materials are easily available. The know-how can be obtained from various sources in the industrialized countries.

A.3 Production of aluminium discs and slugs

Due to the favourable mechanical properties of aluminium, one of the first and most important fields of application is the production of household utensils like pots, pans, covers, kettles, pressure cookers etc. These conventional products have been manufactured and are in use for decades. The producers are applying new and new methods of surface finishing (e.g. anodizing, enamelling lacquering) and coatings (like various types of non-sticking teflon and others).

The household aluminium gas-bottles are also manufactured from discs.

The production of collapsible tubes, some boxes and other packaging materials for the cosmetics, pharmaceutical, food-processing and chemical industries is large consumer of aluminium.

Aluminium discs and slugs are used to all of the above mentioned application. Discs are produced in various sizes (thickeness is in the range of 0,5 - 6.0 m and diameter in the range of 80 - 1500 m). They are cut from aluminium strips or sheets on excentric presses, circulars shears or rotary saws depending on the sizes. Discs of small diameter are called slugs. Slugs are used for the production of collapsible tubes and manufactured from aluminium strips or sheets on excentric presses equipped with multi-position dies.

Good quality raw-material, proper equipment and tools as well as some know-how are the major prerequisites of the manufacturing process.

A.4 Production of high strength aluminium bolts, nuts, screws, rivets etc.

Light weight, good corrosion resistance, favourable mechanical properties as well as non-magnetic character of aluminium offer wide fields of application for aluminium bolts, nuts, screws, nails, rivets and other joining elements in the aerospace, vehicle, chemical, electrical and other industries.

The manufacturing process is basicly the same as for similar products made from traditional metals, but high mechanical strength can be achieved only by the selection of proper alloys, applying know-how and equipment accessible in several industrialized countries. These products are easily marketable, internationally standardized items.

2. DEVELOPMENT AND STRENGTHENING OF IRON AND STEEL INDUSTRIES

2. Development and strengthening of iron and steel industries

Projects in this field are characterized by recent advanced technological processes, e.g. continuous casting, production of special steels and alloys; emphasis is also placed on projects related to direct reduction of iron ores for production of sponge iron and various small scale smelting processes.

Future perspectives

A number of areas that will require UNIDO's attention in the future comprise new production technologies and improved qualities, particularly in the iron and steel industry field. Project requests and projects already under implementation reflect the requirement by developing countries to improve existing technology of quality steel production, including high strength low alloy steels, reflected by projects under implementation in Egypt, Pakistan, Yugoslavia. The following may be worth mentioning as UNIDO has already received indication of interest or official requests for assistance:

(a) Improvement of sintering productivity

Pre-treatment and utilization of ore fines.

(b) Improved Operation of Blast Furnaces

The objective will be to increase lining life, stabilize furnace operations at a high level of productivity and to increase knowledge base to influence decisions on improving existing and specifying new blast furnaces.

(c) Improved and new steelmaking technologies

i. Increased Cold Charge in BOF Vessels

ii. Concurrent blowing in steel converters

UNIDO may assist in the modification of one conventional steel converter to a concurrent blown converter and create indigenous technology necessary for modification and operation.

iii. Among the oxygen steelmaking processes, the concept of the EOF process (energy optimizing furnace) is worth mentioning as being reportedly low in both investment and operating costs.

iv. Production of Clean Steels

This involves the introduction of new steel process technologies covering degassing, desulphurization, dephosphorizing, ladle refining (gas stirring by argon/nitrogen lances) and alloying, wider ranges of chemistry, shrouding techniques, etc., and modified steelmaking and casting practices.

v. Production of high speed low alloy (HSLA) Steels with Improved Weldability

(d) Development of Improved Practices for Continuous Casting of Slabs including Thin Steel Continuous Casting and Product Implications

(e) Hot rolling of slabs
Defect (Internal and Surface) Control during Hot Rolling

(f) Direct reduction of iron ores

i. Establishment of pilot plants for the production of sponge iron, based on DR using coal as reductant

ii. If so requested, UNIDO may inter alia provide technical assistance, e.g. in the elaboration of master plans, ore testing and preparation of feasibility studies related to the application of direct reduction processes, gas or solid reductant based.

iii. Other processes of direct smelting

Depending on the raw material situation of a given country, technological alternatives of direct smelting may be considered.

(g) Electric arc furnace technology

In addition to the well established AC arc furnace technology, UNIDO may provide advice on alternative processes such as the DC arc furnace, the plasma furnace, the K-ES process, and scrap smelters.

(h) Production of ferro-alloys

UNIDO can assist in testing of ores as well as in assessing the economic and technical feasibility of any proposed venture.

(i) In addition to the above technology areas, UNIDO may offer its services related to energy conservation in integrated and mini steel plant operations, optimization of steel industry in developing countries (rationale and performance), analysises of capital and production costs of steel production by different routes/processes. Another important area to focus attention would be raw materials preparation - iron ores, coals and fluxes and developments and applications. This would include utilization of non-coking and low grade coals for conventional steelmaking, including formed coke production.

Project Concepts for possible technical assistance projects in selected developing countries

(to be promoted through missions, etc.)

No.	Title
2.1	Advisory services on modernization and expansion of existing metallurgical enterprises
2.2	Improvement of steelmaking operations in basic oxygen furnaces and electric arc furnaces
2.3	Concurrent blowing in steel converter
2.4	Introduction of converter technology for production of clean steels
2.5	Introduction of technology for High Strength Low Alloy Steel Production
2.6	Improvement of steel quality produced on continuous casting machine
2.7	Production technology of thin steel slabs
2.8	Application of smelting reduction technology for production of pig iron
2.9	Laboratory/pilot scale testing of ilmenite ore for metallurgical processing to titania slag and ductile grade pig iron
2.10	Direct reduction and introduction of ductile grade pig iron production from sponge iron

PROJECT CONCEPT 2.1.

1. TITLE: Advisory services on modernization and expansion of existing metallurgical enterprises

2. AREA: Ferrous metallurgy (iron/steelmaking and rolling)

3. OBJECTIVE:

To provide advisory services and technical assistance on possible modernization and expansion of an existing metallurgical enterprise based on indigenous raw materials and local market demand through application of appropriate up-to-date modern innovative technologies and to enable local companies/Government to take investment decision.

4. BACKGROUND AND JUSTIFICATION

There are many iron and steel metallurgical enterprises in the developing countries (Africa, Asia, Latin America) which are already out of date and need to be modernized and expanded depending on the specific local conditions. Obsolete equipment and old technologies should be replaced by introducing the newest and practically proven innovative metallurgical technologies such as direct reduction/smelting reduction, EAF-BOF with secondary metallurgy and continuous casting/direct rolling of steel, automation of rolling and quality control. The steel demand is increasing and the existing production facilities cannot meet present and future market requirements. The indigenous resources and the infrastructure may be limited and should be expanded. The investment should be identified and techno-economically justified. Programme for co-ordinated modernization/expansion has to be elaborated based on a full fledged opportunity/feasibility study. The technical decision on modernization/expansion should be based on an independent evaluation/study which can be provided by UNIDO advisory services and consultancy.

5. OUTPUTS:

- Short-term consultants technical reports on selection of appropriate metallurgical technologies;
- Techno-economic opportunity study;
- Techno-economic feasibility study

The opportunity/feasibility studies should be awarded to a reputed international engineering company.

6. ACTIVITIES:

- Recruitment of highly qualified international consultants for studying/analyzing the existing technologies and for recommendation of introducing modern and more efficient technologies/equipment.
- Subcontracting - elaboration of opportunity and feasibility studies (based on UNIDO manuals and relevant TOR) for modernization and expansion of the existing metallurgical enterprises.
- Study tours/visit to modern metallurgical plants where newest/recent technologies are introduced.

7. DURATION:

Total 30 months (2.5 year) including:

- Short-term Consultancy	- 6 m/m
- Opportunity Study	- 12 m/m
- Feasibility Study	- 12 m/m

8. COST/BUDGET:

Total US$ 1,250,000 including:

- Short-term Consultancy	US$ 100,000
- Opportunity Study	US$ 500,000
- Feasibility Study	US$ 600,000
- Study Tours	US$ 50,000

PROJECT CONCEPT 2.2.

Title: Improvement of steelmaking operations in basic oxygen furnaces and electric arc furnaces

Project objective:

To develop suitable operating and process parameters for production of steel in basic oxygen furnaces and electric arc furnaces yielding to improvements of performance and economic viability.

Background and justification:

(Information on the status of the iron and steel industry in the requesting country should be provided here, as well as the problems faced)

The project is expected to develop appropriate technolgies for clean steel production through BOF and EAF to meet growing demand of such steels in the country. The improvement of operations of BOF and EAF will expectedly result in enhanced availability and utilization of equipment which will enable to meet the planned production targets. Special emphasis will also be given to the conservation of materials, especially for fluxing agents and to achieve a reduction in overall energy consumption through consolidation of technological improvements like low flux consumption, increased yield and reduction in rejection and downstream losses.

Project Outputs:

Project report with conclusions and recommendations on improvements in

(a) Steelmaking in basic oxygen furnace, considering the following aspects

i. Acceleration of slag formation

ii. Weak/without slag technology

iii. Lining stability

iv. Reburning CO to CO_2

v. BOF dynamic model

vi. Stop of blowing down at prespecified carbon steel content (this is a problem of steel production with high carbon content)

vii. Steelmaking of alloyed steels

(b) Steelmaking in electric arc furnace (EAF)

i. Melting intensification of scrap and pellets

ii. Electrode stability

iii. Reduction of electricity consumption

(b) Scrap preparation

i. Separation and preparation of scrap
ii. Control of non-ferrous impurities (especially with Cu content)
iii. Ways and means of making efficient use of scrap
iv. Increase of scrap share in BOF charge
v. use of special scrapmelting units.

Project Activities:

The project will be implemented through a number of international consultants, experienced in charge preparation for steelmaking. Expertise will particularly be required in pre-refining (desulphurization, dephosphorization and desiliconization), in fluid-flow, high temperature metallurgical operation and process modelling; study tours will be organized on various aspects of process design and operations of hot metal pre-treatment in pilot/commercial units. Efficient use of scrap in BOF charge will be demonstrated.

Project duration: 2.5 years

Estimated cost:

Phase I: Diagnostic identification mission by 2 consultants

		$ 10,000
1 study tour		$ 10,000
	Total	$ 20,000

Phase II: Detailed project report with designs $ 500,000

Project Concept 2.3

Title: Concurrent Blowing in Steel Converter

Country: China (India, Brazil, Algerea, Algentine, Chile, Pakistan Mexico, Zimbabwe)

Background: /Justification In many developing countries, especially in China, following problem in industry is identified; i.e. although the Government calls for increase of quality and improvement of quality, many enterprises are putting one-sided emphasis on increase of quality because of the serious shortage of products. For example, China imported 20 mil. ton steel approximately in 1988, though the total annual steel production reached around 60 mil. ton. In view of recent Government policy to reduce the investment in capital construction, the only way to increase production is technical transformation namely automotization and computerization, introduction and absorption of advanced technology.

"Concurrent blowing in steel converter" has been developed during last decades in developed countries such as U.S.A., West Germaney and Japan. Taking advantage of more efficient reaction in molten steel due to concurrent blowing (top blowing plus bottom blowing), compared to conventional top blowing, this new process can bring;
-high productivity (high yield and short cycle time)
-production capability of quality steel and/or clean steel

Therefore, application of "Concurrent blowing converter" by modifing conventional one is the most practical solution on the problem afore mentioned.

Objectives:
-To improve production capacity of steel industry
-To give production capability of quality steel

Output:
-One concurrent blowing converter modified from conventional top blowing converter (as a model plant)
-Indeginous technology necessary for modification and operation of new converter

Activities:
-Modification of conventional converter
-Establishment of technology for the modification, construction and operation of conccurent blowing converter, especially;
1)Selection of brick material, shape and material of gas inlet
2)Blowing gas flow and composition control
-Establishment of skilled personnel necessary for the construction and operation

Input:	-Technical instruction by international experts -Training of indigenous engineers and operators on the job and abroad -Purchase of equipment 1. Control system including computer 2. Parts of new converter & accessary(financed by the Government) to be carried out under subcontract.
Budget:	to be finelized based upon detailed information from the field
Information: Source	Mr. Sakaguchi/UNDP/NY's informal memo communicated to UNIDO on 28 Feb. 1989

PROJECT CONCEPT 2.4

PROPOSED TITLE: **INTRODUCTION OF CONVERTOR TECHNOLOGY FOR PRODUCTION OF CLEAN STEELS.**

ESTIMATED DURATION: 2 YEARS

ESTIMATED EXTERNAL CONTRIBUTION: 824,400 US$

ESTIMATED COUNTERPART COSTS (IN KIND)

JUSTIFICATION

The development of technology/technologies for production of steel with a highly level of cleanliness, have been a important matter of research in the last years. These technologies permit to achieve consistent and low-levels of impurities like silicon, sulphur and phosphorus in hot metal and conjunctly to increase the performance of BOF.

The project envisages the production of experimental heats in pilot plant and the characterization of non-metallic inclusions and internal defects. Similarly, specifications for new equipment will be formulated and practices leading to production of cleaner steels with the existing facilities will be developed.

The main environmental impact will not be in the steel plant but in the society, since clean steel generally live longer, thus decreasing scrapping, littering, repainting, corrosion, etc.

DEVELOPMENT PROBLEM INTENDED TO BE ADDRESSED BY PROPOSED PROJECT:

Development Objective

To increase the self-reliance in producing clean steels to meet the growing demand of such materials.

Immediate Objectives

1. To acquire and introduce technologies for the production of clean steels by means of process modification.

2. To increase national capabilities of producing clean steels through the establishment of comprehensive training programmes for engineers and technicians.

OUTPUTS

1. Report describing the industrial practices best suited to produce clean steels in selected plants. Report containing results of laboratory and industrial trials, catalog of steel inclusions, computer model and industrial standards

2. A relevant number of researchers and engineers trained in non destructive analysis methods and on clean steel technology.

ACTIVITIES

for Output 1:

1. Installation and operation of laboratory instruments to analyse steel inclusion and impurities.

2. Realization of industrial trials with improved methods.

3. Validation and transfer of industrial practices to steel plants.

for Output 2:

1. Training on materials characterization, slime method analytical instrument.

2. Training under subcontract on clean steel technology.

INPUTS

Government Inputs

-Subcontracts with national R&D centres and universities.
-Use of existing R&D and plant facilities
-Transportation and administrative support

Estimated External Costs:

		US$
International personnel Consultants to advise on methods for characterizing defects and industrial processes to obtain clean steels.	12 m/m	133,600
Subcontract for training and technology for clean steels		114,000
Training including fellowships and study tour		172,800
Equipment		400,000 (*)
Misc.		4,000
Total		824,400 US$

(*) including cost sharing contribution by the technology recipient.

UNITED NATIONS FOR INDUSTRIAL DEVELOPMENT ORGANIZATION

Project Concept 2.5

Country: Countries with large metallurgical sector.

Proposed Title: **Introduction of Technology for High Strength Low Alloys (HSLA) Steel Production.**

Estimated Duration: 2 years

Estimated External contribution 630,000 US$

Estimated counterpart costs (in kind): 180,000 US$

Justification

High Strength Low Alloys (HSLA) Steels comprise a new class of engineering materials. Compared to common carbon steels, they exhibit a two to three times higher yield strength, ranging from 400 to 650 MPa. In addition to strength the new steels possess an interesting balance of engineering properties, such as ductibility, toughnes, and weldability.

For the steel producer, HSLA steels represent an added value product, contributing to better profitability. Of particular importance is the fact that through the use of HSLA steels, the weight of machinery and engineering structures can be substantially reduced by 10 to 25 percent. Because of that, the existing steelmaking capacity can be utilized more effectively reducing thus the pressure for additional capital-intensive expansions of facilities.

For developing countries the production of HSLA could bring following advantages;

-. More effective utilization of equipment capacity;
-. Production without licencing requirements;
-. Added value production;
-. Upgrading of engineering standard in the country;
-. production of HSLA steels to substitute for costly imports of heat-treated steels;
-. Improved competitive stance in export markets.

Development problem intended to be addressed by proposed project:

1. At macro-level:

The importance of improving the competitiveness and self-reliance of the domestic steel industry through the further progress and development of high quality low alloy construction cast steels production by additional microalloying and modification.

During project implementation, the technology of steel refining by electric arc furnace/ladle metallurgy processes should be mastered which is the main prerequisite for acquiring increased mechanical properties through the effects of microalloying and modification. Apart from this, the research activities should be targeted at proper selection of newly developed secondary metallurgy processes such as vaccum degassing, ladle furnace, botton bubling, powder injection process.

2. At micro-level:

The project is expected to enble the recipient domestic steel mills to reach hereunder stated immediate objectives in the sense of mastering, by domestic foundries, the production technology of low and micro-alloy steels with increased mechanical properties by means of:

a) Steel refining by electric arc furnace/ladle metallurgy with research into optimally economic processes with further possibilities of desulphurization, dephosphorization, degassing and deoxidation in the selected technology.
b) To elaborate a technological base for production of high grade construction steel families such as:
b.1 Increased strength and high notched bar impact strength steels production at low temperatures with prominent weldability (HSLA alloys) intended for wagon building, tractors and vehicles industry and process industry as well.
b.2 Production of abrasion resistant steels with good and steady notched bar impact strength for parts subject to dynamical loads and abrasive wear intended for mining and construction industry, thermo-power plants and cement production.

Concerned parties/target beneficiaries

1. Parties identifying projects:
This project was identified by IO/T/MET staff on the basis of implementation of UNIDO projects SI/EGY/88/802 (Egypt) "Quality improvement of standard and low-alloys steel in BOF" and the project DP/YUG/87/015 (Yugoslavia) "Research, development and Adoption of production technology for low and micro alloy steel casting with increased mechanical properties".

2. Target beneficiaries

Production sector of high grade steels and their clients (see 2. b.2 above).

Pre-project and end of project status

_Situation expected at the end of the project

The know-how to be acquired through the project will have a wider applicative guidance for developing production of high grade steels in the country and will bring about raw materials savings. the characteristic of this project lies in the fact that all experiments and researches would take place on industrial level. Fact that which will permit to test some of the parts developed by the project under industrial conditions.

OUTPUTS

1. An introduced and adapted technology for production of cast HSLA steels for various construction applications.

2. Techno-economic study for introducing a controlled secondary metallurgy in selected steel mills for identified products (steel assortment) production.

3. A relevant number of production personnel trained in production of HSLA alloys.

ACTIVITIES

For the accomplishment of the project objectives the following activities are envisaged:

1. Expert service for:

-Introduction of steel refining processes by electric arc furnace/ladle metallurgy and alloying and micro-alloying processes as well as applied processes of controlled secondary metallurgy.

-Production of HSLA cast construction steels and abrasion-resistant high strength cast steels.

2. Training programme including fellowships and study tours to steel plants manufacturing HSLA and abrasion resistant steels, and steelmakers with controlled secondary metallurgy for specific steel qualities in Europe, and USA.

3. Contracting and installing research equipment as per specifications.

4. Research, development and introduction of HSLA production technology through industrial trials.

5. Elaboration of techno-economic study for introduction of high strength steels production by controlled secondary metallurgy.

6. Dissemination of the know-how acquired through the realization of the project to other steel plants.

7. Organization of demonstration activities including Workshops_for both steelmakers and steel users.

INPUTS

In Kind:

The Host Government should:

1. Provide the required qualified professional and clerical staff for supporting project activities.

National Personnel	180m/m	120,000 US$
Training		40,000
Auxiliary equipment		20,000
Total		180,000

2. Cover material costs related to industrial trials.

Estimated External Contribution

		US$
Personnel:		
International 6m/m	-	60,000
Subcontracting	-	180.000
Training		100,000
Equipment		280,000 (*)
Miscellaneous including cost of reporting, scientific lit.		10,000
Total		630,000

(*) Including cost-sharing contribution of the technology recipient.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

·PROJECT CONCEPT 2.6

Country:______________

Project no.

Proposed title: Improvement of Steel Quality produced on continuous casting machine

Estimated duration: 24 months

Tentative UNDP contribution: US$ 460,000

Estimated counterpart costs:

Sources of funds (IPF, SMF/LDCs, cost sharing, other): IPF

A. Development problem(s) intended to be addressed by proposed project:

1. At macro level:

Objective necessity to increase the productivity and effectiveness of quality steel production in most progressive technology-continuous casting machine (CCM); to increase the utilization of capacity; to reduce the production costs. It calls for improvement and optimization of technology of stell production by means of introduction of computerized process control systems.

Causes: Application of an earlier level of equipment and technology in CCM steel operating in the plant.

Evidence: The technical parameters of the operating CCM.

2. At micro level:

Production of slabs and billets on CCM are often faced with the problem of poor quality. Up to 20% of all slabs produces can have different kinds of defects: Longitudinal and transversal cracks, belts, slag inclusion, gas blow holes etc. The cause of these defects lies in the violation of the basic parameters of continuous casting (temperature of steel before casting, intensity of secondary cooling, etc.).

This project envisages to develop and introduce computerized process control (CPCS) which could essentially improve the quality of billets and slabs produced.

Causes: Operations of the CCM on outdated level of technology and equipment installed.

Evidence: Application of CPCS can increase the yield about 1,5%, decrease production costs about 5-8% and decrease the amount of defective slabs by up to 3-5%.

B. Concerned parties/target beneficiaries

1. Party identifying project:

UNIDO in co-operation with National Counterpart.

2. Target beneficiaries:

Target beneficiaries are in the mine steel production sectors of the country. Direct recipients of the project benefits will be the steel producers in BOF and CCM because of the following reasons:

- increasing of yield
- decreasing of production costs

C. Pre-project and end of project status

1. The pre-project situation:

An outdated technology of continuous casting by manual control is used without modern instrumentation and process control system, causing loss of quality increase of cost (up to 20% of the produced billets and slabs are defective).

2. The situation expected at the end of the proposed project:

After the introduction of a modern computerized process control in CCM, the National Counterpart will be able to produce quality steel according to international standards.

D. Special considerations

1. Special considerations and their influence on either the content or form of the project:

After the introduction of Computerized Process Control, the steel plant will demonstrate viability and the expected results will .... the continuous casting process.

2. Negative impact of project:

None.

E. Other donors, programmes active in the same subsector

To be determined.

F. Development objective and its relations to the country programme

To increase the effectiveness of slabs/billets production in continuous casting by means of introduction of computerized process control system.

G. Major elements

Immediate objective	Success criteria
Production of quality steel by means of development and introduction of computerized process control system	

Outputs	Activities	Party responsible for the activity
1.1. State-of-the-art study of technology and production of slabs/billets in specific conditions	1.1.1. Conclusion of contract with sub-contractor	UNIDO/ Ntl.Counterpart
	1.1.2. Fielding of Subcontractor's team for collection of initial data and information required for the preparation of the report	UNIDO
	1.1.3. Preparation of detailed technical report with recommendations on structure and functions of computerized process control system.	Subcontractor/ Ntl.Counterpart/ UNIDO
1.2. Mathematical model and software for process control	1.2.1. Development of models	Subcontractor/ Ntl.Counterpart
	1.2.2. Testing/adjustment of model on practical data	Subcontractor Ntl. Counterpart
	1.2.3. Preparation of TOR with specification for realization of development of mathematical model.	Subcontractor/ Ntl. Counterpart

Outputs	Activities	Party responsible for the activity
1.3.	1.3.1.	
National technical personnel acquainted with the operation of CPCS for CCM.	Selection and nomination of national participants for study tour and fellowship to study international experience on construction and operation of CPCS in different plants.	UNIDO/ Ntl. Counterpart
	1.3.2.	
	Organisation of study tour/fellowships	UNIDO
	1.3.3.	
	Submission of the study tour reports to UNIDO	Ntl.Counterpart/ UNIDO
1.4.	1.4.1	
Computerized process control system	Selection of subcontractor/ computer supplier	UNIDO/ Ntl.Counterpart
	1.4.2.	
	Preparation of technical documentation and specifications	Subcontractor
	1.4.3.	
	Preparation of facilities for equipment installation (rooms, air-conditioning system etc.)	Ntl. Counterpart
	1.4.4.	
	Testing/commissioning of the CPCS	Ntl.Counterpart/ Subcontractor
	1.4.5.	
	Carrying out demonstration work shops for national/international staff.	UNIDO Ntl. Counterpart

H. Project strategy

1. Direct recipient:

The Iron and Steel plant to be identified.

2. Relationship between direct recipients and target beneficiaries:

Identical.

3. Implementation arrangements:

The implementation could be carried out by UNIDO in close co-operation with counterpart.

4. Alternative strategies/implementation arrangements considered:

Using of the models which were developed for other plants. They could be adapted and up-dated to suit local conditions.

I. Host country committment

1.a. Evidence of counterpart support, availability of physical facilities, sustainability:

Request and project document signed and submitted by the Government.

1.b. Availability of physical facilities, sustainability:

- provision of experienced nationa staff already involved in executing different research projects. Additional staff will be provided if and when required.
- provision of the land, building, analytical facilities available at ......plant required for execution of the project.
- provision of all expenses for providing office space, secretarial services, transport for internal travel for both national and international staff.
- construction of pilot-scale reactor according to output 1.3.
- organisation of core groups in selected steel plants for industrial scale implementation.
- proposals to obtain capital sanction for the expenditures to be incurred under government inputs are under active consideration of the plant management.

2. Arrangements to assure staff trained by the project will remain in their posts:

Legal arrangements by way of ....would be made to ensure that staff trained by the project will remain at their posts for a reasonable period after completion of training.

J. Risks

Description of risk	Estimated likelyhood of occurrence
1. Factors which may at the outset cause major delays or prevent achievement of the project's outputs and objectives.	
- long duration of project approval	medium
- long duration of recruitment of external and internal personnel	medium
- long duration of choice for subcontractor	medium
2. Factors which could over time cause major delays or prevent achievement of the project's outputs and objectives.	
- major changes in the concept of computerized systems and/or a part of the total scope	medium
- timely input in the form of infra-structural facilities envisaged the proposal and expert support	medium
-long duration of equipment supply	medium

K. <u>Inputs</u>

1. <u>Skeleton budget</u>:

	National inputs (specify currency)	External inputs (US dollars)
Personnel		5,000
Sub-contracts (specify types of goods or services)		100,000
Training		50,000
Equipment		300,000
Miscellaneous		5,000
Totals:		460,000

UN exchange rate: $1.= ______

2. Comments on possible project input policy issues.

PROJECT CONCEPT 2.7

1. Title: Production technology of thin steel slabs.

2. Objectives:

To transfer production technology for thin steel slabs.

3. Background and Justification

The possibility to produce thin steel slabs directly from the liquid metal without the intermediary rolling steps is a breakthrough in steelmaking only achieved in the 80's. The importance is not only economic (less operating costs, less production steps) but also environmental, since less energy will be used for heating during the rolling operations. Apart from that, it was observed that even the quality of the steel sheets would be better than the traditional route.

Thin slab casting technology or compact strip/rolling mill technology is a further development of continuous slab casting. Continuous casted thin slabs eliminate roughing train, can be hot charged and direct rolled into hot strips. The investment and operational costs are considerably less in comparison with the conventional technology. The new technology could be introduced through the establishment of new casters or by modifying existing.

A few steelmaking companies and equipment manufacturers have already succeeded in testing at commercial level thin slab casters in Europe, U.S.A. and Japan. Despite the intense R&D work still underway, the technology is already available on a commercial basis.

Despite their interest, the steelmaking companies in the developing countries do not have easy access on facilities to follow up closely the progress in this fast moving technology field. UNIDO, having contacts with a number of steelmakers and equipment manufacturers in Europe, U.S.A. and Japan can help in the followup and dissemination of technology. In other words, it can act as a focal point among suppliers and potential users of the technology and also to provide assistance to the developing countries when they decide to acquire/develop the technology for their own steelmarkers.

This project aims at creating conditions for technology transfer through study tours, economic and technology assessments, industrial tests, etc.

4. Outputs

4.1 Technical reports containing assessed information of the thin steel slabs technology.

4.2 Technical advisory report on possibility of introducing thin slab casting technology;

4.3 Techno-economic opportunity and feasibility study on establishment of thin slab casting and compact strip rolling facilities.

5. Activities

5.1 Assessment of the introduction of the technology.

5.2 Preparation under subcontract of an opportunity study on the introduction thin steels slab technology to a steelmaker in a selected developing country 10 m/m

5.3 Preparation under subcontract of a feasibility study (including opportunity study) 12 m/m

6. Costs

6.1 Assessment, study tour	70-100,000
6.2 Opportunity study	400,000
6.3 Feasibility study	600,000

PROJECT CONCEPT 2.8

1. TITLE: Application of smelting reduction technology for production of pig iron

2. AREA: Ferrous metallurgy (ironmaking)

3. OBJECTIVE:

To provide technical consultancy and assistance in industrial application of a smelting reduction technology for production of pig iron from indigenous raw materials (wide range of iron ores and non-coking coals) and to enable local companies/Government to take investment decision.

4. BACKGROUND AND JUSTIFICATION

Recently several smelting reduction processes were elaborated and developed for industrial implementation (e.g. Corex). These processes are variants of the blast furnace and the reactions take place in two reactors - Reduction and Smelter (Gasifier). They are more flexible in relation to the raw materials and energy. The processes make the use of sintering and coking plants unnecesary. The main advantages are: use of wide range of iron ores and coals, independence from coking coals and coke, less investment, more economic production of hot metal in relatively small scale capacity (up to 900 t/day), less environmental problems, utilization of waste energy from the reactors (steam/power generation, fuel/reducing gases). The quality of pig iron is suitable for the following steelmaking process. The fixed carbon consumption is about 650 kg/ton hot metal. Smelting reduction facilities are suitable for mini and medium size steel plants (up to 2 million t/y) and countries with reserves of cheap non-coking coal.

5. OUTPUTS

- Reports on testing results (reduction and smelting tests of the iron ore and coals);
- Techno-economic opportunity and feasibility study; laboratory/bench-scale tests with the indigenous raw materials and preparation of the techno-economic studies will be contracted with the appropriate engineering company.

6. ACTIVITIES

- Short-term consultancy and advisory services on possibility and necessity of application of smelting reduction technology;
- Collection of iron ore and coal samples for testing;
- Laboratory/bench-scale testing on smelting reduction;
- Subcontracting elaboration of techno-economic opportunity/feasiblity study for the establishment of a smelting reduction plant with appropriate hot metal (pig iron) production capacity;
- Visits/study tour to existing industrial facilities.

7. DURATION:

Total: 24 months (2 years)

- Short-term Consultancy	-	3 m/m
- Laboratory/bench-scale tests	-	9 m/m
- Opportunity/Feasibility Study	-	12 m/m

8. COST/BUDGET

Total: US$ 950,000 including:

- Short-term Consultancy	US$ 50,000
- Laboratory/bench-scale testings	US$ 250,000
- Techno-economic studies	US$ 600,000
- Study Tour	US$ 50,000

PROJECT CONCEPT 2.9

Title: Laboratory/pilot scale testing of ilmenite ore for metallurgical processing to titania slag and ductile grade pig iron

Project objective:

To determine by laboratory and pilot scale testing the suitability of available ilmenite ore or concentrate and coal reductant for the tandem technology of direct reduction and electrosmelting to titania-rich slag and low phosphorous pig iron, including the assessment of main technical parameters and products' quality for the case of industrial processing.

Background and justification:

Although the utilization of ilmenite concentrates to produce titanium dioxide of pigment grade directly, by the sulphate route, is steadily decreasing because of the unsolved or financially prohibitive problem of eliminiation of ferrous sulphate and acidic b-yproduct wastes, still the scope of processing of ilmenite concentrates to titania-rich slag by electrosmelting is increasing steadily in Canada, USSR, South Africa and Norway - countries who have developed independent technically and economically viable electrometallurgical technologies for this purpose. This trend is further strengthened by the availability of the low-phosphorous, high quality byproduct pig iron, which has become a trade mark product of e.g. the Canadian processing plant, located at Sorel ("Sorel metal"). The production and utilization for processing to pigment-grade titanium oxide of titania slag has overtaken already the diminishing quantity of ilmenite used for the same purpose directly. Accordingly, the annual production of titania slag has reached by now abt.2,5 million tons per year and it will further increase in the future. Both the slag and the byproduct, special quality pig iron, are highly priced products of international market value (US$250-300 and US$160-180 per metric ton at the end of 1988).

UNIDO continues to have access to one of the sources of the successful electrosmelting technology of processing ilmenite concentrates to titania-rich slag and pig iron developed in the USSR. At the same time, within the scope of another UNIDO technical assistance project being carried out with the company Sponge Iron India, Ltd. (SIIL), another, innovative technology of direct reduction of ilmenite concentrates by coal to ilmenitic sponge iron has been developed. The application of this technology to ilmenite concentrates prior to electrosmelting results in decreasing the specific energy consumption at the subsequent electrosmelting by close to half, with doubling the production capacity of the electric arc furnace. Accordingly, UNIDO has access to testing of concentrate samples also for preliminary, direct reduction prior to electrosmelting. The combination of the two successfull technologies is expected to lead to products of high quality and of highly competitive investment and production costs, significantly lower than that of the classical, one-stage route of processing (e.g. specific electric energy consumption of electrosmelting is expected to be on the level of abt. 700 kwh/t as against abt. 1400 kwh/t in direct electrosmelting).

The above conclusion has been proven by the latest entry into the group of producers of titania slag by the Norwegian company v/s Ilmenitsmelteverket, Tysedal. This is the first application in the world of the tandem technology described in the above, that is, pre-reduction to an iron-titania sponge and electrosmelting of the sponge to titania-slag and pig iron. A typical composition of the ilmenite concentrate used is the following:

TiO_2 = 44,6%
Fe_2O_3 = 11,9%
FeO = 34,8%
Cr_2O_3 = 0,07%
MgO = 4,7%
SiO_2 = 2,8%
Al_2O_3 = 0,7%

The products are a 75% TiO_2-containing slag of a quantity of 200,000 tpy and high-quality pig iron, suitable for direct production of ductile iron.

As the next possible follow-up, the laboratory/pilot scale testing is proposed to be complemented, in case of positive conclusions, by a detailed techno-economic feasibility study of industrial processing.

Project Outputs

Reports on laboratory and pilot-scale direct reduction by coal reductant of a characteristic ilmenite ore sample to ilmenitic sponge iron and subsequentelectrosmelting of the reduced ilmenitic sponge iron sample to titania-rich slag and high quality pig iron.

Project Activities:

1. Preparation by the national counterpart of one ilmenite concentrate sample of 600 kg from a selected deposit

2. Conclusion of contracts for bench/pilot scale direct reduction of ilmenite ores to ilmenitic sponge iron with metallization (iron) of at least 80% and for bench-scale electrosmelting of ilmenitic raw materials to titania slag and high quality pig iron.

3. Transportation of the ilmenite ore sample from (country) to testing facilities of contractor.

4. Completion of bench/pilot-scale direct reduction testing of the ore sample, preparation and submission to UNIDO of progress report.

5. Transportation of the reduced ilmenite ore sample to the testing facilities of the contractor.

6. Completion of pilot-scale electrcsmelting testing of the pre-reduced sample in the facilities of the contractor; preparation and submission of report to UNIDO.

7. Final evaluation of results of activities 1-6 in (country) with participation of consultants from contractors and UNIDO's backstopping professional staff

Project duration: 8 months

Estimated cost: $ 90,000

PROJECT CONCEPT 2.10

Title: Direct reduction and introduction of ductile grade pig iron production from sponge iron

Project objective:

To introduce and increase the application of non-coking coal reductant for production of pig iron and high quality steel thereof, in substitution of metallurgical coke. To create conditions for mobilization of private capital for investment in the iron and steel sector by demonstrating the techno-economic viability of investment on mini- and midi plant scale by introducing new/innovative technologies.

Background information and justification:

The project will contribute to opening up a new horizon in energy conservation in iron and steel industry by combination of effects of applying pre-reduction in solid state before metallurgical smelting, utilization of non-coking coal instead of metallurgical coke and demonstrating possibility of energy self-sustainability of an electrometallurgical process relying in its energy requirement fully on the utilization of calorific value of the non-coking coal used in the first, preparatory phase of the tandem metallurgical process applied.

The sub-merged arc electrosmelting of sponge iron can be supplied by electric energy fully from utilization of internal energy-generating potential of a solid based direct reduction plant (hot furnace gases, coal containing middlings of beneficiation of coal reduction before metallurgical utilization).

Beneficiaries from the project will be the automotive and machine building industries of the country as they will have an internal source of supply of low-phosphorous, ductile grade pig iron used for heavy-duty castings; pig iron of this kind is presently being imported from overseas which constitutes a drain on the balance of payments.

Project outputs

Output No. 1

Basic engineering design, available and accepted to enable and proceed with the physical establishment of the pig iron unit at a given direct reduction plant.

Output No. 2

A team of local specialists, trained and capable subsequently of successfully fulfilling the subject task for physical establishment of a pig iron manufactuting unit.

Project activities

Project activities will essentially center around preparation of basic engineering design required for proceeding with the physical establishment on demonstration scale of the new process and operations of production of special quality pig iron from coal based on sponge iron.

At the same time a group of local specialists will be built up - trained in the preparation of investment decision and physical establishment of industrial units of manufacturing pig iron from sponge iron by the sponge iron submerged arc furnace route.

The project will be implemented through an international sub-contractor who will prepare the basic engineering design. UNIDO will monitor and evaluate progress of work. Manpower will be built up through organization of training programmes and study tours. Experts under sub-contract will be provided in the pilot plant erection phase to tackle the selection of local equipment, supervision of erection and installation of the pig iron plant and successful starting up and operation of the plant.

Duration: 2 years

Estimated costs: about $ 1 million

3. DEVELOPMENT AND STRENGTHENING OF FOUNDRY AND OTHER METAL FORMING/TRANSFORMATION INDUSTRIES AND PRODUCTS

(including casting, forging, rolling, extrusion, stamping, heat treatment, welding, etc.)

3. <u>Development and strengthening of foundry and other metal forming/transformation industries and products</u>(including casting, forging, rolling, extrusion, stamping, heat treatment, welding, etc.)

Most projects aim at assisting least or lesser developed countries, particularly in Africa, in improving foundry operations to enable the manufacturing of essential tools, agricultural implements, etc.; activities also cover the establishment of pilot and demonstration foundry/forge shops and modern technologies such as investment or precision casting.

Future perspectives:

The foundry industry is complementary to any metalworking or metal processing activity and is thus an indispensable supplier of spare parts in any country. Apart from the establishment of Pilot and Demonstration Foundries and Mechanical Workshops special emphasis is expected to be accorded to the introduction of near to shape casting processes and the following may be mentioned:

(a) Investment casting:

In investment casting, a ceramic slurry is applied around a disposable pattern, usually wax, and allowed to harden to form a disposable castig mold. Two processes are in use: solid mold and the ceramic shell process. The latter has become predominant for engineering applications. Patterns for investment casting are made by injecting the pattern into metal molds of the desired shape. Ceramic shell molds are fired to remove moisture to burn off residual pattern material and any organics used in the shell slurry, to sinter the ceramic and to preheat the mold to the temperature required for casting. For melting, nowadays most investment casting uses induction furnaces. Sequence of post-casting operations include knockout, cut-off, core removal, heat treatment and others. Precision or investment casting is applicable economically in all fields of mechanical engineering where small size parts and components requiring considerable machining work are produced in small, medium and large series. The lost-wax casting method is the most flexible and popular for all precision casting technologies due to the advantages in mould-making, dimensional accuracy and the wide range of material qualities which may be used. This technology lends itself for casting of almost all commercial and high-grade alloys. A special advantage of the process is that total production time from design to the finished product is very short. Application thus involves considerable savings.

(b) Electroslag melting

Significant interest by developing countries has been expressed during a Workshop in the field of welding and electroslag technology, held at the E.O. Paton Institute of Welding, Kiev, from 11 - 16 September 1989. The introduction of the so-called electroslag melting for spare parts and tool steels production found particular interest as a means of production which reduces investment costs. The Paton Electric Welding Institute's pilot plant of special electrometallurgy manufactures cast billets from different steels, copper and copper-base alloys. Cast billets made following these methods are successfully used instead of forgings, rolled products and dies; metal utilization factor being 1.5 to 2 times increased. Through this method, costly heavy equipment (e.g. forging presses) can be avoided, which makes the process particularly attractive for developing countries. Cast electroslag billets are distinguished for the isotropy of physico-mechanical properties, high performance and life of components, their geometric sizes and shapes made close to the future component. Electroslag crucible melting is the basis of the new electroslag technology. It most favourably combines the refining features of the electroslag possibilities of permanent metal mould and centrifugal casting. The salient feature of electroslag crucible melting, electroslag permanent mould casting and centrifugal electroslag casting is the possibility to utilize as an initial material either consumable electrodes in the form of worn-out or rejected parts, tools, crop ends of rolling, press forgings, chips or liquid metal made in another melting unit. Interest in the process was particularly expressed by participants from Argentina, Brazil, People's Rep. of China, Egypt, Mexico, Turkey and Iran.

Project Concepts for possible technical assistance projects in selected developing countries
(to be promoted through missions, etc.)

No.	Title
3.1	Establishment of a Demonstration Production Foundry
3.2	Scrap collection and recycling of ferrous and non-ferrous metals
3.3	Upgrading the level of welding technology
3.4	Assistance to Industry for the Establishment of a Centre for the Promotion of Spare Parts Production and the Utilization of existing Facilities
3.5	Establishment of a Pilot and Demonstration Electroslag Permanent Mould Casting (EPMC) for the Manufacture of Billets for Spare Parts Production
3.6	Introduction of the Investment Casting Process into an existing operational foundry plant

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

PROJECT CONCEPT 3.1

Title: Establishment of a Demonstration Production Foundry

Duration: 4.5 months

Executing Agency: United Nations Industrial Development Organization (UNIDO)

UNDP inputs for the preparatory assistance: $ 71,000

UNDP inputs for the main project: $ 1,500,000

The Main Project:

The foundry will produce a minimum of 500 tons per annum of steel, iron and non-ferrous castings and would be expected to be profitable. This statement presupposes that all costs required for the establishment and start up of the plant are to be amortised, as for a normal commercial operation. No Government subsidies would be required, although the initial working capital must be supplied (as a loan), and access to a limited quanitity of foreign exchange will be required for the importaion of some raw materials.

Estimated UNDP inputs:

Chief technical advisor	18 m/m :	$ 180,000
Patternmaker	18 m/m :	$ 180,000
Short term consultants	8 m/m	$ 80,000
Other personnel costs:		$ 15,000
Training		$ 200,000
Equipment:		$ 800,000
Miscellaneous		$ 45,000
Total:		$ 1,500,000

Covered plant area will be of the order of 1,800 sq. metres, and office space and laboratories some 500 sq. meters.

Immediate Objectives:

The immediate objectives of the preparatory phase of the project are to obtain
a. a report containing financial and technical analytical data concerning the establishment and operation of the Demonstration foundry. This will allow the Government and UNDP to decide upon the financial viability and technical and commercial utilty of the main project:

b. The Project Document for the main project.

Background and Justification

All economies require a source of supply of spare parts for the machinery and equipment installed, and training sites to promote investment in the country. The foundry industry is indispensible as support for the economic growth of a country, but there is not normally such a large requirement as to justify the establishment of institutions dedicated exclusively to training of foundry personnel. There is however in all economies a profitable market for spare parts which can be manufactured in a small foundry which must have excellent installations and be staffed by personnel of the highest quality. Such a foundry is an excellent training site for high level technical and management staff, and can operate the more sophisticated equipment and technologies to the required level of excellence producing at the same time, spare parts of controlled quality for the local industry and make a healthy profit.

UNIDO studies have shown that this is a most attractive concept, but that it requires dedication, a correct autonomous management structure, and a strong preparatory training programme for the technical and management staff.

The Demonstration Foundry, at an estimated total cost of US$ 1,5 million (not including buildings, infrastructure and the cost of the subject preparatory assistance), will be expected to serve the national economy with high quality, specialised spare parts castings for the local industry, of a specified international standards quality, and to provide training in plant operations, quality assurance and control, and essential design of castings and foundry patterns. Consultancy services will be supplied. The highly detailed work programme which is to be prepared under this preparatory phase, will take these requirements into account.

The demonstration foundry is expected to be a profitable operation when analysed under standard accounting practices, and the preparatory assistance will design the plant and the production programme in such a manner to ensure that this is so.

Outputs

The following will be the output of the preparatory phase:

Output 1

A detailed report which will contain:

- a survey of the castings to be manufactured and a list indicating the order in which they will be put into production;

- selection of the production processes to be used;
- an estimation of the production capacity which will be required, based upon the existing demand and upon its development over, say 10 years;
- tentative production programme, with development to near-full capacity;
- pattern manufacturing programme (including subcontracts for the patterns for start-up);
- tentative training programme
    - locally where possible.
    - academic, locally where possible,
    - abroad, academic, in-plant

Output 2

- Financial analysis of the establishment and work-up to full operation of the foundry, and an analysis of national and imported inputs for work-up and for full operation;
- equipment list;
- Draft engineering drawings of
    - buildings
    - plant layout

Output 3

- Project Document for the establishment of the Demonstration Foundry

Activities (for Outputs 1,2,3)

A team of international experts will visit the country a for a period of up to two months to work with the counterparts in obtaining data on market, local costs, availability of staff and of material inputs and of possible project sites.

The team will then prepare a draft outline of the project document and the project budget which will be discussed with UNDP and the counterpart, in order to arrive at a broad agreement concerning the magnitude of the project and the modality of implementation, together with the clear definition and agreement of counterpart/Government inputs.

The team will then return to their home office and will prepare the work programme, training programmes, etc., as given in Outputs above, and a final draft Project Document for discussion and analysis with UNIDO, and for later submission to the consideration of the Government and UNDP. Should it be considered necessary, a return mission of the expert/Team Leader, may be made, to discuss the project with UNDP/counterpart.

Schedule	Month
Signature of the Preparatory Assistance Document	0
Fielding of expert team	1
Receipt of draft Project Document	2.5
Receipt of draft Final Report	3.5
Receipt of Final Report	4.5

Inputs

UNDP Inputs

			US$
11-01	Foundry expert; Team Leader (1.5 m/m field, 1.0 m/m home office work)	2.5 m/m	20,000
11-02	Expert, Patternmaking (1.0 m/m field, 1.0 m/m home office work)	2.0 m/m	16,000
11-03	Expert, industrial economist, specialised in foundry production (1.0 m/m field, 1.0 m/m home office work)	2.0 m/m	16,000
11-04	Expert, Foundry Plant Design (0.5 m/m field, 1.0 m/m home office work)	1.5 m/m	14,000
11-99	Total Experts		66,000
59-99	Miscellaneous (reports, drawings, etc.)		5,000
99-99	Project Total		71,000

Government Inputs

The counterpart will provide local transport for the expert team, offices and secretarial services.

Counterpart staff will, where possible be provided as follows:
- Metallurgist/mechanical engineer with foundry experience.
- Engineer with knowledge of maintenance/spare parts utilisation.
- Economist/accountant to assist with economic evaluation.
- Civil engineer, to assist with plant design.

Before the arrival of the expert team, the counterpart will prepare basic data concerning spare parts consumption in industry and will provide the curriculum vitae of personnel who may be considered for employment in the foundry, for examination by the expert team.

PROJECT CONCEPT (3.2)

Title: Scrap collection and recycling of ferrous and non-ferrous metals

Project objective:

To strengthen the industrial economy by improving the supply of raw materials - metal scrap - and, hence, upgrading the outputs of the existing metallurgical/foundry enterprises.

Background information and justification:

There are considerable amounts of metal scrap, especially iron and steel scrap, spread over a number of countries, particularly in post-war regions such as Vietnam, Angola, Iran, Iraq. At the same time the metallurgical/ foundry shops experience a serious shortage of scrap to feed their melting facilities, which leads to an underutilization of available capacities. Usually no or a very limited system exists for collection and processing of metal scrap and a suitable national structure for collection, processing and supplying metal scrap needs to be established. There are usually two alternatives for supplying the national metallurgical industry with metal scrap: first - to import metal scrap - very expensive as techno-economic solution for the national economy, and second - creation of a national system for utilization of the existing metal scrap.

Both collection and further processing of scrap necessitate the participation of competent experts to achieve good economic results and to master complicated activities, such as sorting of scrap. Careful consideration should be given to the geographical location of collection and processing plants.

Project Outputs:

Phase 1

Techno-economic analysis and report for establishing scrap collection and processing

Phase 2

Detailed design (blue print) for the establishment of a scrap collection and processing centre; with detailed plan for its implementation

Phase 3:

Physical facilities of a pilot scrap collection and processing plant or, in case the country decides to immediately establish an industrial plant: Various expert reports based on technical assistance in the construction/ operating phase of the plant. Skilled workers through training programmes.

Project Activities:

Phase 1:

The first step would usually involve a diagnostic mission to establish a preliminary inventory of available scrap and, based on collected data, to elaborate a techno-economic report for its collection and processing, through the introduction of a national scrap collection system.

Phase 2:

Based upon positive results of the techno-economic analysis, to prepare the detailed design (blue-print) for the establishment of (a) scrap collection and processing centre(s)

Phase 3:

Phases 1 and 2 to be followed up with

(a) The establishment of a pilot scrap collection and processing centre; or

(b) An industrial pilot scrap collection and processing centre;

In both cases UNDP/UNIDO assistance may be envisaged through the provision of expertise and equipment and arrangement of study tours.

Assistance would also relate to the preparation of terms of reference, invitation for bidding, evaluation, selection and contracting of national sub-contractors for establishment of scrap collection/processing plant (including scrap yards, general warehouse, repair shop for maintenance of equipment, canteen, oil and lubrification shop, dismantling shop, warehouse shop for second hand utilization materials, metal recovery furnaces, etc., civil construction works, water and electricity supply, etc.); assistance to the national counterpart in the specification, selection, contracting and procurement of imported equipment; daily collaboration, synchronization and supervising of the activities of foreign and local firms, assembly work of equipment; elaboration of organizational structure of the plant or pilot plant; assistance to the national counterpart in the scrap collecting and processing activity (planning/scheduling of scrap collection, maintenance and repair, etc., supervision of operation of press shear and other equipment, training of personnel, etc.)

Estimated costs: Phase 1: about $ 50,000

Phase 2: about $ 500,000

Phase 3: about $, depending on Government contribution/cost-sharing

Estimated duration:

Phase 1: about 6 months

Phase 2: about 12 months

Phase 3: about 3 years

For more details on the subject please refer to document UNIDO/IO.549 of 23 June 1983 "Profile on establishment of national systems for metal scrap collection and processing", which may be obtained from UNIDO free of charge.

PROJECT CONCEPT(3.3)

UNITED NATIONS DEVELOPMENT PROGRAMME

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Title: Upgrading the level of welding technology

Duration: Sector: Industry

Government Implementing Agency: Estimated Cost: US$625,000

Brief description:

The project aims to enhance the technical capabilities in welding by the preparation and implementation of audio-visual and practical training courses, and by training at least 50 well-qualified master welders and trainers who will be able to disseminate the acquired up-to-date welding techniques throughout the country by using a well-equipped mobile training unit and the audio-visual training course materials, both provided under the project.

The project addresses the following Government priorities:

- Developing human resources.
- Strengthening small and medium-scale enterprises.
- Broadening the technological base and industrial linkages in the country.
- Realizing savings through import substitution by improving productivity and product quality in industry.

Part A. Context

Due to the buoyant industrial development, a large number of new industrial facilities together with their infrastructure, office buildings and housing are under construction. These projects require huge amounts of welding work, which are often very sophisticated requiring various skills, techniques and equipment. The quality of welding - like the weakest link of the chain - can determine the strength and quality of the entire structure; therefore, construction work in several fields can be performed only by highly qualified and certified welders, equipped with proper welding machinery, jig and fixtures, and applying well-selected welding techniques and consumables. In spite of the demand for high requirements there is a great discrepancy in the quality of weldings, due to lack of skilled and well-trained welders, welding engineers up-to-date in welding technologies and equipment.

In the light of the described serious deficiencies, the majority of small and medium-size and even some large enterprises are unable to perform complicated, and even some simple welding jobs in critical fields of applications, like in petrochemical plants, pressure vessel manufacturing and repair, gas or oil pipeline construction, repair of castings for pumps and high-pressure applications, etc. To fill the gap, the industry may employ a large number of welders from abroad despite the manpower oversupply in the country.

Based on the described situation, there is an urgent need for technical and training assistance to upgrade the level of technologies and human resources in the field of welding technology.

Part B. Project Justification

It is expected that at the end of the project the technical capabilities of the base institution in the field of welding technology, will be enhanced and by the preparation and implementation of audio-visual and practical training courses, at least 50 well-qualified master welders and trainers will be trained through the project, who will be able to disseminate the acquired up-to-date welding techniques throughout the country by using a well-equipped mobile training unit and the audio-visual training course material, both provided under the project.

The target beneficiaries of the project are mainly the small and medium-size enterprises of the metalsusing, building and contracting industries.

The strategy of the project is to implement it in two stages:

- In stage 1 an international expert will visit the country to assess the capabilities and make recommendations for the overall strengthening in welding technologies and practices. The expert, together with a national counterpart, will visit in several industrial regions, important sophisticated projects under implementation, engineering companies producing pressure vessels, pumps and other products in which the quality of weldings are critical, as well as the existing training, quality control and product/welder certification facilities. Based on the findings, a report will be prepared with recommendations on the strengthening of the welding materials producing sector and welding technology in the country.

  In stage 2 one highly qualified international expert and two master welders will visit the country and organize training courses to train master welders and engineers who will be able to continue the disssemination of know-how in the future and perform sophisticated welding operations. In this stage, an audio-visual training course will be prepared and a mobile welding training unit will be procured and put into operation to serve the needs of the training component of the present project, and of the future training courses directed and performed by the trained staff.

The reason for UNDP/UNIDO assistance is UNIDO's wide experience in the field and its contacts with a large number of experts (on its roster) in this field, including specialists and institutions from the developing countries which faced the same problems and went through and gained experience during the establishment and operating of similar facilities and systems (i.e., possibility of TCDC).

No co-ordination arrangements are required beyond those needed between the parties involved in the realization of the project, assuming that the institutions designated to take part in project implementation are operational, and the respective industrial associations are well-organized and able to effectively assist to put the system into operation.

Part D. Immediate Objective(s), Outputs and Activities

The immediate objective of the project is to strengthen the welding sector of the country by enhancing the capabilities of its base institution in welding, training welder trainers and master welders and providing the necessary training materials and equipment for further dissemination of welding know-how and techniques.

D.1 Outputs

1. Stage 1

1.1 Report on the capabilities of the country's base institution in the welding sector, containing recommendations for their enhancement.

1.2 Report on the assessment of the level of welding technology in the industry and the available training facilities in the field of welding, as well as on the estimated demand in welding technologies and personnel. The report prepared by an international consultant with the assistance of a national counterpart will contain recommendations on strengthening of welding technology in the country.

1.3 Some new welding equipment for the country's base institution put into operation and staff trained in their operation.

2. Stage 2

2.1 Audio-visually supported training material prepared.

2.2 Operating mobile training unit will be put into operation.

2.3 Approximately 50 master welders and trainers will be trained in at least three different locations.

D. 2 Activities

Stage 1

1. Data collection on site.

2. Commissioning of the new welding equipment and implementation of measures aiming at strengthening the base institution, as required.

3. Training of staff in operating the new equipment.

4. Preparation and submission of reports and recommendations as described in outputs 1.1 and 1.2.

Stage 2

1. Preparation of audio-visual training materials.

2. Design, manufactuing and commissioning of the mobile training unit.

3. Training of about 50 master welders and trainers.

Part E. Inputs

(a) Government/national counterpart's inputs

The Goverment will assign a national counterpart and a project director who will collect and provide information, data, organizational help in making the necessary arrangements with the institutions, authorities, associations, production companies, etc. as required for the successful implementation of the project. The Government will also provide, on site, accommodation (if needed), logistic, local transportation and language support (during the survey, in particular), office and secretarial services for the international experts. The Government/national counterpart will translate, publish an disseminate all the training material prepared by the expert(s). The Government/national counterpart will make available classrooms and workshop with the necessary infrastructure for the implementation of training courses, and provide the truck for the mobile training unit.

(b) UNDP/UNIDO inputs

(i) Stage 1

a)	International consultant for fact-finding mission.	US$ 60,000
b)	National consultant for stage 1	US$ 20,000
c)	Consultant for putting into operation of the new equipment in the base institution and training its personnel	US$ 25,000
d)	New equipment required for the strengthening of the base institution in welding	US$ 50,000
e)	Other	US$ 10,000
	Sub-total for stage 1	US$165,000

ii) Stage 2

a)	International expert and master welders	US$300,000
b)	National consultant	US$ 25,000
c)	Mobile training unit	US$ 80,000
d)	Audio-visual training course and welding raw materials for training	US$ 25,000
e)	Other	US$ 30,000
	Sub-total for stage 2	US$460,000
	GRAND TOTAL	US$625,000

For further information please contact Mr. Grof, IO/T/MET.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANZIATION

PROJECT CONCEPT 3.4

TITLE: Assistance to Industry for the Establishment of a Centre for the Promotion of Spare Part Production and the Utilization of existing Facilities

TOTAL BUDGET PHASE I: US$ 143,000
PHASE II: US$ 255,000
TOTAL $ 398,000

BACKSTOPPING SECTION/BRANCH: IO/T/Metallurgical Industries Branch

BACKGROUND AND JUSTIFICATION

When there is a limited foreign exchange availability, there is also a shortage of of spare parts and the frequency and number of breakdowns of industrial plants, machinery and equipment increases. There is a growing tendency to encourage the domestic manufacture of spare parts within the existing foundries, forging, heat treatment and machine shop facilites.

The major constraints to the development of the local manufacture of spare parts is the lack of confidence in the capabilities of the manufacturers. In general, very little regard is given to the requirements of the consumers of the spare parts. However, with proper specifications and careful analyses, design and manufacturing parameters, the prices of locally produced spare parts could be 40-50% lower than imported spare parts. The reason being that since specialized low volume parts are not generally produced by the equipment manufacturers, they have to be supplied by others, and shipped by an agent. The result is that the prices of such parts are loaded with three or more profit margins. In addition, the administrative procedures and length of time required to obtain the proforma invoices, letter of credit, import licence, procurement of order and customs clearance invariably add to the cost of placing the spare parts at the consumer's warehouse.

If spare parts production is to be properly promoted and developed in a technically acceptable manner, a system and programme must be established to define the consumer's requirements and the capability of local manufacturers to meet these requirements. The demands upon the local manufacturers will become steadily more exigent as consumers aquire confidence in their capabilities; manufacturers will begin to penetrate this technically complex market, they will be willing to make additional investment in terms of upgrading/expanding their capacities and the training of their personnel.

The project idea is directed at the establishment of the local technological base or centre which will advise and orientate both consumers and producers by providing specifications and through which technical assistance and training can be given to both consumers and producers of spare parts.

The Centre - a Description

1. Personnel

(i) Technical Advisory Committee

It is frequently found in developing countries, that there are a number of qualified persons who are employed in areas which have little or no relation with their studies and earlier experience. It may be found that although they are properly employed, their training and experience is not being fully used and it is almost certain that such people would obtain considerable personal satisfaction from an involvement in an important development programme.

The Centre must use the services of anyone with relevant experience. Such people are normally employed, will have no wish to change employment and will be available only as consultants; a Technical Advisory Committee will be constituted and such people incorporated into the Committee.

The Committee will be a working group and will meet once a week to revise the work of the Centre and to assist in programming and orienting the work for the following week. The members will be expected to participate in the revision of specifications and drawings and to advise concerning the possibilities for the local manufacture of the more complicated parts. Thus, the members of the Committee will be expected to have a thorough knowledge of the manufacturing capacity and capability of the country, i.e. who has which machine tools, processes, etc., and how well they can operate them.

The Committee should be composed of people selected from the industries which produce and consume parts. They should be metallurgists and mechanical engineers, with possibly one analytical chemist. Where the local industry is sufficiently advanced, plastics and rubber may be treated.

A properly qualified representative of the Ministry for Foreign Trade (for example) may be invited to participate as an observer. This will give the Ministry a close view of the problems and the attempts being made to solve them; the Commitee will also offer sound advice as to what must be imported and what can be manufactured locally.

The Design Department of the University should be represented by a properly qualified staff member, who will be expected to participate in the work of the Centre, through the Committee. This will also establish a necessary liaison with the University, for obtaining testing services, assistance in design of parts and possibly in the preparation of engineering drawings - by groups of students, properly supervised by the Design Department.

The University and the students will benefit from the experience obtained from participation in the programme and this benefit will be transferred to industry in the medium term as these students graduate and begin to work in industry or establish their own workshops.

(ii) Centre Staff

The Centre staff will be initially composed of:
1 Metallurgist
1 Mechanical Engineer
1 Analytical Chemist
3 Assistants (including draughtsmen) properly trained
1 Secretary - receptionist
1 Book-keeper - librarian, archivist
1 Messenger - odd job man

The number of assistants and, most obvious, draughtsmen, will depend upon the volume of work. The use of Computer Aided Design should be encouraged because the rate of preparation of engineering drawings will limit the productivity of the Centre.

The Committee and staff of the Centre will be expected to give technical advice and assistance to the consumers and to the producers of the spare parts. The consumers should be required to encourage their technical staff to participate in a properly structured programme of assistance to the producers - it is in their interest to have a healthy producer industry!

(iii) Technical Assistance

As noted in the previous section, the Centre should offer assistance to the manufacturers of parts. This is a somewhat open-ended statement and if not carefully qualified, could cause the Centre to grow to become like a technological institute. This must be resisted, but it may be found that a certain minimum equipment may be usefully employed (if not available at other institutions) - by the Centre solely for assisting in the control of production procedures; for example, sand testing equipment for foundries.

(iv) Exhibition Room or 'Spare Part Fair'

The 'room' is a very low cost structure, in which consumers exhibit parts which they wish to manufacture locally, and for which they have not found a manufacturer. Each part is accompanied by a technical specification card, together with the quantity required per order, and the order frequency. The staff of the Centre and the Committee will be available at certain times to discuss with prospective manufacturers and to allow them to consult the engineering drawings (copies of these may be given or preferably sold to prospective manufacturers).

2. Ownership and Finance

The success of the Centre will depend almost totally upon three factors:

(a) the quality of the personnel of the Centre

(b) the composition and interest of the Technical Advisory Committee and clients
(c) the ownership of the Centre.

The salaries paid by the Centre must compete favourably with those offered by Industry. There is great job satisfaction to be obtained from work at the Centre but the salary factor will eventually exert a determining influence and it is vitally important that the invaluable experience obtained by the staff continue to remain at the service of industry.

The Centre must be at the service of the consumers and (to a lesser extent perhaps) of the producers. These are the interested parties and should have a determining influence in the Centre. They should thus be the owners, through a trade organization, association or similar. No Government body or Institute should be able to influence the working of the Centre as this will lead inevitably to the Centre becoming independent of those it is to serve. In which case it will sooner or later cease to serve them. The local Chamber of Commerce should also not be involved as it may tend to stand between the Centre and the clients.

The requirement for capital for buildings (some 250 square metres) and equipment and for income must be determined.

The income of the Centre will come from subsidy and services, the former supplying close to 100%, for the first 6 months or so, decreasing to around zero after a period of five years, as the Centre proves its worth.

During the first year, it may be possible to operate the Centre with laboratory assistants only, who would be given the task of performing the chemical analyses, preparing specimens, etc., for examination by Committee members who would visit the Centre once or twice per week, in addition to their normal meeting, in order to guide and advise.

(Staff may be taken from amongst the retired or semi-retired, experienced professionals, as indeed may some of the Committee members.)

The site or sites selected for the establishment of centres will be such (in consideration of the present budget restrictions) that the equipment listed under (d) Inputs, 1. National Inputs, will be readily available. PTA will identify such sites and confirm the existence of properly operating equipment.

II. THE PROJECT

(a) Project Objective

1) Development Objective

The development objective is to increase the industrial producivity and improve the utilisation of the installed capacity by making spare parts opportunity available.

2) Immediate Objective

To assist the consumers of spare parts to establish a Centre for the Promotion of Cast and Machined Spare Parts, which will specify materials, production processes and engineering data, and offer technical assistance to consumers and manufacturers of spares.

(b) Outputs

The Centre, as described in the Background above, will be composed of the following:

(i) Chemical and Metalographic and Metallurgical analysis section
(ii) Engineering Design section
(iii) Library and Information service
(iv) Extension service
(v) 'Spare Part Fair'.

Descriptions

(i) Chemical and Metalographic and Metallurgical analysis

Will provide a full description of the chemical and metallurgical characteristics of a metal part, and will advise concerning the manufacturing processes required to reproduce the part and to obtain adequate, similar physical and mechanical properties. Possible changes will be discussed and suggested.

(ii) Engineering Design section

Will provide engineering drawings, tolerance and surface finish specifications. It will also advise on manufacturing procedures required to reproduce the part and where possible or necessary, design changes may be proposed.

(iii) Library and Information Service

Will provide the staff of the Centre and manufacturers and others with all necessary information concerning materials properties and manufacturing processes. The Service will also obtain information concerning manufacturing capabilities processes and services available of specialized services, such as heat treatment, electro-plating, spray coating, etc.

(iv) Extension Service

The Centre is set up to advise the consumers of spare parts concerning local manufacture. This will develop into a system of constant contact between the Centre and the consumers as these become more and more dependent upon the Centre for assistance and advice. The Centre will also be able to advise the manufacturers concerning the procedures and methods to follow, and to help to adjust manufacturing processes, to obtain improvements. This is not and cannot be its primary concern or responsibility, given that the very varied manufacturing processes involve a great number of disciplines which will not all be available at the Centre. The Centre, however, will be able to assist in the establishment of certain process controls, and will be able to check the conformity of the products against the specifications.

The Technical Advisory Committee will, however, be expected to offer independent advice to both manufacturers and consumers.

(v) Spare Part Fair

This may be considered as part of the extension service, however this permanent exhibition will serve to both simplyifying and make more active, the normal market procedures by bringing consumers and producers together in the presence of a technically competent intermediary.

The experts will prepare a comprehensive report, covering the activities and with a complete discussion and recommendations.

(c) Activities

The project is directed at promoting and organising the establishment of Centres using wherever possible available equipment and qualified personnel. The project is thus not expected to provide equipment or training except for clearly defined special objectives. The following activities will be undertaken under the supervision of an expert team, consisting of a metallurgical engineer and a mechanical engineer, with experience in this field.

i) Census of consumers, to obtain a preview of their requirements, inform them of the programme and to obtain their participation.

ii) Identification of technical personnel to serve on the Advisory Committee.

iii) Census of foundries, manufacturing plants and workshops with details of machinery, processes and capabilities of the personnel.

iv) Formation of the Advisory Committee, with the guidance of representatives of the consumer and producer industries.

v) Identification of available technical personnel within producer and consumer industries.

vi) Identification of staff for the centre.

vii) Formulation of training programme for the Centre staff.

viii) Census of available testing equipment in institutions which may offer services to the Centre.

ix) Preparation of equipment list, on the basis of availability of other sites.

x) Selection of site (preferably an existing building) for the Centre.

xi) Order equipment, on behalf of sponsors or promoters.

xii) Initiate training programme
Details of the training programmes will be determined following upon the selection of the counterpart staff and local consultants, after studying CV's.

xiii) Preparation of the second draft programme of assistance to consumers to determine their requirements in detail and to prepare a draft manufacturing schedule for a series of parts for each consumer.

xiv) Preparation of the draft programme of assistance to manufacturers, foundries, machine shops, heat treatment shops, etc., taking into account their requirements for additional equipment, processes and training.

xv) Preparation of work programme, from xiii) and xiv) above.

xvi) The experts, together with Centre Staff, will prepare a final report, containing the above and such observations and recommendations as may be required.

Note 1.
Once the programme has begun to function, the consumers and producers will tend to organize their own affairs, requesting the assistance and advice of the Centre.

Note 2.
The manufacturing schedules (xiii, above) will be so designed as to provide a certain clarity of objectives and possibilities to consumers and manufacturers. It will also permit manufacturers to programme (or at least contemplate the advisability of) capital investment, on the basis of a wider view of the market for the services of more specialized processes and equipment.

Note 3. - Concerning requirements for additional assistance
Expert Assistance - Expatriate and Local
The detailed requirements foi expert assistance will be examined during the preparatory assistance phase. It is to be expected however, that personnel available will be able to do some or most of the work, and that the interested consumers and producers will contribute (enlightened self interest) to the project. Where expatriate experts are required, it is expected that specialist missions will become predominant during the last two or three years of the project. The requirement for a resident CTA will depend upon the qualifications of the Chief Engineer of the Centre; the requirements for other experts will also depend upon the availability of local, qualified and experienced personnel who may be co-opted as local consultants, with the support of the consumers. It is noted however, that the Centre will be expected to develop permanent contacts with local professionals to the exclusion of expatriate 'experts'.

(d) Inputs

1. National Inputs

(a) The following equipment must be made available (to the Centre (with Universities, Technical Institutes and similar):

(i) Metalographic anlaysis

1 abrasive disc cut-off machine
1 continuous belt pregrinder
1 2-disc abrasive grinder (to 400)
1 2-disc polisher
1 manual hydraulic, specimen mounting press
Cold mounting materials for metallurgical specimens
Simple glassware and measuring cylinders
Fume cupboard
Chemicals for preparation of solutions for etching specimens
Metallurgical microscope, inverted with camara, with complete set of filters
Microdurometer for above.

(ii) Mechanical Testing

Fixed hardness tester, with Rockwell and Brinnel scales
Portable hardness tester (with tungsten carbide ball)
Portable, impact hardness tester, or similar for hardness determinations of parts, which are sited in the unusual positions.

(iii) Chemical Analysis

Atomic absorption spectrometer, with all accessories, necessary lamps and chemicals

Carbon and sulphur determinator (tube furnace), complete with accessories, oxygen pressure reducing valve, flowmeter and purification train (combustion boats, etc. plus other consumables and spares for 3-4 years' operation)

Analytical balance.

(iv) Engineering equipment

Measuring equipment, etc.

(v) Engineering Drawing

Standard drawing equipment.

(vi) Library

Texts and standards on alloy compositions and applications from the major countries of the world. (Metals Handbook, American Society for Metals (ASM).

Tool Steels (ASM)
Handbooks on corrosion and electroplating
Engineering Handbooks

b) Personnel

Project budget restraints impose the necessity of obtaining counterpart personnel with high qualifications and experience, thus CV's of candidates for the membership of the Technical Advisory Committee and for posts within the Centre will be supplied to UNIDO for analysis before the expert's preparatory mission.

The experts will interview short-listed candidates and will advise as to the suitability of these for the posts.

2. UNDP Inputs

a) Phase I

Two experts will visit the regions chosen for the establishment of the Centres in order to carry out, with local staff, the preparatory activities and work plan described on page ..:

11-01	Metallurgist	4 m/m	$ 32,000
11-02	Mechanical Engineer	4 m/m	$ 32,000
15-00	Project Travel		$ 2,000
16-00	Staff member mission		$ 4,000
31-00	Training		$ 18,000
41-00	Books and Literature		$ 7,000
42-00	CAD Equipment comprising: P.Computer, normal monitor, high resulution, colour monitor, etc.; standard printer and printer for AO drawing paper. Basic software and Application software.		$ 47,000
53-00	Miscellaneous		$ 1,000
99-99	Project Total		$ 143,000

3. Prior Obligations

Counterpart

The counterpart will identify available equipment and obtain C.V.'s of candidates for Centre Staff posts as indicated under Part II.G.1. - National Inputs.

Phase II:

11-50	Special Consultant Missions These should cover special casting procedures, heat treatment, special machining techniques, and in all cases advice on equipment selection.	12 m/m	$ 96,000
16-00	UNIDO Staff expert mission		$ 15,000
32-00	Short training programmes in special techniques and technology		$ 40,000
42-00	Additional provision for equipment not found to be available (see National inputs)		$ 100,000
53-00	Sundries		$ 4,000
99-99	Phase II Total		$ 255,000

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT CONCEPT 3.5

PROPOSED TITLE: **ESTABLISHMENT OF A PILOT AND DEMONSTRATION ELECTROSLAG PERMANENT MOULD CASTING (EPMC) FOR THE MANUFACTURE OF BILLETS FOR SPARE PARTS PRODUCTION**

ESTIMATED DURATION: SIX MONTHS

ESTIMATED EXTERNAL CONTRIBUTION: 275,000 US$

ESTIMATED COUNTERPART COSTS (IN KIND): 40,000 US $

JUSTIFICATION

Electroslag Permanent Mould Casting process is a recently developed casting technology for the economic production of billets and spare parts using as initial material either consumable elctrodes in the form of worn-out/rejected parts tools, crop ends of rolling, press forging, chips, or liquid metal from other melting unit.

The process is sub-divided into two stages: first the molten metal is produced by the electroslag technique in a crucible furnace; it is then poured into an incooled metal mould, usually together with the slag which has been used in the melting process. Also, it is possible to pour both the molten metal and slag prepared in a separated unit, together.

Due to the good surfaces and sastifactory mechanical propierties of EPMC, castings can be used instead of forgings, for producing cast billets with minimun allowances for further machining and finishing. In addition, this technology can be used in the production of billets for an extremely wide range of important components used at steel works which are made of structural carbon and alloy steels, tool steels, die steels, high speed and rolled steels, stainless steel, etc.

The introduction of EPMC technique in a selected spareparts factory will provide on the spot know-how and re-conditioning facilities for re-use of existing components mentioned below as electrodes and subsequent manufacture of similar parts by EPMC techniques.

- Crankshafts for single cylinder engine upto 50 kg.
- Gears of complicated shapes,
- Stop valves bodies for power station and petrochemical industries.
- Tools, and parts for machine tools,
- Components of mining equipment,
- Crane wheels, large gears,
- Tractor parts,
- Agricultural machinery parts,
- Wide range of mechanical parts.

The proposed Unit will also serve as training center for operators from other national industries in EPMC technology. It will act as a focal point demonstration unit for large, medium and small scale industries for the production of parts and components.

DEVELOPMENT PROBLEM INTENDED TO BE ADDRESSED BY THE PROPOSED PROJECT;

Development Objective:

The development objective of the project will be to produce spare parts through EPMC process in order to support existing industrial production and productivity by reducing the down times of machinery and equipment with the aim to keep them in acceptable operational conditions. Promotion of technical skills to stimulate the overall industrial development in country will be the core concept of the project. The proposed EPMC Unit can become a basis of future large scale industrial operation.

Immediate Objectives

The immediate objective of the project will be to establish a Demonstration-cum-Production Spare Parts Unit within existing facilities of a selected Spareparts Factory by means of incorporating technology and physical facilities for Electroslag Permanent Mould Casting (EPMC) for the production of billets for spareparts and tools in-plant training of operatives and entrepreneuers in the country.

Output

Commissioning and running of 50 kg Electroslag Permanent Mould Casting Equipment (EPMC) to produce upto 60 kg of billets per hour for reconditioned parts and components. The unit will train 20 to 30 operatives per annum from other enterprises.

Activities

1. Mission of experts to identify and determine the size of equipment required for EPMC including fixtures, tool, mould requirements, in-plant lay out and designing of in-plant training programme.

2. Preparation of detailed specification of machinery, equipment, fixtures, moulds requirements including contract document.

3. Procurement and shipping of machinery and equipment with spare parts.

4. Trial runs and training (in-plant and abroad) of local counterpart operatives and supervisor.

5. Introduction of process sheets, design adaptation techniques, standardization of production e.g. consumption of electrodes, flux, refractories; estimation and cost, etc.

6. Introduction of training programmes and demonstration activities for local operatives of sparepart manufacturers.

INPUTS

Government Inputs (in kind)

The national counterpart should provide the required professional and administrative personnel as well as the logistic support necessary during the project implementation.

National personnel consisting of Supervisors, EPMC operators, inspectors, operators	48 m/m	25,000 US$
Local travel		2,000 US$
Expendable Equipment		10,000 US$
Sundries		3,000 US$
Total		40,000 US$

External Contribution

International Personnel Spare Parts Reconditioning Co-ordinator Expert on EPMC Technique Expert on mould and fixture design	13 m/m	130,000 US$
Travel		20,000 US$
Training		45,000 US$
Equipment Expendable		35,000 US$
Non-expendable including 50 kg casting mass EPMC, Ultrasonic testing equip.		60,000 US$
Misc.		5,000 US$
Total		275,000 US$

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT CONCEPT 3.6

Title: Introduction of the Investment Casting Process with Existing Operational Foundry Plant.

Inputs: Preparatory Phase	$ 23,000
Main Project	$450,000
	$473,000

Background Information

The investment casting unit would be expected to make a significant economic contribution to a small (500-1500 Ton per annum) jobbing foundry operating a medium frequency coreless induction furnace, or a cast iron foundry producing small cast iron parts for agricultural machinery, sewing machines and spares for textile machinery.

Investment casting is one of the 'near net shape' manufacturing processes which have become very important within the last two decades. The process allows the application of a primary production process which uses molten metal, of a part which has dimensions very close to those required for its final use in machinery.

The advantages are a reduction of the final cost of the completed part due to savings in : material, and thus energy
: processing costs
: machinery and finishing.

The process is environmentally neutral.

Investment casting can be used to produce small parts with a smooth surface finish, which could not be produced by any other process. It is utilised for parts ranging from hand tools to fine parts for textile machinery and complex parts for specialist machinery. Such pieces as conveyors chain links, rolling mill guides, agricultural hand tools, and parts for use 'as cast': gear wheels and parts for agricultural machinery represent but a very few of the pieces which can be produced by this method.

The cost of establishing a new plant is quite high, and the introduction or obtaining of the basic foundry skills within a developing country can take a long time and be very costly. The addition of an investment casting line to an existing foundry which is already operating an induction furnace for steel casting can be a low cost exercise, and the adaptation of the personnel to the additional technologies can be very rapid indeed.

The equipment required includes a 'burn out' furnace for the shell moulds. A steel foundry will have a furnace for the heat treatment of castings, which can be used, at least initially as a 'burn out' furnace. Of the remaining equipment, much can also be manufactured locally - such as fluidisation - coating tanks, wax mixers and others. Designs will be supplied by UNIDO as part of the main project, and advice on their production be given as required.

Activities

1. Preparatory Phase

This phase would consist of a short (one month) mission by two experts to:

(a) Examine the existing facilities;
(b) select a production programme from the existing market, and hold discussions with the identified clients;
(c) prepare the complete equipment list, specifying what is to be manufactured locally;
(d) specify a schedule for the manufacture of the wax injection dies;
(e) prepare the work plan for the project;
(f) specify the training schedules and prepare the job descriptions for the operative personnel for the Investment Casting Unit;
(g) prepare the full project document if the project is to be financed from external sources;
(h) prepare a financial analysis of the Investment Casting Unit;
(g) submit to a general meeting a report containing findings and recommendations to be discussed by all parties concerned.

2. Main Project Phase to be implemented against the agreed work plan, if a positive decision is taken at the meeting.

Counterpart Inputs: Local transport, offices, secretarial services, engineering drawings.

UNDP (or other source) Inputs

Preparatory Phase

Expert Investment Casting (1 m/m field, 0.5 home office)	1.5 m/m	13,000
Expert financial analysis	1.0 m/m	10,000
	Total	23,000

Main Project

The consultant component will depend upon the availability of local staff. ...ver, it is considered that short term consultants w... be required for design, start-up and for trouble shooti... during the first months of operation.

Consultants	6 m/m	60,000
Training		80,000
Equipment & supplies		300,000
Misc.		10,000
	Total	450,000

TOTAL, PHASES I,II $473,000

4. ESTABLISHMENT AND STRENGTHENING OF CENTRES FOR METALLURGICAL TECHNOLOGY AND CORROSION PROTECTION

4. **Establishment and strengthening of centres for metallurgical technology and corrosion protection**

Activities cover mineral and metallurgical research and development, pilot plant investigations and setting up of demonstration plants designed to promote an indigenous technical base and capabilities;

Future perspectives:

Establishment and operation of R and D Centres, laboratories, institutes, pilot and demonstration units in selected fields of industrial development is the main instrument to both transfer and adaptation of existing and also development of new achievements and capabilities. This is the reason why UNIDO attaches great importance to this subject. Centres for Metallurgical Technology are created or supported by UNIDO's technical co-operation programme to try to effectively promote first of all the adaptation and modification of proven processes and products and later, relying on the accumulated knowledge and experience, to develop new processes and products most suited to prevailing conditions.

Such Centres may cover broad sectors of the metallurgical industry, or be limited to a specific branch, e.g. iron and steel or aluminium. Areas covered usually include ore beneficiation, metal extraction, refining, transformation, welding research, heat treatment, surface protection and also application of metals and alloys in various shapes and forms, standardization, fuel and energy conservation, environmental aspects and diverse consultancy work for local clients.

The centres would also undertake such activities as cataloguing and dissemination of technical information and documentation, evaluation, testing of metallurgical raw materials, preparation of feasibility studies, market surveys and project reports, providing technical training for industry and research personnel, arranging the exchange of personnel for on-the-spot studies - as well as other activities to promote the growth and expansion of the metallurgical section in a given country or region.

Establishment of mineral beneficiation pilot plants

Based on the successful implementation of UNIDO projects in this field, e.g. in Pakistan and Cuba, UNIDO has recently launched a project for Establishment of a Mineral Processing Technological Centre for the Mining Industry in Mongolia. It is expected that future requests will be received from other developing countries wishing to develop and or/strengthen their capabilities and capacities for carrying out complex mineral beneficiation, mineralogical and hydrometallurgical investigations in order to elaborate and determine the optimum alternatives of industrial mineral processing technologies for various metallic and non-metallic ores and to develop a nucleus of national qualified, skilled and trained staff in this field.

UNIDO's assistance may comprise diagnostic missions, expertise and equipment for the establishment of physical facilities of the Centre, on-the-spot training and training programmes abroad, preparation of work plans, supervision of R and D programmes.

Project Concepts for possible technical assistance projects in selected developing countries

(to be promoted through missions, etc.)

No.	Title
4.1	Establishment of a Welding Research Institute (WRI) for Training, Testing and Documentation
4.2	Establishment (or strengthening) of Heat Treatment Centre

PROJECT CONCEPT 4.1

Title: Establishment of a Welding Research Institute (WRI) for Training, Testing and Documentation

Project objective:

To establish a Welding Research Institute to make available trained manpower and offer testing services for the country/region in the field of welding technology. The Institute would also act as knowledge dissemination centre.

Background information and justification:

Welding plays a vital role in industrialization. It has become an irreplaceable tool for manufacturing industries and constitutes as such an important element towards industrial progress of a developing country. Most engineering and construction companies in the developed countries carry out extensive welding and most developed countries have a Welding Institute or Organisation were developed work, quality control and standardization, as well as national training and examination of welding and welders respectively is carried out. UNIDO's programme in welding aims at introducing new welding techniques and improving and as far as practicable standardizing existing welding practices in the developing countries.

It is important that a developing country should have an indigenous science and technology capacity of its own. In the engineering sector, welding has come to play a major role in fabrication in a large number of fields be it in chemical, fertilizer, automobile, power generation, oil, aircraft, space, electronics, etc. and also has revolutionized the development of joining processes. In a developing country and with ever expanding field of application of welding, a higher percentage of growth can be expected in the field of metal joining. The demands of the joining material has a direct bearing on the steel consumed in a country. Therefore, the welding fabrication industry would have to look forward to a period of steady expansion not merely in quantitative but also in new terms of new types of fabrication involving special steels, stainless steels, and various metals and alloys. The necessity of testing capability development goes directly with the fabrication development.

In the field of welding, education and testing is far from satisfactory in developing countries, due to absence of specialized central infrastructure. Specialized training of the country's requirements is usually provided by industries through training abroad at high cost. Also, the need to update the existing processes to maintain a progresssive growth rate calls for documentation of know-how to be disseminated to all industries from a central source, i.e. a Welding Research Institute.

Project Outputs:

For Phase I (diagnostic survey by experts)

(a) Separate studies/surveys of the type of welding carried out in the country or region; the welding equipment and technologies applied being catalogued as well as an assessment of the institutional support existing within the country/region for welding and details of training course for welders within the country or each country in a region, together with the description and assessment of the certification provided.

(b) Recommendations for introduction of new welding technologies in the country/region and also the additional training and certification required to support the increased sophistication and quality of welding at the country and the regional level as well as recommendations for any new Institution(s) to be established. The latter requires the elaboration of a detailed project document, with list of equipment, etc. for the establishment of a WRI.

Phase II

(a) Physical facilities of a Welding Research Institute to solve practical problems of the fabrication and welding industry, to carry out R and D and adapt and introduce new and advanced welding practices into the country/ region. The WRI will be

i. fully equipped with modern welding equipment both for training and demonstration to the practising technicians in welding and for developing and adopting newer technologies in the country/region.

ii. equipped with advanced testing and inspection equipment to initiate quality control services with a view to improve the quality of the products produced in the country/region and establish a good reputation for the welded fabrication industry abroad.

(b) Skilled welding personnel, at various levels; such a nucleus will be built up through the conducting of training programmes and on the spot training by experts. They will undertake R and D and adapt new welding technologies and equipment for application within their country/region.

Project Activities:

Phase I

Team(s) of experts will be selected to survey welding activities, equipment and technology, training and certification, institutional facilities for technical support and R + D and adaptation of new welding technologies. The team(s) will comprise three persons and will spent 2 - 3 weeks in the country or 2 weeks in each country of a given region. Country studies will be prepared with the assistance and involvement of local welding engineers. The studies prepared by team(s) will be reviewed with UNIDO assistance, to determine the required follow-up and prepare the project document for establishment of a WRI in the country/region.

The project will therefore define the national/regional needs for training, certification, institutional support and technological as well as R and D programmes/activities needed for the future development of welding.

Phase II

A consulting company or a number of international experts will be engaged who will prepare the detailed design and layout for the WRI, complete with specifications for testing and inspection equipment. Essentially the WRI would cover Sections for Management Services, Training, Testing (destructive and non-destructive), Research and Development, and Documentation. The WRI will organize and co-ordinate training programmes for technical personnel in industries in appropriate fields of welding technology. They will also recommend welding technologies to be established/adopted to the country's requirements.

Project duration: Phase I - 6 months

Phase II - 3 years

Estimated costs: Phase I - about $ 100,000

Phase II - about $ 3 - 4 million, depending on the Government contribution as well as availability of building, infrastructure, etc.

Project Concept 4.2

Title: Establishment (or strengthening) of Heat Treatment Centre

Country:

Background/Justification:

Heat _ ment is one of the key technologies to improve material prope ie such as strength, resistance to corrosion, abraision and fatigu. order to extend the service life of product and utilize the limi resources.

In deve ing countries, a lot of people are engaged in the heat treatment industry and number of factories are in operation. However, we understand that most equipment is rather obsolete, QC method is not applied and communication between industry and academy is not always successful. Therefore, production capacity of factory is not always utilized, yield of product is less satisfactory. Furthermore, application of new technology such as CVD, PVD and TMT(ThermoMechanical Treatment) is also urgent need to supply parts for electronic and auto industries. We would, therefore, propose "the establishment of (or strengthening of existing) a Heat Treatment Centre", which possess the following tow main functions;

- rehabilitation of existing factories
- R & D of new heat treatment technology.

Objectives:

- to improve the quality and productivity of existing heat treatment factories by providing technical service and training of personnel.
- to introduce new technology to the industry in order that they can produce high quality parts necessary for electronic and auto industries.

Output:

Establishment of (or strengthening of existing) a Heat Treatment Centre, which is composed of following units;

- R & D unit; to improve new heat treatment technology.
- QC & Standerdization unit; to establish a know how for QC & Standerdization
- Technical service unit; to act as liason unit between factories and above two units for the rehabilitation of former.

Activities:

-Preparation of building, equipment and personnel for the Centre
-Establishment of technology in the Centre
-Establishment of skilled personnel necessary for the operation of the Centre

Input: -Technical instruction by international experts
-Training of indigenous engineers and operators
-Purchase of equipment for QC and R&D
to be finalized based upon detailed information from the field.

Budget: to be finalized based upon detailed information from the field

Information:
Source

5. INDUSTRIAL PROCESSES FOR UTILIZATION OF METALLURGICAL WASTES, PROMOTION OF ENVIRONMENTAL AND POLLUTION CONTROL MEASURES AND PROCESSING OF METALLURGICAL SCRAP TO PRODUCE ADDED VALUE PRODUCTS

5. Industrial processes for utilization of metallurgical wastes, promotion of environmental and pollution control measures and processing of metallurgical scrap to produce added value products:

Apart from utilization of metallurgical wastes, e.g. utilization of red mud from bauxite processing, energy saving projects which also have a direct impact on the environment are promoted.

Future perspectives:

(a) Scrap collection and processing

Based on the successful implementation of several projects of establishing scrap collection and processing units, UNIDO expects this trend to continue and aims at playing a significant role in activities related to environmental protection, such as scrap collection and recycling of ferrous and non-ferrous metals. Such projects aim at strengthening the industrial economy by improving the supply of raw materials - metal scrap - and, hence, upgrading the outputs of the existing metallurgical/foundry enterprises. Technical assistance may essentially comprise the preparation of a detailed techno-economic analysis and report for establishing scrap collection and processing, the preparation of detailed design (blue print) for the establishment of a scrap collection and processing centre and assistance in actual establishment of the physical facilities.

(b) Energy conservation and environmental control in metallurgical industries (alumina and aluminium industry, iron and steel industry and others, as may be requested)

i. Energy conservation

Activities under this heading will essentially aim at reducing energy consumption (electricity, steam, etc.) through reconstruction of alumina refineries and aluminium smelters, e.g. the application of tube digestion in alumina plants will bring about decreases in steam consumption, reconstruction of the calcination stage will provide considerable reductions in oil consumption for alumina calcination. To increase efficiency of pots high amperage pots may be introduced and special measures can be taken to improve cell life.

Based on the successful introduction of energy saving and conservation in SAIL steel plants (see page 13) UNIDO expects to become more and more active in energy auditing, efficient energy management and adoption of adequate energy utilization and conservation measures using computer based methodologies for monitoring energy consumption rates.

ii. Environmental aspects including utilization of metallurgical wastes

Based on projects successfully implemented for China, Jamaica and India, activities related to environmental control will continue to emphasize the utilization of red mud for the production of building materials, such as bricks and tiles. Apart from assistance in the extraction of gallium, vanadium pentoxide and other elements from bauxite, technical assistance may also be provided in the extraction of rare earth, vanadium, scandium, yttrium and other elements from red mud. Extraction of light and heavy rare earths will have significant commercial implications. Consumption of these elements steadily increases with the fast growing high technology industries (electronics, lighting and electro-mechanical sector). UNIDO may assist R and D efforts aimed at extracting these valuable elements, through provision of experts to work out process flow sheets, feasibility, etc. A small project to this aim has recently been approved for Jamaica.

Alternative waste disposal measures such as dry stacking of red mud wastes will also be a subject of attention.

The introduction of gas filters in existing aluminium smelters will likewise be promoted.

Project Concepts for possible technical assistance projects in selected developing countries
(to be promoted through missions, etc.)

No.	Title
5.1	Assistance in introducing environmentally-sound technologies in metallurgical industries
5.2	Energy conservation in metallurgical industries
5.3	Production of ferro-alloys using undisposable waste

UNITED NATIONS FOR INDUSTRIAL DEVELOPMENT ORGANIZATION

Project Concept 5.1

PROPOSED TITLE: **ASSISTANCE IN INTRODUCING ENVIRONMENTALLY -SOUND TECHNOLOGIES IN METALLURGICAL INDUSTRIES.**

ESTIMATED DURATION: 1 YEAR

ESTIMATED EXTERNAL CONTRIBUTION 1,500,000 US $

ESTIMATED COUNTERPART COSTS (IN KIND) 640,000 US $

JUSTIFICATION

The harmful effects caused by environmental pollution and the need to protect the environment have recently become issues of national concern in developing countries. Although adequate norms and regulations have been already introduced in several developing countries, pollution control does not meet international standards. Sulfur oxides, nitrogen oxides, dust and other emissions still being thrown in to the environment in unacceptable quantities, increasing the environmental load in developing countries and the waste of valuable energetic resources. The main reason of this situation is the absence of adequate technological and managerial know-how in the field of environment pollution abatement.

The iron and steel industry is one of the biggest source of pollution e.g. sulfur oxides which are genereted from the fuels consumed in sinter plants, boilers, etc.; nitrogen oxides which are produced as result of combustion at high temperatures. In steel works, the major sources of dust and particles are sinter plants, coke ovens, blast furnace, oxygen converters, electric arc furnaces (EAF), and downstream processes such as rolling and galvanizing. Other major causes are in the handling, storing and crusing of raw materials.

In order to ameliorate these environmental problems and introduce energy conservation measures, more efficient environmental control technology and facilities should be adopted e.g. desulfurization of sinter plant, ovens and reheating furnaces; adoption of enclosed type dust collection systems; extensive application of advanced systems for treatment of industrial waste water, sludges and dusts, etc.

DEVELOPMENT PROBLEM INTENDED TO BE ADDRESSED BY PROPOSED PROJECT:

Development Objective:

To assist developing countries in upgrading the environment control (SO_x and NO_x control, dust, sludge, waste waters) in the metallurgical industries of heavily polluted regions by means of monitoring the production level and introducing low-waste technologies and energy conservation measures.

Immediate Objectives:

1. To prepare techno-economic studies for the rehabilitation of medium-size metallurgical plants focussed on the introduction of environmental pollution control measures. Particularly, those aiming at reducing the emissions of sulfur oxides, nitrogen oxides, dust and other metallurgical wastes.

2. To enable the Government to formulate and develop comprehensive environmental policies for its iron and steel industry and other metallurgical industries by means of introducting technology and equipment for the establishment of an experimental plant as well as by organizing comprehensive training programmes for managers, technician and operators.

PROJECT OUTPUTS

1. An established experimental pollution control unit at an selected steel/metallurgical plant for measuring the level of pollutants and emissions.

2.Based on surveys, monitoring record of environmental and experimental results obtained from the experimental plant, the following reports will be prepared:

2.1 Monitoring record of environmental pollutants such as SO_x, NO_x, dust and sludges from the selected plant.

2.2. Assessment of technological measures which may be applied to reduce air, earth and water pollution, based upon experimental results of the pilot plant operation.

2.3 Recommendations on measures necessary to introduce in order to comply with the national pollution control rules and regulations.

2.4 Training programme for pollution control personnel, as well as for plant managers.

2.5. Comprehensive programme for investment in pollution abatement equipment in metallurgical industries including specifications of equipment.

ACTIVITIES

The project will be implemented in three stages:

1. First Stage: Fact-finding mission for determining the level of pollution of several steel/metallurgical plants and identifying a steel plant for the establishment of the experimental pollution control unit. This will include preparation of action plans for monitoring the pollutant level and the specification of required measuring equipment.

2. Second Stage: Procurament of mobile monitoring unit. Monitoring of pollutant level. At this stage, the technical specifications for the pollution control pilot unit will be prepared. Study tours to metallurgical plants abroad will be carried out.

3. Third Stage: Establishment and operation of pollution control pilot plant. The technology, equipment and operations know-how will be provided under a subcontracting agreement.
A future action programme on subjects such as water recycling, waste utilization, energy conservation and combustion technology will also be elaborated

INPUTS

Government Inputs:

The host Government should cover the necessary counterpart staff to work together with the international staff, logistic support and laboratory and basic measuring equipment to carry out activities at plant level.

Estimated Costs: 640,000 US $

External Contribution:		US $
International Personnel 4m/m		40,000
Project travel and missions		20,000
Study tours to metallurgical plants abroad 6 persons-two weeks each		30,000
Subcontract including: Personnel, Travel, Know-how, Equipment		1,360,000
Misc.		50,000
Project Total	US$	1,500,000

UNITED NATIONS FOR INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT CONCEPT 5.2

COUNTRIES: COUNTRIES with a large metallurgical Sector.

PROPOSED TITLE: **ENERGY CONSERVATION IN METALLURGICAL INDUSTRIES**

ESTIMATED DURATION: 1 YEAR

ESTIMATED EXTERNAL CONTRIBUTION 430,000 US$

ESTIMATED COUNTERPART COSTS (IN KIND): 20,000 US$

JUSTIFICATION

In developing countries technological standards of the metallurgical plants vary widely as also their individual capacities, size of electric furnaces, plant equipment and infra-structure. However, one common element of a major number of Steel Mills is their high energy consumption per ton of steel made and lack of latest technical innovations and limited applications of Secondary Steel making, ladle refining and treatment techniques. Even though a few units are well equipped, their operations may not conform to international standards and norms in terms of energy consumption, overall production costs and techno-economic returns on the capital invested.

By reducing the local energy consumption and by implementing effective measures of recovering useful secondary's resources, immediate reductions in the general industrial energy costs of the plants can be achieved. And, as a result reductions in the production costs of the finished outputs and the possibility of increasing industrial production at current or at lower energy utilization levels. Similarly, developing countries depending on energy imports, could have a positively affect their balance of payments or debt difficulties and consequently improve the international competitiveness of their Steelmaking plants.

DEVELOPMENT PROBLEM INTENDED TO BE ADDRESSED BY PROPOSED PROJECT:

Development Objective:

To upgrade the level of energy utilization in relevant number Steelmaking and other metallurgical plants byt means of introduction of latest technological measures and energy conservation strategies in the metallurgical sector.

Immediate Objectives

1. To establisn a basis for energy conservation activities in a number of companies/plants of the metallurgical sector through energy audit.

2. To determine potential savings in energy consumption at selected plants through:

   2.1 Improved management and utilization of existing equipment/facilities.
   2.2 Capital investment

3. To establish training activities for domestic personnel in multiple fields of Energy Conservation in Steel production.

OUTPUTS

1. Reports on the current energy consumption in selected companies and production areas with comparison to international standards.

2. Reports recommending specific measures to save energy based on studies concerning:

   2.1. Improved management and utilization of existing equipment/facilities.

   2.2 Capital investment to replace or complement existing equipment/facilities.

3. Concrete results on specific energy-consuming units (to be identified) expected to lead to a minimum of 5 % reduction in energy consumption.

4. A relevant number of engineers, policy-makers, technicians trained in multiple fields of energy utilization/conservation in the metallurgical sector.

ACTIVITIES

1. diagnostic mission of areas with high energy consumption in a relevant number of steelmaking/metallurgical plants.

2. Identification and evaluation of existing schemes for energy conservation subsidies and incentives in other countries, and elaboration of recommendations to a system suitable for domestic conditions.

3. Carry out energy audit in selected steelmaking plants. Identification of level of utilization of energy at different production stages. Elaboration of a report on the base-line situation of the plants in terms of energy consumption and management.

4. Formulation of recommendations aiming at the reduction of energy consumption per unit of finished product including quantitative estimates of savings which will achieved with the proposed improvements in management and utilization of existing equipment/facilities

5. Assessment of capital investment required in order to achieve further savings in fuel consumption.

6. Training activities for senior engineers, technicians and policy makers to selected countries with successfully implemented energy conservation policies and measures.

INPUTS

Government inputs:

-Counterpart staff (10 m/m = 20,000 US$) to work together with the international staff, logistic support, technicians; labor and basic measuring equipment to carry out activities at plant levels.

Estimated External Contribution:

		US$
Project Personnel		
International	21 m/m	210,000
Training		50,000
Evaluation mission		10,000
Instrument and Equipment		150,000
Misc.		10,000
		=================
Total:		430,000

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT CONCEPT 5.3

PROJECT FORMULATION FRAMEWORK

Country:

Project No:

Proposed title: Production of ferro-alloys using undisposable waste

Estimated duration: 18 months

Tentative UNDP contribution : $ 360,000.-

Estimated counterpart contribution: $ 40.000,- (in kind)

Sources of funds (IPF, SMF/LDCs, cost sharing, other)

A. Development problem(s) intended to be addressed by proposed project:

1. At macro level :

Iron and steel industry being one of the traditional industries, using classical technology for hot-metal and steel production. As a rule, a "byproduct" of such technology are different kinds of waste, which are polluting the environment and increase production costs.

2. At micro level

Undisposable wastes in form of slag, which occur during production of high-speed steel and other alloys steel can be reprocessed in ferro-alloys for the use in steel production.

B. Concerned parties/target beneficiaries :

1. Parties identifying projects :

Unido in cooperation with national counterpart.

2. Target beneficiaries

National Counterpart and production sector of ferro-alloys.

C. Pre-project and end of project status

1. In smelting high-speed steel by the most saving single-slag technology about 3...5% of slag is formed (out of the total metal weight) containing about 1% WO_3, 10% Cr_2O_3, 4% V_2O_5, 0,2% MoO_3. As a rule, this slag contained also in other electric-furnace slags is processed into crushed stone and then dumped. Wastes from polishing high-speed steel with corundum grinding wheels are not utilized either. This masses are polluting the environement.

2. The situation expected at the end of the project

A new technology has been developed of producing ferroalloys containing the said wastes, namely 20-45%Cr, 1-6%W, 0,3-3%Mo, 0,2-4%V, ~3%Mn,rem.Fe. These alloys can be used in steelmaking to produce alloy steels (high-speed, constructional steel and others) saving in standard ferroaloys.The total annual output is 500-1000 tons of ferroalloys, depending on capacity of steel shop. Extracting alloying elements - tungsten, vanadium, chromium, molybdenum contained in undisposable wastes from the production of high-speed steel (slag and polishing wastes) give a possibility to save ferroalloys in alloy-steel production, to solve ecological problems.

D. Special considerations

1. Special considerations and their influence on either the content or form of the project.

New technology of reprocessing at undisposable waste will positively have an impact on environmental protection.

2. Negative considerations

None.

E. Other doners, programmes active in the same subsector

To be determinated by the national counterpart.

F. Development objectives and its relation to the country programme

To utilize undisposable wastes from iron and steel plants.

G. Major elements

Immediate objectives

Production of iron based ferroalloys using undisposable wastes from smelting and processing of high-speed steel.

Outputs	Activities	Party resp. for activity
1.1 A detailed techno-economical report prepared acc. to TOR to be attached later	1.1.1Conclusion of contract with sub-contractor selected by UNIDO	UNIDO/NC
	1.1.2Fielding of sub-contr.'s team for collection of initial data and info.required for the preparation of the detailed proj.report	UNIDO
	1.1.3Preparation of detailed project report by sub-contractor	
	1.1.4Submission of draft report through UNIDO to NC and its discussion in the field with participation of sub-contractor's team and UNIDO staff	UNIDO/NC
	1.1.5Submission of final detailed report through UNIDO to the Govmt.	UNIDO
1.2 National technical pers.acquainted with the new technology and equipmt. in operations abroad and applied in detailed report for introduction of new technology	1.2.1Selection and nomination of national participants for ST to design institutes and alumina plants abroad applying new techn. equipmt. considered for applicat. in the reconstruction of plant	UNIDO/NC
	1.2.2Organization of ST abroad as per 1.2.1 above	UNIDO
	1.2.3Submission of ST team's report to UNIDO	UNIDO/NC
1.3 New technology know-how introduced to steel plant	1.3.1Testing pf new technology in plant	NC/sub-con..
	1.3.2Analysis of results of new technology applications	NC/UNIDO
	1.3.3Carrying out of demonstration workshop for national international staff	UNIDO

H. Project strategy

1. Direct recipients :

Direct recipients of the project benefits are managers/technologists of electro-smelting shop.

2. Relationships between direct recipients and target beneficiairies:

Target beneficiairies are in the field of main production.

3. Implementation arrangements:

Implementation can be arranged according to project concept.

4. Alternative strategies/implementation arrangements considered:none.

I. Host country commitment:

1. Evidence of counterpart support, availability of physical facilities, substantively:

- provision of experienced national staff already involved in executing different projects. Additional staff will be provided if and when required.

- provision of the land, analytical facilities available at plant required for execution of project

- provision of all expenses for providing office space, secretarial services, transport for internal travel for both national and international staff will be provided by plant

- organization of core groups in steel plants for industrial scale implementation.

J. Risks

Description of risks	Estimated likelihood of occurrence
1. Factors which may at the outset cause major delays or prevent achievements of the project's output and objectives	
-long duration of project approval	medium
-long duration of recruitment of external and internal personnel	medium
-long duration of choice for subcontractor	medium

2. Factors which could over time cause major delays or prevent achievements of the project's outputs and objectives — not known

K. Inputs

1. Budget	Nat.Input (US$ equiv.)	Ext.Input(US$)
Personnel	-	10.000
Subcontract	-	250.000
Training	30.000	50.000
Equipment		30.000
Misc.	10.000	20.000
TOTAL	40.000	360.000

6. INTRODUCTION OF RATIONALISATION AND COMPUTERIZED SYSTEMS IN PRODUCTION PROCESSES, MAINTENANCE AND RELATED FIELDS

6. Introduction of rationalization and computerized systems in production processes, maintenance and related fields

Projects aim at introducing computerized production and process control as well as managed maintenance systems in metallurgical plants. Apart from productivity increase and production and inventory cost savings, uniform quality and timely deliveries can be achieved. Most innovative production technologies require computer control as an indispensable pre-condition.

Future perspectives:

(a) Introduction of computerized managed maintenance systems (CMMS)

Following the past pattern of successful introduction of CMMS in metallurgical plants UNIDO will also continue to assist this sub-sector as a means to save production costs. Envisaged projects aim to assist Algeria, the Arab region countries, Indonesia and the ASEAN countries; assistance will be continued to India and Mexico. The subject of CMMS will further be promoted through the organization of Expert group meetings and workshops. The Third Expert Group Meeting on Managed Maintenance Systems is planned to be held in November 1990 in Singapore and a 3-weeks Workshop for African countries is planned for September 1990 to be held in Czechoslovakia.

One pre-condition for introduction of new technology, which is often neglected, is a proper functioning process and production control, automated and computerized. When planning the use of computer controlled plant monitoring, the metallurgical industries, being capital and energy intensive, deserve particular attention as they offer vast areas where improvements in productivity, efficiency and quality through the introduction of such systems can be achieved. Most innovations require computer control as an indispensable pre-condition. New technologies in the metallurgical industries, backed by the progress in automation, create new concepts which make old well-proven solutions obsolete. Optimization of production processes requires that entire production units and plants have to be covered with automation systems and computer control. Those plants and plant areas in which computerized production and process control can be introduced with most promising results will have to be identified. In addition to the productivity-increase type of goals, uniform product quality and timely deliveries based on customer's requirements are decisive factors for introduction of production and process control. Other benefits of industrial automation and computer application are increased yield, increased raw material utilization, increased plant availability, decreased specific energy consumption, decreased specific utility consumption and reduced manpower and personnel costs. Integrated automation systems are very complex, hierarchically structured and distributed. They may consist of several computers or computer systems, a large amount of distributed control systems and many related sub-systems. It is expected that requests for UNIDO technical assistance in this field will be forthcoming from a number of developing countries. Information on UNIDO projects related to CMMS can be found in the Annex.

(b) Software Development and Training Centre

A one-page project concept is attached.

(c) Computerized energy conservation in metallurgical industries

This subject is also gaining more and more interest and UNIDO may offer assstance in computerized energy auditing and monitoring and possibly the establishment of a model computerized energy centre.

Project Concepts for possible technical assistance projects in selected developing countries
(to be promoted through missions, etc.)

No.	Title
6.1	Assistance in Introduction of Computerized Maintenance Management Systems (CMMS) for the Metallurgical Industries
6.2	Complementary concepts for:
	(a) - Computer application for production process control in the iron and steel industry
	(b) - Computerized energy conservation in metallurgical industries
	(c) - Software Development and Training Centre

Annex

Information on UNIDO's activities related to the Introduction of computerized Managed Maintenance Systems in Metallurgical Industries

UNIDO, in particular the Metallurgical Industries Branch, is fully aware of the industrial maintenance management problems (inadequate maintenance being specifically costly for the large capital asset investments into rapidly established steel plants in developing countries) and started as early as 1972 organisational studies to create due awareness of this problem in developing countries. Studies were undertaken for Hungary (Dunaivaros Steelworks), a computerized managed maintenance system (CMMS) was introduced into the Egyptian Iron and Steel Company, Helwan, followed-up by implementation of CMMS in Czechoslovakia (East Slovakian Steelworks, Kosice). Another preparatory assistance project was undertaken for SIDERMEX in Mexico in 1985, with a follow-up cost-sharing project for AHMSA and SICARTSA steelworks. A large scale project on the introduction of CMMS into the Steel Authority of India (1986 Rourkela Steel plant with follow-up transplant to Bhilai and Bokaro steelplants) was successfully implemented and regional projects for ASEAN and Arab countries are about to commence.

1. Ongoing or implemented technical assistance projects

More detailed information is provided on the projects in Czechoslovakia, Egypt, India and Mexico, as well as an outlook for future prespectives.

(a) Czechoslovakia: Introduction of the CSSR UNDP/UNIDO project on computerized maintenance systems

The growth of range and costs of maintenance and repairs in CSSR metallurgical industries was marked by a steady 5.5 % increase per year during the decade 1971-1980, the value of the new sophisticated installed and rehabilitated production facilities having been more than doubled during that period. Consequently, the demand for both qualified maintenance manpower and management and planning personnel had also grown and the necessity for rationalization and improvement in maintenance productivity, planning and management arose. In order to meet these needs of metallurgial industries within the framework of CSSR industry development plants, UNDP/UNIDO assistance was requested in the "Application of a Modern Maintenance System in the Iron and Steel Industry" and became operational in 1979, for a duration of about 4 years, including follow-up activities. The CSSR Federal Ministry of Metallurgy and Heavy Engineering represented by INORGA Research Institute for Industrial Management and Automation, Prague, was appointed as Government Co-operating Agency, providing the requisite framework, project management and counterpart organization in co-operation with the East Slovakian Steelworks, Kosice, where the computerized managed maintenance system was installed.Whilst the Government provided existing computer facilities, salaries for counterpart, building, etc. the UNDP contribution to the project was of the order of 1.06 million, essentially covering consulting services, equipment and training.

Project activities covered major maintenance subsystem structuring and development, procurement and installation and operation of computer and communications hardware facilities, consultancy subcontracting and software packages development, extensive home and international training as well as the follow-up activities in the dissemination of know-how upon project completion.

Apart from the project's intangible benefits such as better information for decision-making and spare parts supply as well as budgeting, smoother work load on a long term basis, standardization, etc., concrete annual savings of about 63 million crowns were achieved, due to lower inventory levels of spare parts, due to increased volume of assemblies and spare parts reconditioning, due to lower imports of spare parts, due to increased productivity of standardized assembly repairs, due to lower downtimes of key production facilities, due to improved planning of repairs and manpower utilization, due to lower rescheduling of maintenance jobs and transportation times. The project has favoured technical co-operation among developing countries (TCDC) as it provided training on CMMS development, on an international level and under UNIDO auspices, to other countries like Algeria, Egypt, India, Mexico.

(b) Czechoslovakia: National Technical Consultancy and Training Centre (NTCTC)

In order to meet the requirements of national development plans of Czechoslovakia which demanded an increase in productivity and efficiency of basic industrial sectors, the establishment of a National Technical Consultancy and Training Centre for computer techniques in metallurgical and other basic industries was agreed and UNDP/UNIDO assistance requested.

The project was to capitalize the results achieved in the field of computer applications during the implementation of two large scale projects related to the Application of a Modern Maintenance System in the Iron and Steel Industry and to Assistance in Computer Aided Design and Manufacture (CAD/CAM) in Machinery Building Industry.

For project implementation, the Government authorities provided existing computer facilities, laboratories and introduced new computer and terminal facilities and staff. UNDP inputs amounted to $ 0.8 million, mainly covering equipment, expertise and training to set-up an operating computerized data bank, development of a pilot small-batch and single-piece production control system and other industrial software; set-up of a nucleus for provision of professional consultations and expertise for basic industries oriented towards production control systems and maintenance management systems, CAD/CAM, etc., establishment of training capability. The successful implementation of the project has contributed through NTCTC operation to the extended and speedy introduction of advanced computer aided systems and techniques into metallurgical and basic industries and will continue to provide this possibility. The NTCTC provided as a part of this activities also numerous expert, consultancy and training services to counterparts in developing countries. This led to the establishment of the UNIDO-Czechoslovak Joint Programme for Co-operation in Metallic Industries which, within a European regional outreach programme under UNIDO auspices, as well as bilaterally, continues these activities e.g. through the organization of Network Steering Committee Meetings and other Workshops, training and TCDC activities.

(c) Egypt: Establishment of managed maintenance system at the Egyptian Iron and Steel Company (EISCO)

Financed from UNDP contribution and with UNIDO as executing agency, a computerized managed maintenance system covering practically all departments of EISCO was installed. Technical assistance to the Egyptian iron and steel company and follow-up projects covered expert and sub-contractor consultancy services, a large training component and equipment installation. The introduction of CMMS has led to a significant increase in production as well as in savings accruing from improved stock control and organization of spare parts manufacture. Through the project a professional group of computer staff consisting of systems analysts, programmers, operations co-ordination personnel was formed and resulted in improved planning for spare parts requirements and more effective shop loading.

The Egyptian Iron and Steel Co. has spread the computerized system throughout its complex with an increase in production of 12 % and savings of US$ 8 million (figures are based on an assessment made in 1985) resulting from organized inventory systems, effective utilization of spare parts and elimination of unexpected failure of machinery. The system was introduced in four companies.

From the successful introduction of CMMS at EISCO, a number of other spin-off projects evolved, namely "Intercountry project for managed maintenance" under which a "Demonstration Workshop on Managed Maintenance in Metallurgical and Foundry Industries for African Developing Countries" was held in Cairo form 26 March - 15 April 1983. A Second Regional Demonstration Workshop on Managed Maintenance in Metallurgical and Foundry Industries for African Developing Countries was held in Cairo from 17 November - 7 December 1984. Training programmes were organized for Somali and Pakistani trainees. A UNDP/UNIDO/EISCO diagnostic mission was organized to identify areas of co-operation with African industrial establishments.

EISCO is now operating as a National Centre for Managed Maintenance in metallurgical and other basic industries. The Centre was officially inaugurated in March 1988, at the occasion of the Opening of the Second UNIDO Expert Group Meeting on Computerized Maintenance Systems in Metallurgy, held in Cairo from 6 - 12 March 1988. Now the concept of regional co-operation in managed maintenance of metallurgical and other industries needs to be promoted.

(d) India: Introduction of CMMS in plants of the Steel Authority of India Ltd.

Under a UNDP financed and UNIDO executed project CMMS was introduced into the Rourkela Steel Plant starting in April 1986. The system has the following modules:

i. planning of preventive maintenance and repair and scheduled shutdowns

ii. upgrading the present system of procurement and inventory control for sub-assemblies, assemblies and stores

iii. effective planning in manufacturing and reconditioning spare parts within the steel plant and other indigenous workshops.

In addition, the project foresees the establishment of a specialized data bank at the steel plant to record and technically codify spare parts and material supplies to support the above sub-systems.

Special attention is given to the training of specialists in various fields of computer managed maintenance.

CMMS packages were developed in-house with the support from international sub-contractors. In the software development more than 10 computer engineers and 10 maintenance engineers were involved. The project is about to be completed. The benefits obtained so far are those associated with CMMS awareness and improved computer application. Particular mention may be made of the following results which could be achieved: in preventive maintenance and repair, in the pilot area blooming and slabbing mill, delays due to mechanical, electrical and cranes availability could be decreased from 663 hours annually to 385 hours. In the material planning module, the introduction of centralized procurement instead of departmental procurement has led to a reduced workload of the individual departments by about 20 - 25 % in terms of procurement value and 50 - 75 % in terms of manhours. This has proved that computerization of material management activities is a step towards automation with possible scope for reduction/redeployment of manpower. CMMS development and implementation in all plant areas will bring ultimate benefits in higher plant availability, increased manpower productivity, reduced stores, higher production of spare parts and reconditioning and better financial control of maintenance function. It is planned to duplicate the system for the Bhilai and Bokaro plants of the Steel Authority of India Ltd. Personnel from both pl .ts already participated in study tours, awareness programme and system design phase. The project developed a good potential for transfer of know-how to other industries and TCDC.

(e) <u>Establishment of a Computerized Management Maintenance System at SIDERMEX, Mexico</u>

Based on preparatory assistance carried out in 1985, a project was launched and pilot departments, namely Blast Furnace No. 5 and hot mills for Ahmsa and the rod mill and coking plant for Sicartsa, were chosen for introduction of CMMS. The project team developed an on-line transaction oriented system, called SIMA (Sistema Integral Mecanizado de Administracion de Mantenimiento), which covers six modules, namely: preventive maintenance, shops, evaluation, planning and scheduling, warehouse and purchasing and overall maintenance feedback monitoring. Presently, an important new component is being added to the system: the plant condition monitoring which provides on the process control level important feedback to the SIMA system. This sets the trend for the future when all major production facilities of the plant should be covered by this type of systems to enable not only monitoring but also forecasting of future reliability and thus to improve the peventive maintenance planning and to prolong life of equipment. Personal computers are introduced thus proving that distributed processing approach is also effective as compared to mainframe computer application. Potentials for provision of training on national and regional level are envisaged to be opened by the project.

COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEMS

PROJECT CONCEPT 6.1

TITLE : Assistance in Introduction of Computerized Maintenance Management Systems (CMMS) for the Metallurgical Industries.

DURATION: 2 1/2 years

COUNTERPART AGENCY : Government Institutions and Enterprises willing to participate.

ESTIMATED UNDP CONTRIBUTION
+COST SHARING: 545,000 US$

PROJECT OBJECTIVES

Development Objective

To contribute to increase the domestic metallurgical, related capital goods and spare parts production, and to enhance the national industrial competitiveness by means of rationalizing maintenance activities in domestic plants, which will enable to increase the industrial availability of equipment and spare parts and to balance manpower activities. In this way, to achieve relevant production costs reductions.

Immediate Objective

The overall aim of the project is to increase the productivity and effectiveness of utilization of resources in domestic metallurgical plants through achievement of following objectives:

Objective 1: To design, develop and implement a Computerized Maintenance Management Systems which will include the following modules: planning and scheduling of maintenance work; inventory and purchase control of spare parts, assemblies, sub-assemblies and materials; manufacture and/or recondition of these parts and materials; modern diagnostic methods and coordination of the production/maintenance activities in selected production and management areas (e.g. Sinter Plant, Blast Furnace Plant, Hot Rolling Mill, Departments of Purchasing and Inventory Control) of the plant.

<u>Objective 2:</u> To develop and establish comprehensive training programmes in the field of planning, development, introduction and application of CMMS for specialists of the selected plant/plants.

JUSTIFICATION

The iron and steel industry has a considerable role to play in the economic development programmes of developing countries. The fulfillment of this role requires the accelerated development of new production processes, the further intensification of production and the introduction of modern high performance equipment. In connection with this, a new approach is needed to the organization, management, planning and scheduling of maintenance activities in order to increase the efficiency of utilization of the plant capacities i.e. maintenance personnel and equipment. The importance of good enterprise management and proper management of maintenance activities is stressed by the fact being proved in many countries, that negligence of maintenance (specifically preventive and planned maintenance routines) can decrease the production effectiveness by 10-15 percents and concurrently increase the production expenses by the same volume.

One effective way to address the topics of better management and higher utilization of national industrial resources is through the introduction and pilot implementation of Computerized Maintenance Management System (CMMS) in selected plants as a part of comprehensive Computerized Management Systems (CMS)*. This CMMS depending on the size and configuration will have the following major subsystems and integrating elements:

- Preventive Maintenance and Repairs Planning;
- Spare Parts, Semiproducts and Materials Requirements Planning;
- Capacity Planning and Scheduling of Maintenance Work;
- Inventory Control and Materials and Spare Parts Purchasing;
- Spare Parts Manufacture Planning and Control;
- CMMS Maintenance Monitoring Function;
- System Software Support Function.

According to the experience acquired in the implementation of CMMS in various countries, the following tangible benefits can be expected from the the project:

1) <u>PRODUCTION EQUIPMENT</u>
   a) Increased plant availability and efficiency
   b) Reduction of breakdowns and failures

* Background information on handling plant maintenance, and plant and local networks for computer application: to be added by the plants.

2) <u>MAINTENANCE POWER</u>
   a) Better scheduling of maintenance work
   b) Better availability of spare parts and materials
   c) Increased efficiency of manpower
3) <u>INVENTORIES OF SPARE PARTS AND MATERIALS</u>
   a) Reduction of stock levels
   b) Elimination of out-of-stock situations
   c) Reduction of number of parts
4) <u>SPARE PARTS REPAIR AND MANUFACTURE</u>
   a) Increased manufacture of spare parts
   b) Increased volume of reconditioned parts
   c) Reduction of imported spare parts

Apart from these tangible benefits, a number of intangible benefits can be expected: a longer life of equipment due to the better preventive maintenance routines; improved quality due to better production processes; balanced production/maintenance activities due to better planning of repairs and overhauls, smoother workload due to better planning and scheduling of maintenance activities; standardization due to a better system of standards and coding and a more accurate budgeting of maintenance work due to better costing.

UNIDO has already successfully executed a number of CMMS projects. The most relevant examples of these activities are the development and introduction of CMMS in metallurgical plants in Algeria, Czechoslovakia, Egypt, India, and Mexico which are based on mainframe computer, mini-computers and connected terminals and PCs. In Czechoslovakia, through the introduction of CMMS concrete annual savings of about 63 million crowns were achieved. At EISCO, Egypt a CMMS covering practically all departments of the plant was installed. This has allowed the plant to increase the production by 12 % and to achieve savings of US$ 8 million.

PROJECT OUTPUTS

The project, depending upon the available financial and human resources, choice of centralized/ integrated and/or distributed system design concept and other specific decision making aspects, could be expected to produce the following outputs:

- Development and Introduction of pilot application modules in the selected areas of the plant. Realization of one integrated pilot application;

- Acquisition of equipment based on microprocessors for monitoring of plant condition for preventive maintenance purposes;

- Standard documentation of the system , manuals for all CMMS functions as well as with a techno-economic evaluation of the application of CMMS at the pilot plant.

- An integrated Data Base Manager (Software to handle data files) to service the CMMS functions;

- A relevant number of personnel (terminal operators, informatics personnel, maintenance managers and planners) trained in introductory aspects of CMMS as well as in programming design and in implementation of CMMS.

PROJECT ACTIVITIES

1. Survey and detailed diagnose of existing maintenance facilities and systems in terms of products, materials, management organization, machinery, equipment, design capability for spare parts, spare parts planning and movement. manpower and all other related constraints at the plant.

2. Based on survay in activity 1, elaboration of step-by-step development and implementation of CMMS in the plant which includes:
   -Selection of the pilot implementation areas,
   -Determination/Selection of priority subsystems and/or modules together with integrated activities,
   -Preparation of system design specification;

3. Specifications and procurement of necessary equipment.Installation of network facilities including training of technical personnel;

4. Procurement and provision of the subcontracting services for CMMS development and software application, which includes:
   -Translation of system design specification into the language of computer,
   -Programme testing and debugging, data collection,
   -Introductory system implementation (testing) and training of informatics personnel and documentation,
   -System implementation,
   -System operation and maintenance (including improvements of running programmes and update,
   -Installation of a Date Base Manager to service the CMMS functions;

5. Study-tours to plants with advanced CMMS application, to existing analogous UNDP/UNIDO programmes centres, fellowships and introductory on-site/abroad training for end-user (maintenance) personnel;

6. Techno-economic evaluation of the implemented system;

7. Preparation and execution of demonstration workshops to facilitate transfer of know-how to other areas of the plant.

TENTATIVE INPUTS

Experts

a) International Experts on CMMS in the Iron and Steel industry.
40,000 $US

UNIDO/UNDP staff missions
5,000

Equipment
Mini-computers, shared devices, disk storages, Terminals, transmission controller, data base system, Network software system.
110,000

Contract
Sub-contracting for development of CMMS, management and training of personnel,
250,000

Training
Study tours, Fellowship, organization of Workshops,
120,000

Miscellaneous
Communication, sundries, reports preparation, etc.
20,000

Estimated Project Total: aprox. 545,000 $US

Project Concept 6.2 (a)

Title: **Computer application for production process control in the iron and steel industry**

Project objective:

Through the introduction of computerized process control, quality control, production control, production planning, integrated information system, etc. to improve productivity and capacity utilization and the quality of the output, particularly for competitive advanced technology products.

Background information and justification:

Whilst developed countries have been introducing computers in production and process control since the 1960ies, developing countries are lagging behind, often a reason for poor capacity utilization of plants and poor quality products. It is clear that full-scale advantages offered by new technologies can only be implemented in new plants; however, existing plants can be refurbished and perfectioned with good results and cost savings as well as increase in product quality can be achieved.

When planning the use of computer controlled plant monitoring, the metallurgical and engineering industries, being capital and energy intensive, deserve particular attention as they offer vast areas where improvements in productivity, efficiency and quality can be attained. Optimization of production processes requires that entire production units and plants have to be covered with automation systems and computer control. Those plants and plant areas in which computerized production and process control can be introduced with most promising results will have to be identified. The benefits may be substantial particularly in the following areas: sinter plant, blast furnace, LD-plant, EAF-plant, ladle treatment plant, continuous casting plant and rolling mill. Process control and basic automation comprises functions which are usually performed by programmable logical controls, microprocessors and instrumentation systems. A distributed control system provides the following functions:

- direct acquisition of on-line data
- direct outputs of setpoints
- sequencing
- direct control
- interlocking
- change of mode of operation

For process optimization production automation, process computers are used which coordinate and control production units like sinter plant, LD-plant, ladle metallurgy, continuous caster, etc. Via serial interfaces and/or data highway they are linked to the main system and to each other to perform transmission of information and acknowledgement of results between production units. Each production unit can be operated autonomously. Their main functions are:

- Process monitoring
- process models
- co-ordination of partial processes
- recipe management
- operator guidance
- data gathering

- short range data storage
- quality control

In many cases, the optimization of the individual production units or processes is insufficient and production and quality control needs to be introduced. This calls for planning and co-ordination of all individual production units or processes in one plant and comprise the following main functions:

- entry of production orders
- scheduling
- mill pacing
- control of material flow
- control of production
- quality control
- operation sequence control
- determination of production conditions (process and product parameters)
- medium range data storage

Project Outputs:

- Project report by a consulting company with identified plant areas where the computerized process control will bring about maximum benefits.

- Evaluation of available hardware and software for installation.

- Equipment and software installed, and personnel trained in computerized production and process control system.

- Data Bank and documentation established.

Project Activities:

The project aims at development and application of computerized systems for process control. This will be achieved through:

- identification of relevant plant areas.

- procurement of hardware; development, testing and application of computerized systems for process control, depending on specific application conditions.

- direct connexion between other computerized plant systems, data bank, etc. to support the integration of the above functions.

- organization of training programmes and workshops.

Implementation of the project by a consulting firm (UNIDO sub-contractor) should be envisaged, with some individual consultants to be recruited.
The project is of both direct support and capacity building nature, resulting in direct, tangible benefits in industrial units connected to the computer network. The project may be implemented through linkage to mainframe computers, mini computers, and/or the application of personal computers. The latter approach will offer an inexpensive solution of application of computers to many smaller plants and companies.

Project Concept 6.2 (b)

Title: Computerized Energy Conservation in Metallurgical Industries

Project objective:

The project will establish computerized energy auditing and monitoring and, in a later stage, a model computerized energy centre to serve the local metallurgical industries to monitor the production and utilize all energy to facilitate control over the distribution of such energy.

Background information and justification:

Through efficient energy management and adoption of adequate energy utilization and conservation measures, with the help of computer based methodologies for monitoring energy consumption rates at various production stages, substantial energy savings can be achieved. UNIDO may report a particularly successful project undertaken for steel plants of the Steel Authority of India Ltd. through which a number of areas for potential savings could be identified, including coke ovens, sinter plant, blast furnaces, OH steel stops, LD steel shops, continuous caasting, primary mills, hot mill furnaces, etc. The findings and recommendations by the project will bring about total energy savings in these areas which are estimated at 6,020 Tcal/y for the Bhilai Steel Plant, 4,650 for the Rourkela Steel Plant and 6,550 for the Bokaro Steel Plant of SAIL. To obtain maximum benefits, the setting up of a computer network, such as done for the Ranchi Steel Plant in India, for energy management and monitoring should be considered. Energy conservation should particularly be directed to the following:

- elimination of wastes of different forms of energy
- improvement of operational practices to reduce energy consumption
- improvement of equipment design
- adoption of economic waste heat recovery
- adoption of modern energy efficient technologies
- establishment of a computerized energy centre for integrated energy control

Project Outputs:

Phase I

- Computer based methodologies for monitoring energy consumption rates at various production units (to be identified) of an iron and steel or other metallurgical plant

- Technical studies recommending means and measures to improve the energy consumption at the identified steel units.

- Identified potentials for energy conservation through systematic data collection.

- Mobile energy diagnostic laboratory; portable measurement instruments.

- Set up of a mini computer network linked to PCs and directly fed by energy related data from the mobile diagnostic laboratory.

- Energy Audit Manual (for carrying out audit of energy consumption and energy costs, to eneable detailed variance analysis and identification of specific deviating factors.

- Plant engineers, trained in energy conservation.

Phase II - Establishment of a Computerized Energy Centre

- Preparation of a detailed plan for the establisment of a centre, incl. technical feasibility study report

- One model centre established at one selected steel plant

Project activities:

It is proposed to implement the project through a consulting company (UNIDO sub-contractor) and individual consultants as need may be. Activities will be in line with desired outputs and will specifically cover:

For Phase I:

- Preparation of computer based methodolcgies for monitoring energy consumption rates at various production units (to be identified);

- Preparation of technical studies recommending means and measures to improve the energy consumption at the identified steel units.

- Establishment of a data bank.

- Procurement of mobile energy diagnostic laboratory; portable measurement insturments; introduction to use of instruments

- Procurement and set up of a mini computer network linked to PCs and directly fed by energy related data from the mobile diagnostic lab. Procurement/development of required software.

- Preparation of Energy Audit Manual (for carrying out audit of energy consumption and energy costs, to eneable detailed variance analysis and identification of specific deviating factors.

- Training programme for plant engineers.

For Phase II

- Preparation of a report with complete list of equipment/instruments for the energy conservation centre;

- Development of software packages, procurement of software, adoption, testing and operation.

- Physical establishment of Energy Conservation Centre; advisory services by consultants, as required.

- Training (local and abroad) of Centre staff.

Project Concept 6.2 (c)

Title: Software Development and Training Centre

Project objective:

To improve the self-reliance and to increase a country's independence on foreign software development/procurement by making full use of available national intellectual human resources for the automation of the metallurgical and other basic sectors of the economy, thereby saving foreign exchange for the import of software "know-how" and licenses and adaptation to local requirements.

Background information and justification:

With the advent of micro-electronic revolution the ratio of software cost to hardware cost in computer projects has considerably changed. As a result of this development, a higher share of computing cost is now attributable to software. Since software is basically an intellectual product, the investment needed to create a domestic software industry is mainly in the area of education and not, therefore, to be considered as a substantial capital equipment. The establishment of software development centres at both national and company levels can enhance and speed up the introduction of computer-aided process control systems. In this regard the metallurgical sector can highly benefit through the coordination and concentration of national capabilities of software development. The software centre will permit a better and more efficient use of national human resources in developing software for the industry and in adapting modern technologies to the national conditions. Further, the centre could extend its activities in providing assistance in introducing and upgrading computerized process controls to other basic industries at both national and regional levels.

Project Outputs:

A full-functioning Software Development House with trained staff who will elaborate, based on clients' requests, required tailor-made software, adapt software to local conditions and cater for training needs.

Project activities::

The work in this field will focus on:

- Providing assistance in the attainment of experience and know-how to establish a software development and training centre

- Providing assistance to develop methodologies and training activities aimed at upgrading the national capabilities of software development.

- Providing assistance and consultancy in the selection and acquisition of reliable hardware and equipment and in the development of comprehensive methodologies of training.

A project of this nature is being now prepared to be undertaken for the Steel Autority of India Ltd. and it is expected that technical assistance in this field will be requested by a number of developing countries; indications of interest, e.g. from Mexico, already exist.

7. DEVELOPMENT OF NEW ADVANCED METALS, ALLOYS AND COMPOSITE MATERIALS

7. Development of new advanced metals, alloys and composite materials

The programme covers the requirement by the more advanced developing countries for more sophisticated technology, such as processing of raw materials for the electronic industries, e.g. silicon, gallium arsenide, etc.

Future perspectives:

Major technological advances in new metals and materials are characterized by a high degree of R and D content. Therefore, UNIDO has spent time and efforts in order to set up proper infrastructure for the production of new materials. This has been promoted through the introduction of computerization, energy saving technologies, also considering environmental aspects. A major impact is achieved through metallurgical technology centres. Other promising fields which UNIDO could further promote or take up in the future are the production of super-purity metals (e.g. super-purity silicon, gallium and aluminium), development and application of special aluminas and advanced ceramic materials, production of so-called metallic glasses, etc. Examples that may be worth considering:

(a) Assistance in the production of special grade aluminas

The purpose of assistance would be to optimize utilization of existing bauxite resources and to enable the production of special grade aluminas. Such aluminas are used in the eletronic, electric, oil production industries, in automobile (spark plug insulators) and aircraft manufacture, machine building and in metallurgy (refractories) and any other applications where special material properties are demanded. The production of technical grade ceramics plays an important role. Corundum grains for production of abrasive grinding wheels may be produced. Special aluminium hydrates are used as filling material for the rubber and textile industry (flame retarding effect), aluminium sulphate for wastewater treatment, particularly in the paper industry. Special types of aluminas increase mechanical strength, improve heat conductivity, diminish thermal expansion, impart good resistance against thermal shock, increase resistance against acids and alkalis and impart a low current conductivity coefficient even at high tempertures in the ceramics produced from them. Technical assistance may cover the preparation of a detailed project report including design engineering, expertise.

(b) Development of rapidly solidified amorphous alloys

(c) Processing of Metallic Materials and Production of new semi-conductor grade alloys for electronics industry (e.g. silicon wafers for integrated circuit (IC) production)

In developing countries with potentials for raw materials for developing an electronic industry for the production of ICs and other electronic parts UNIDO may undertake a survey of such indigenous raw materials which would contain silicon, gallium, germanium, indium, rare earths elements and others, in concentrations economically extractable. Expert assistance may be provided to examine and elaborate on the most suitable techno-economic methods of processing the materials into semi-fabricates for further production. Initial diagnostic missions may be followed up by a feasibility study, testing of raw materials, creation of R and D facilities, demonstration plant, etc.

(d) Production of metals for the electronic industry (for uses other than for ICs)

Modern metal alloys are becoming crucial for the electronic industries, especially in those developing countries having mass production factories. Brazing alloys, solders, conductors, lead frames, printed circuit plates, magnets, are only a few examples of electronic products that require high purity alloys such as copper, gold, silver and aluminium.

UNIDO can assist in establishing metallurgical plants to supply such alloys to the factories manufacturing electronic parts. UNIDO can also offer to assist in standardization of products, establishment of training and R and D centres as well as dissemintion of technological information.

Project Concepts for possible technical assistance projects
in selected developing countries
(to be promoted through missions, etc.)

No.	Title	Remark
7.1	Production of semi-conductor grade gallium arsenide for electronics industry	
7.2	Technology for production and application of amorphous materials	
7.3	Introduction of advanced powder metallurgical techniques for special applications	
7.4	Production of modern metal alloys and semi-conductor materials used for electronoc applications	

PROJECT CONCEPT 7.1

Title: Production of semi cönductor grade gallium arsenide for electronics industry

Project objective:

The project will contribute to the supply of indigenous metallic raw and semi-fabricated materials for the country's electronic industry by developing a self-sufficient high-technology sub-sector.

Background information and justification:

Gallium arsenide is increasing its share gradually as electronic raw material in view of the speed of reaction to electric/electronic impulses which is several times larger than that in high purity silicon which is still the dominating material in the production of integrated chips/circuits and other microelectronic elements.

The production of high purity gallium arsenide requires first high purity (6N) constituents of gallium and arsen to be produced. Thereafter two main technological directions are to be followed depending on whether the application of gallium arsenide is intended in the form of production and processing of wafers or in the form of apitaxy. In the first case the high purity polycrystals of the initial materials are first to be converted into monocrystals which would be cut therefrom into thin wafers and processed further, principally in a way similar to silicon. In the second case the metal organic chemical vapour deposition (MOCVD) technique is applied to deposit jointly gallium and arsenide from the wafers to form apitaxial layers. Both forms are used, with the first one in significantly larger volume than the second application.

Project outputs:

Capability, including relevant equipment and trained personnel for R and D of producing gallium-arsenide for electronic devices.

Project Activities:

1. Analysis of market for gallium-arsenide in the country or region

2. Establishment of strategy of raw material supply for commercial grade materials up to wafers

3. Tentatively, adaptation of technologies for refining the commercial grade starting materials to high purity, introduction of production of main crystals on laboratory/pilot scale, experimental production of wafers

Duration: Depending on envisaged activities. In case of establishment of R and D facilities, about 3 years to be envisaged.

Estimated cost: For all activities (items 1 to 3) about $ 1 million

PROJECT CONCEPT 7.2

1. Title: Technology for production and application of amorphous metals.

2. Objective:

To assist a developing country in creating/strengthening its capability to produce modern materials - amorphous metals.

3. Background and Justification

Amorphous metals (AM) are a new kind of modern materials possessing extremely interesting structures and properties. First invented in the 60's and commercially applied in the 70's, their use is spreading into a large number of high-tech applications.

Amorphous metals, which are produced through very rapid solidification, do not crystalize but keep the "liquid" form after cooling, thus enhancing some properties such as magnetic, electrical. Example of applications are in small transformer cores, in alloys for soldering and brazing, high performance structural materials (aerospace), tool and bearing materials, magnetic alloys (soft, hard), stainless steels.

The solidification of metallic melts is one of the most important processes determining the properties of solid metals and alloys. Alloys e.g. iron-aluminium and titanium-based alloys are referred frequently as "microcrystalline" because of their fine grain size. Benefits of rapid solidification can be divided into two categories: rapid solidification extends the formation of new, metastable phases, increases the solubility of a few alloying elements, can result in unusual, fine grained microstructure or, in special cases, glassy structure. This will lead to better physical and chemical properties. Secondly, the rapid solidification of the metallic melts is a one-step process by which alloys small cross section e.g. ribbons, wires or powders can be produced directly from the melt. The commercialization of rapidly solidified alloys has started. The excellent soft magnetic properties of metallic glasses are exploited in several devices, e.g. magnetic heads, shields, inductive components, ribbons for anti-thief systems, sensors. The use of flexible brazing and soldering foils is also gaining importance. High-strength light metal alloys have found high-performance applications in aerospace industry. Research in this direction has inter alia been undertaken in Hungary and a technical paper is available to interested developing countries.

Possibilities for the developing countries

Running laboratory and pilot work with amorphous metals is not particularly expensive and can be undertaken in any institution with a sound scientific basis. However, acquiring the manufacturing technologies for commercial production might be difficult due to the high-tech nature of the activity.

Developing countries possessing both the scientific basis and the potential market may start a programme to upgrade its fundamental research and create a demonstration plant to develop practical applications and motivate/train industry personnel aiming at full application of AM in its high-tech industries.

UNIDO, which has access to a few leading R&D centres in Europe, can assist the developing countries in formulating and implementing such a programme.

4. Outputs

4.1 State-of-art report on amorphous metals applications in industries.

4.2 A team of engineers and researchers able to formulate, design, implement technology applications of amorphous metals.

4.3 Assessed information of applications of amorphous metals in selected developing countries.

5. Activities

5.1 Survey of state-of-art in industrialized countries and of the needs of selected developing countries.

5.2 Formulation and implementation of a research programme at laboratory and pilot scale in a selected developing country.

5.3 Transfer and dissemination of the technologies to the local industries.

Estimated Project Budget:

	m/m	US$
International personnel		
Training		
Procurement of R&D equipment		

UNITED NATIONS FOR INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT CONCEPT 7.3

PROPOSED TITLE: INTRODUCTION OF ADVANCED POWDER METALLURGICAL TECHNIQUES FOR SPECIAL APPLICATIONS

COUNTRIES: BRAZIL, CHILE, CHINA, MEXICO, INDIA, IRAN, INDONESIA, PHILLIPINES, R. OF KOREA, YUGOSLAVIA, VENEZUELA.

ESTIMATED DURATION: 2 years

ESTIMATED EXTERNAL CONTRIBUTION
+ COST SHARING: 1,190,000 US$

ESTIMATED COUNTERPART COSTS (IN KIND) 140,000 US$

JUSTIFICATION

In recent years, the powder metallurgy has rapidly developed from a laboratory technology for the production of unconventional materials into a widespread production technique with almost unlimited possibilities, both concerning the materials produced and the shapes of the parts.

With respect to the production "conventional" materials, such as iron, aluminium, bronze the principal advantages of powder metallurgy compared to other production processes are:

a) The possibility of producing complicatly-shaped parts in large numbers at moderate costs, and

b) The possibility of producting alloys composition impossible to produce with traditional ingot-metallurgy techniques.

c) The excellent tolerances obtained without necessity of further machining.

The production of dispersion-strengthened alloys is one of the novel technologies developed for producing materials with improved high-temperatures properties. The powder metallurgycal technology, so-called mechanical alloying, permits for instance the production of aluminium/copper alloys capable of substituting expensive materials in their high-temperature applications.

DEVELOPMENT PROBLEM INTENDED TO BE ADDRESSED BY PROPOSED PROJECT:

Development Objective:

Development and upgrading of local capabilities in production of dispersion strengthened materials with improved resistance, quality and performance.

Immediate Objective:

The following immediate objectives are envisaged:

1. Establishment of pilot-production site for development of advanced dispersion-strengthened materials through powder metallurgical techniques for special applications in the industry.

2. Establishment of comprehensive training programmes for upgrading domestic capabilities for formulation, development and application of powder metallurgical techniques for the production of ligther materials of novel compositions with improved properties.

OUTPUTS

1. Report containing technological guidelines for production of dispersion-strengthened materials for selected applications.

2. A relevant number of engineers, technicians, operators trained in advanced powder metallurgical production techniques, in particular in production of dispersion-strengthened materials.

3. An established pilot institution, for production of a limited number of metallurgical parts and for implementing research activities in powder metallurgy.

ACTIVITIES

1. Identification of the level of development in new materials research of the Host Country, selection of the national institution/enterprise responsible for project implementation.

2. Specification of equipment required and development of tailored comprehensive training programmes for engineers, technicians and operators for the establishment of a core group recipient of the technology.

3. Preparation and elaboration of comprehensive training activities in production techniques of Dispersion-Strengthened Alloys. The training programmes will cover all the stages of the production techniques of dispersion-strengthened aluminium/copper materials including: powder production, composition selection, selection of optimal milling conditions, determination of heat-treatment conditions, compacting techniques and process quality control. They will consits of individual fellowships and study tours.

3. The acquisition of technological knowhow in powder metallurgy techniques for production of dispersion strengthened alloys. Development and adaptation to domestic conditions including specific internal demands.

4. Laboratory trials of the developed dispersion-strengthened materials for specific domestic requirements.

4. Establishment of pilot-production for dispersion-strengthened materials in accordance with world standards.

5. Dissemination of the acquired powder-metallurgical techniques to other institutions/enterprises working in the field of materials development through the organization of demonstration workshops and seminars.

ESTIMATED INPUTS

Government Contribution (in kind)

The national counterpart should provide the required professional and administrative personnel as well as the logistic support required during the project implementation.

National Personnel, including:
Including materials engineers, technician and administrative support.

	80 m/m	60,000 US$
Equipment (auxiliary)		80,000
Total		140,000 US$

External Contribution

in US$

Project Personnel

Expert on powder metallurgical production techniques
Expert on techno-economic assessment.

	8m/m	80,000
Sub-contracting		150,000
Training		200,000
Equipment including: Powder atomizer, High-energy mills, Press, Furnace, etc		750,000 (*)
Miscellaneous		10,000
Total		1,190,000

(*) Including cost-sharing contribution of the technology recipient.

PROJECT CONCEPT 7.4

1. Title: Production of modern metal alloys and semi-conductors metals used for electronic application.

2. Objective:

To create/strengthen the local capability to design and produce metal alloys and semi-conductormetals used in electronic devices.

3. Background and Justification:

It is an emerging and widening challenge for UNIDO to transfer the experience of developed countries in the production of new electronic raw materials to developing countries to enable them to quickly develop their own industry of electronics.

A number of metal alloys are used in manufacture of electronic devices: soldering, frames, boards, brazing, coloring, high/low conductivity, high/low expandability, contacts, etc. Most of these alloys are specifically designed to suit the required technical performance of the electronic component. Most are "high-tech" alloys used in mass production and, therefore, produced under severe quality control many developing countries have raw materials used to produce electronic parts. UNIDO can assist in establishing industries to produce the electronicparts, starting with a survey of the indigenous raw materials such as silicon, gallium, germanium, indium and rare earths.

Access to the design and production technology of these alloys and semi-conductors is becoming more and more difficult, due to the highly specific design and production characteristic. UNIDO can assist the metals processors in developing countries in accessing/developing such kind of technology. Expert assistance may be provided to examine and elaborate on the most suitable methods of processing the materials into semi-fabricates for ICs production including advice on the design, construction, fabrication and quality requirements for IC products. Such initial diagnostic missions may be followed up by a feasibility study and/or the establishment of a pilot plant.

4. Output 1:

4.1 Production technology for metal alloys used in electronic devices.

4.2 A team of engineers to specify, analyse, design and produce the alloys.

4.3 A metallurgical demonstration plant equipped to analyse and produce the alloys.

5. Activities:

First Phase

5.1 Survey of the requirements for the electronic industries need in terms of metals alloys and semi-conductors.

5.2 Formulation of a plan of action to create or adapt industrial technology for the local production of metal alloys and semi-conductors.

Second Phase

5.3 Design and installation/upgrading of a demonstration plant.

5.4 Running of an R&D programme jointly undertaken by the project staff and engineers from industry.

5.5 Transfer of technology to industry.

6. Inputs

First Phase:

5-8 m/m of field work by a consultant; study tour abroad about $100,000.

Second Phase:

Will depend on the design of the demonstration plant.