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**EVALUATION OF THE
NATIONAL CLEANER PRODUCTION CENTRES IN CENTRAL EUROPE**

US/CEH/94/071: Czech Cleaner Production Centre
US/HUN/96/093: Hungarian Cleaner Production Centre
US/SLO/94/072: Slovak Cleaner Production Centre

Volume 4

**Hungarian Cleaner Production Centre
US/HUN/96/093**

Report of the joint in-depth evaluation mission*

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Table of Contents

| | Page |
|---|-----------|
| Explanatory Notes | 2 |
| Acronyms | 2 |
| 1. INTRODUCTION | 3 |
| 2. CONCEPT AND DESIGN..... | 3 |
| 2.1 Socio-economic Context | 3 |
| 2.2 Institutional Framework | 4 |
| 2.3 Project Relevance and Design..... | 5 |
| 3. IMPLEMENTATION | 7 |
| 3.1 Inputs, Budget and Expenditures | 7 |
| 3.2 Activities | 8 |
| 3.3 Project Management | 9 |
| 4. RESULTS | 10 |
| 4.1 Outputs..... | 10 |
| 4.2 Achievement of the Purpose | 15 |
| 4.3 Impact..... | 15 |
| 5. SUSTAINABILITY..... | 17 |
| 6. ANNEX | 18 |
| 6.1 Persons met and interviewed | 18 |
| 6.2 Visits in Companies | 19 |
| 6.3 Table HUN-4: Categories of Selected Cleaner Production Measures of the Hungarian Cleaner Production Centre | 21 |

Explanatory Notes

Value of Hungarian Forint (HUF) during the period of the evaluation, according to the UN operational rate of exchange is:

1 US\$ = 296.0000 FORINT (HUF)

Acronyms

| | |
|------|--|
| BAT | - Best Available Technologies |
| CCPC | - Czech Cleaner Production Centre |
| CIP | - Cleaner Industrial Production |
| CP | - Cleaner Production |
| DBU | - German Foundation of Deutsche Bundes Umwelt Stiftung |
| EMS | - Environmental Management System |
| EMAS | - Environmental Management and Audit System |
| HCPC | - Hungarian Cleaner Production Centre |
| PPR | - Project Progress Reports |
| REC | - Regional Environment Club for Central and Eastern Europe |
| SCPC | - Slovak Cleaner Production Centre |

1. INTRODUCTION

Evaluation of the Hungarian Cleaner Production Centre (HCPC) constitutes a part of evaluation of 3 UNIDO NCPCs funded by the Austrian Ministry of Foreign Affairs, the donor of the project. The evaluation of HCPC was carried by a team consisting of:

- Mr. Andreas Windsperger, team leader
- Mr. Miklos Bulla, national consultant
- Mr. Jaroslav Navrátil, UNIDO staff.

The field mission was carried out 28 May – 1 June 2001. The list of persons met and interviewed is in Annex 6.1.

Conclusions and lessons learned are summarized for all three Centres in a separate text.

2. CONCEPT AND DESIGN

2.1 Socio-economic Context

During the last three years the economy started to grow and an increasing number of domestic and foreign companies has been set up. This process has been paralleled by an increase in the environmental awareness of the population although still far from being as high as in developed countries. This trend and the requirements of international treaties and the approximation of Hungarian environmental law to EU regulations were reflected in the changes of environmental legislation in the last couple of years. Although enforcement still lags behind, regulations are covering all aspects of environmental protection and the implementation of the European environmental law is not far away in many fields. From 2001 the Hungarian central environmental fund provides resources for preventive environmental measures in order to support cleaner production initiatives within the country. At the local level, local governments still lag behind due to lack of both skills and resources.

Development of technologies has taken an enormous step with the inflow of foreign capital. This includes both the modernisation of existing and the installation of new manufacturing facilities. As a result, pollution prevention options have been exploited to a certain extent within these - usually big size - enterprises. On the other hand small and medium size enterprises lag behind and low or no cost options (low hanging fruits) still prevail.

The basic driving force behind the environmental measures and investments of companies can be seen in national environmental regulations and environmental requirements of customers (e.g. multinational companies). During the last three years environmental management practices have gained importance in the corporate sector. Specially multinational and large national enterprises with considerable environmental impact can no longer operate without the use of at least the basic environmental management tools (company environmental policy, environmental representative, etc.). The most widespread environmental management tools utilized by Hungarian companies have been surveyed by the HCPC in 1999-2000 showing an increase of awareness within some sectors of the economy.

Environmental management systems are also getting more and more widespread as more than 200 companies have certified ISO14001 systems installed and EMAS systems have also been implemented at a couple of organisations. On the other hand, there are still a high number of specially small and medium sized companies which do not utilize any environmental management tools and there are a number of new tools which are only in their experimenting phases. Environmental indicators and environmental accounting are such fields.

The joining of the European Union (estimated in 2003-2004) still provides a lot of tasks both at the policy level and at the corporate level for the Hungarian companies. Environmental expertise is badly needed for the preparation of new environmental legislation while consulting services are required by the corporate sector.

2.2 Institutional Framework

The institutional framework of environmental protection in Hungary has developed in the last five years enormously. Efforts directed to the legal background of corporate environmental activities have started to close the gap between European and domestic regulations, the state organisations (both central and local) have been set up and a number of other organisations have started to concentrate on environmental issues: environmental NGO's, research and educational organisations. The market of environmentally sound technologies and solutions as well as consulting services have also developed at a high rate.

These factors determine the background to the activities of the HCPC aiming at the institutional framework of cleaner production in the country.

2.2.1 State institutions related to cleaner production

- (1) Legal environment. The framework environmental protection act which was passed in 1995 includes prevention of pollution at the source as one of its underlying principles. This has resulted in an urge by state organisations to foster cleaner production and other preventive approaches.
- (2) The Ministry of the Environment deals with cleaner production in connection with its activities in the fields of waste management and environmental technologies and the regulation of integrated pollution prevention and control, among others. The central environmental fund (KAC) operating in the form of a budget line within the state budget, includes cleaner production as one of the objectives to be supported by non-repayable loans. The Hungarian Cleaner Production Centre is working on a more comprehensive set of criteria to be used during the identification of preventive measures which will be used in the future. An office for the registration of EMAS companies is also going to be set up in the near future.
- (3) The Ministry of Economic Affairs is also involved in cleaner production and environmental management through the operation of a subsidy for the corporate sector which aims at the implementation of Environmental Management Systems.
- (4) Special organisations within the framework of the Ministry of the Environment deal with eco-labeling (Környezetbarát termék Kht., Environmentally Friendly Product Plc.), integrated pollution prevention and BAT (to be set up in 2001 at the Környezetgazdálkodási Intézet, Institute of Environmental Management).

2.2.2 Non-governmental organisations

- (1) Követ-INEM Hungaria is an association of 50-60 environmentally oriented manufacturing, service and consulting companies. The secretariat has 8-10 employees and acts as the Hungarian partner of the International Network of Environmental Management. It has been involved in a number of CP related activities, very often in cooperation with HCPC. For HCPC it is a partner, rarely a competitor. As a rule, Követ-INEM organizes events, HCPC delivers training, lectures, etc.
- (2) The Regional Environmental Centre (REC) in Szentendre has organised eco-efficiency trainings in the country. REC is also involved in the co-ordination of CP activities within the Eastern and Central European region. For HCPC it is sometimes a competitor.

- (3) The HCPC also runs a joint project with the Association of Hungarian Nature Preservers concentrating on the communication and relationship between the corporate and non-governmental sectors.

2.2.3 Higher education and other CP training

A number of higher education organisations have adopted the principles and methodologies of cleaner production during the last 3 years. These universities include the followings:

- Budapest University of Economic Sciences and Public Administration
- Budapest University of Technology and Economics
- Széchenyi István College, Győr
- Veszprém University
- Debrecen University and
- Szeged University.

These universities offer courses in cleaner production and environmental management to engineering and economics students both at the undergraduate and graduate levels.

2.2.4 Scientific research

Most universities involved in the education of cleaner production principles are also involved in research activities relating to cleaner production. These activities provide a basis for environmental policy advice which has been often used by the Ministry of the Environment and the Ministry of Economics Affairs and other organisations.

2.2.5 Private consulting companies

As a result of the interest of the corporate sector in environmental management tools, environmental consulting has emerged during the last couple of years. International as well as domestic consulting companies provide services in a number of environmental fields such as environmental impact assessment, environmental management systems, environmental reporting, etc.

As a result of the boom in EMS in Hungary, more than 200 companies have obtained the ISO14001 or EMAS certificates by early 2000 which - compared to the size of the country - is a remarkable number.

EMS certification organisations have also evolved during the last years.

2.3 Project Relevance and Design

Project document for the Hungarian CPC was prepared later than project documents for the other two Centres. Apart from that the situation in Hungary differed in two aspects: there was no prior CP programme in Hungary like the Norwegian one in the Czech and Slovak republics. Second, the project in Hungary was supposed to be hosted by a research organization. Therefore the strength and weaknesses of the project design are partly different:

Strengths (what turned out to be valid/relevant):

- Combining capacity building for direct advisory services to industry with creating conducive environment for CP
- Capacity building primarily through intensive training and on-the-job training (in-plant demonstrations), with support of a twinning organization from a developed country
- Conceiving the Centre primarily as pivotal organization promoting CP both directly (awareness raising) and indirectly through policy dialog
- Idea of setting up branch offices in some regions
- The concept of the Advisory Committee and its composition

Weaknesses:

- Expectations about "immediate and significant savings ... achieved at low (or no) cost" were too optimistic
- No risks were identified
- Project objective is blurred due to the fact that it has three means-end levels (establishing a Centre – building up national capacity in CP – wide scale and sustainable application of CP)
- No indicators even at output level
- Conceiving CP in isolation, not linking it with EMS and/or quality management system
- Paying no attention to assistance in accessing financial resources for implementation of CP measures
- Absence of a firm commitment of the host country to subsidize public functions of the Centre (awareness raising, policy, training, information, etc.).

In the Business Plan and in the course of project implementation some of the weaknesses were rectified (integration with EMS was established; change of the host organization provided for more distinct in-kind contribution of the host country to the project, risks were identified, etc.). Specification of project outputs was changed to accentuate establishment of the regional offices.

The Centre has so far managed to remain a relevant organization particularly due to its high-quality awareness raising function and extension of advisory services to include advanced voluntary measures such as environmental reporting and environmental accounting. The capacity to work on advanced tools is facilitated by close links with the host organization (university).

3. IMPLEMENTATION

3.1 Inputs, Budget and Expenditures

As in the other NCPC projects the host country was expected to provide office space, salary of the deputy director and the administrative assistant, and logistical support (communication). This should have been provided by the Institute of Logistics and Production Engineering, Miskolc as the host organization. However, this organization declined to carry out this function and – after some negotiations – it was the Department of Environmental Economics and Technology at the Budapest University of Economic Sciences and Public Administration that became the host organization. The University provided adequate office space, salary to the deputy director and also some other support in kind, among others by employing some other staff of the Centre on part-time basis. The Centre also has had the possibility of drawing on the professional knowledge of other departments of the University. After the completion of the UNIDO project the Director of the Centre has been on University payroll. Thus the host country inputs have generally come very close to the requirements of the project document.

UNIDO inputs were provided in the framework of the UNIDO budget and its revisions (see Table HUN-1).

Table HUN-1: Budget and Expenditures :US/HUN/96/093

| Budget line | | Original Budget | Latest Revised Budget | Total expenditures |
|---------------|---------------------------------|-----------------|-----------------------|--------------------|
| 11-99 | Project Personnel | 150,000 | 150,000 | 137,988 |
| 15-99 | Project Travel | 23,500 | 24,000 | 21,338 |
| 16-99 | Other Personnel Costs | 5,000 | 7,000 | 5,191 |
| 17-99 | Short-Term National Consultants | 90,000 | 158,000 | 154,621 |
| 19-99 | Personnel | 268,500 | 339,000 | 319,138 |
| 29-99 | Contracts | 15,000 | 4,675 | 4,675 |
| 39-99 | Training | 120,000 | 29,806 | 19,065 |
| 49-99 | Equipment | 32,000 | 43,012 | 43,779 |
| 59-99 | Miscellaneous | 8,500 | 27,507 | 10,083 |
| Total: | | 444,000 | 444,000 | 396,740 |

Breakdown of the budget and actual expenditures reflects the following features of the implementation modality:

- extensive use of national experts (including salary of the Director) (BL 17)
- use of the twinning organization STENUM (24% of total expenditures) (BL 11)
- provision of some office equipment (no laboratory equipment) (BL 49).

Differences between the original budget and its latest revision concern primarily a shift between training (BL 39) and national consultants (BL 17) which reflects the fact that the discretionary budget was discontinued and training was carried out by staff recruited as national experts.

Cooperation with STENUM Graz represented a support for the Centre but it was not the exclusive source of foreign expertise (even though it was dominant and the Centre's staff proposed wider twinning arrangements for consideration in the future). Use of expertise of other advanced countries (USA, UK) was limited to short-term consultancy missions. On the other hand the Centre benefited from the experience of other Centres of the UNEP/UNIDO network.

UNIDO project represented the key support for the Centre during the project lifetime but not the only one. This can be illustrated in budgetary terms as follows:

| | |
|--|-------------|
| Total budget revenue of the HCPC 1997-2000 approx [a] | USD 536,000 |
| Total UNIDO expenditures [b] | USD 396,740 |
| UNIDO support recorded in the budget of the Centre [c] | USD 314,742 |
| % of the UNIDO project in the Centre's revenue [d]=[c]/[a] | 58 |
| Total resources: 536000 + (396740-314742) [e] | USD 617,998 |
| Share of the UNIDO project in total resources(%) [f]=[b]/[e] | 64 |

High amount of UNIDO project expenditures captured by the budget of the Centre (USD 314,742) reflects administrative requirements of the University which records in the budget of the Centre not only the discretionary UNIDO budget over which the Centre had full control, but also most of the "direct funding by UNIDO". The discretionary budget was very small and amounted to USD 21860 only (4% of total revenue of the Centre, 5.5% of total UNIDO expenditures).

It is apparent that the UNIDO project with total expenditures of USD 396740 in the course of four years did not cover the whole budget of the Centre and the Centre had to secure complementary funding. The other sources of income included ministries (in particular the Ministry of Environment), USAID, PHARE, NATO and even a private company (Siemens) donating a contribution to the 6th Round Table. For the projects of the Ministry of Environment the Centre had to go through competitive bidding. Some income was generated through fees charged to companies or other organizations primarily for training. However, the revenue breakdown in the Financial data does not allow for reliable identification of these sources and their relative importance.

3.2 Activities

As the activities are embodied in results reported in Chapter 4 (internal institution building activities primarily in Output 1, external services for clients in the other outputs), this section refrains from duplication and focuses only on some aspects highlighting important features of implementation:

- *Slow start of the project.* Due to changes of the host organization in the initial phase of the project the activities started properly only in 1998. In 1999 the Centre was heavily involved in preparation and organization of the 6th European Roundtable on Cleaner Production which influenced the structure of the Centre's activities.
- *Cooperation with STENUM Graz.* It was greatly facilitated thanks to one staff member of the Centre who himself used to work for STENUM. Consultants from STENUM participated primarily in elaboration of methodological tools and provided guidance in conducting training. First training of teams under Ekoprofit was detrimentally influenced by the need for translation so that all other training was conducted by national experts.
- *Wide networking and cooperation with regional organizations.* In order to promote the CP concept the Centre has promoted establishment of regional CP centres (hosted by universities) and cooperates with a number of provincial offices (EkoReg) established and supported under a Phare project.
- *Use of external consultants (primarily national ones).* The Centre contracts external consultants recruited among others from the regional centres (or consultants associated with them) for conducting training and in-plant assessments. However, the Centre's staff themselves also participate intensively in training activities.
- *Use of young graduates.* Young graduates – usually from technical universities hosting the regional centres – worked for 6 months in companies, supporting them in identification and application of CP measures. After initial training (without any staff from the companies participating in the training which turned out to be a mistake) the young graduates worked in the companies with financial support of the Centre and a token salary from the companies. Once a month there was a joint meeting of the graduates with the Centre to share experience and get advice on the process.

- *Focus on group training outside companies* rather than company-targeted in-house CP training. The former modality prevails.
- *Attention to information dissemination*, including use of advanced information technology. A number of large conferences and similar events was organized or co-organized, a CD-ROM to promote CP and HCPC was issued.
- *Acting as platform for discussion between industry, Government and NGOs*. This can be exemplified by the workshop on corporate environmental reporting.
- *Great efforts in searching for clients*. Two factors proved particularly important: personal contacts (frequently dating back to the pre-project time) and availability of funds for subsidizing the services. In most cases the clients can not pay at all for the services and frequently the SMEs are not willing to release staff for training even if it is free of charge. As experience with the Ekoprofit project showed, out of 200 companies addressed in writing jointly by the HCPC and a mayor only 15 companies attended the first briefing and only 3 participated fully in the project.
- *Evolution of new activities*. Confronted with low company demand for CP in-plant assessments alone the Centre engaged in new activities extending the scope of services to cover other fields (environmental reporting, environmental accounting, integrating CP with EMS, etc.). Given the academic background the Centre tries to be at the forefront of applied research, testing it usually in larger companies.

As regards evolution and scope of activities (as well as results) it should be borne in mind that HCPC was established later than the other two centres under review and was supported by a project of shorter duration.

3.3 Project Management

The project document was signed by the then Ministry of Industry and Trade. However, the execution of the national management function was not well established for some time particularly when the originally envisaged host organization did not take over this role. The situation was consolidated as regards functioning of the host organization once this role was taken over by the Department of Environmental Economics and Technology of the Budapest University of Economic Sciences and Public Administration. However, the role of a Government counterpart was not clearly assigned so that the national ownership of the project was discharged by an Advisory Board. In the initial phase its functioning was not satisfactory. After the change of the Chairman (currently a well recognized Member of the Academy) the Advisory Board met regularly to review the work of the Centre. The Advisory Boards consists of representatives of the Ministry of Environment, Ministry of Economic Affairs, Ministry of Education, Academy of Science, three universities and one industrial company. The composition of the Advisory Board was adequate to the task of strategic guidance except for low representation of industry. (One large company is represented in the Board but an association or chamber of industry could also be represented to support closer contacts with the industry sector.) For annual reviews of the Centre's activities the standard UNIDO Project Progress Reports (PPR) were not used except for the Terminal Report dated October 2000. (This report is available at the UNIDO Office of Internal Oversight and Evaluation.)

Operational management was in the hands of a national Director, a Director of a Department at the University with excellent professional qualifications and well established contacts in the academia, industry as well as at the ministry level. In terms of financial management he however had to comply with financial rules of UNIDO as well as the University. The Centre had a sub-account at the University but use of funds had to be approved by a Faculty Council. In combination with the requirements of UNIDO financial rules and special requirements of the discretionary budget the financial management became quite heavy and pragmatic solutions had to be gradually established.

Recent upgrading of the Deputy Director to a Managing Director and delegation of operational management to him proved to be an effective arrangement as can be confirmed by experience of the evaluation team acquired through working contacts with HCPC.

The project was executed by UNIDO. The project management function was carried out (during 4 years) subsequently by five UNIDO staff. Though they were from the same Branch frequent changes of Project Managers required extra time for repeated "running in". Contacts between UNIDO and the Centre, including visits for briefing, training and solving administration issues, were quite frequent. Monitoring of the project by UNIDO included participation of the UNIDO Project Manager at the review meetings of the Advisory Board. Contacts with UNEP were confined to communication in writing and receipt of methodological papers, reports and other information including the database of CP case studies.

4. RESULTS

4.1 Outputs

Presentation of Outputs follows the list of Outputs as stipulated in the original project document. When the University took over the contract the structure of the outputs was modified, but the content remained roughly the same so that they can be presented here in the order of the original document.

4.1.1 Establishment of the Centre

According to the project document the Centre should have a staff of two-three professionals and one-two administrative assistants and it should be able to carry various promotional, training and advisory functions.

When the initial national counterpart of the UNIDO contract, the Institute of Logistics and Production Engineering, Miskolc pulled out as the host organization, the Department of Environmental Economics and Technology at the Budapest University of Economic Sciences and Public Administration became the host organization. The University provided adequate office space, salary to the deputy director and also some other support in kind, among others by employing some other staff of the Centre on part-time basis. The support by the colleagues at the University and the Department especially has proved to be an important background of the HCPC in projects in companies and for public administration.

Currently HCPC has 7 staff, 2 and a half of them are on the payroll of the University, three are employed by the University with reimbursement by the Centre and one is working on contract basis. All members of the technical staff have academic education, some of them have industry or consulting experience, the majority of them are perfect in English. Through the close connection to University an excellent academic expertise could be built up. The expertise of the core team seems to be balanced the right way, the director serves with his reputation as the link to public bodies and large companies, but also to the scientific community, which lead also to hosting the European Cleaner Production Roundtable.

The office in Budapest has adequate office space, office equipment and secretary service provided by the University. Measuring or laboratory equipment is not available.

As regards management information system, activities are well documented but there is no monitoring of environmental and financial impact of implemented CP options once a project in the company is completed. The Centre prepared well designed annual reports.

The Centre encouraged establishment of regional CP centres in Győr, Debrecen, Veszprém and Szeged. The regional centres are located at Universities, they are financially fully independent but there is a clear connection with the Centre in Budapest, which is strengthened by mutual support in projects and training courses. The regional centres are managed by University teachers as well, they also use students for projects, who are working on contract basis mainly. On one hand involvement of students in CP projects implies multiplication effects without additional costs. On the other hand it

may lead to some fluctuation of staff which implies increased requirements for internal education, and also the probability of generating competition. This is in principle a desirable strategy for public interest but it further strengthens the need for keeping the leading position in the methodology and knowledge.

In the framework of a PHARE project, coordinated by KÖVET INEM Hungaria, ÖkoReg Offices have been installed in Kecskemet, Nyiregyhaza, Eger, Szeged, Pecs and Miskolc to further contribute to sound environmental management practices and preventive environmental approaches including dissemination of CP-principles and their practical implementation. HCPC supports them in their activities, particularly by training trainers. Primary focus of the two networks is on local small and medium sized enterprises. Education, training, demonstration projects and consulting are included in their toolbox.

The Centre is capable of performing all services envisaged in the projects document as well as services that were not envisaged (such as EMS, environmental reporting, environmental accounting, etc.).

Assessment: More than planned

4.1.2 Dissemination of information

HCPC is very active in dissemination of information on CP. There is a regular newsletter "Green and profitable", published (500 copies, quarterly) since 1998 together with KÖVET. The newsletter provides information on preventive environmental methodologies and EMS issues. Articles introduce activities of the both institutions, for information of the companies lists of new environmental legislation are included.

An electronic database TTinfo has been set up, supported by the Environmental Fund of Hungarian Ministry of the Environment. The objective was to prepare an easily accessible database on environmental technology, production methods and preventive solutions. The database contains more than 100 Hungarian and international case studies. As the most recent step a comprehensive CD-ROM publication about CP was published. It includes a lot of essential information like case studies, technology information, conference papers as well as all information issued up to now (including 4 handbooks on CP prepared by the Centre). The CD-ROM was distributed among the key experts and interested institutions at a conference in May 2001.

The HCPC also has a library with a collection of the essential titles of CP related topics. The publications are available for public reading or copying at the Centre. However, the use of both TTinfo and the library by users outside of the University is limited.

The website is rather modest, it has links to relevant sources of information and information on some HCPC projects, with only several web pages in English.

HCPC organized or co-organized numerous conferences on national and international levels. The most striking event was the 6th European Roundtable on Cleaner Production attended by more than 200 participants of 35 countries. The conferences and seminars strengthened the position of HCPC as focal point for CP in Hungary.

Assessment: More than planned

4.1.3 Demonstration projects

Three types of HCPC projects can be listed under demonstrations:

- EKOPROFIT
- Young graduates (CP assessment projects)
- POEMS (TisoT)

The EKOPROFIT Projects aim at strengthening both the economic and environmental situation in a region or a city. The projects are based on workshops and company visits, which were supported in this case by the Austrian twinning institution STENUM. The workshops followed the standard EKOPROFIT pattern. At the end of the project the best companies received an award.

Up to now three such projects were carried out, with 16 participating companies, mainly from industry like metal production and manufacturing, or municipal service and transport. Three of them already had an EMS (independently of the project).

Young graduates. The programme aimed at identification of potential CP measures through placing young graduates for 6 months in participating companies. The CP-assessment initiative allowed students a training on the job in companies, on the other hand it allowed them a good insight about the CP possibilities in the companies. The project started with a start-up meeting, where the students were informed about their tasks and the objective of their mission in the companies. During their stay for half a year in the company there were joint monthly meetings with the Centre to discuss procedure and progress. Up to now 8 young graduates participated in the programme (working in 8 companies).

This initiative was most appreciated by the students and also by the companies (who paid only a token salary to the graduates). The experiences showed that especially the work in the company allowed better understanding of what is possible, on the other hand the periodic contact among the students in advisory meetings with an exchange of experiences helped to pursue their mission. The students benefited from practical experience, two of them are now employed by HCPC. One drawback might have been too little involvement of the companies in the preparation of the project, a fact of which the HCPC staff is aware and which will be changed in future, and little involvement of HCPC staff themselves in companies.

From the two types of demonstration projects the latter one worked definitely better. This can be demonstrated also by the number of CP options identified in the participating companies:

Table HUN-2: Number of companies and CP options, by programme

| Programme | # of participating companies | # of identified CP options |
|------------------|-------------------------------------|-----------------------------------|
| EKOPROFIT | 16 | 24 |
| Young Graduates | 8 | 23 |
| Total: | 24 | 47 |

HCPC knows how to further improve the Young Graduates programme. However, its continuation will depend on financial resources to subsidize 6-months salaries of the graduates.

POEMS (TisoT). HCPC and KÖVET started the project in 1999 to assist SMEs in implementation of the principles of Cleaner Production in the course of introducing EMS. Like EKOPROFIT, the project consists of a series of workshops but is more oriented on training outside companies than on on-site support in the company. In every project there were 12 workshops during a 10 month period which were attended by 1 to 2 environmental representatives per company. After the first workshop experts of the Centre (together with KÖVET) visited the companies to identify most pressing problems and to explore solutions. As a result of the programme, new knowledge was developed through training and suggestions were developed how to implement CP and other measures. Best companies in the

programme received a free certification audit which was experienced as a strong motivation for the work. Up to 2000 two projects could be completed with 18 companies in total, in 2001 another project was carried out with 5 companies. Approximately 50% were manufacturing companies, the other ones were construction, service and consulting companies. Up to now several of them (4-5) progressed enough to be certified ISO 14000.

Assessment: As planned

4.1.4 Training

Training conducted in the course of demonstration projects involved approximately 50-60 people trained in CP. In addition, some other training courses were carried out, some of them in cooperation with other organizations.

Training for auditors and environmental managers. The training was organized with the Hungarian Standardization Organization. The 12-day courses cover also CP and other tools of preventive environmental protection. The training is oriented towards consultants and quality managers for audits. About 100 persons attended, about one third were consultants.

Training for ÖkoReg offices was organised by KÖVET-INEM and delivered by HCPC. It includes a CP component.

Short-term training. Other training programmes comprise short term training for 1 or two days for special issues like seminars for groups of selected companies to introduce the idea of CP, presentations for micro enterprises, etc. (40-50 participants).

Assessment: As planned

4.1.5 Research Institutes

According to the project document two R&D efforts in the field of process and production modifications should have been initiated in research institutes. This result was not achieved. As a supporting activity, HCPC hosted a NATO Advanced Research Workshop on green engineering and management methods which included life-cycle analysis.

Assessment: Less than planned

4.1.6 Documentation and Manuals

In addition to reports documenting individual CP or EMS projects the Centre issued a number of manuals and other publications either in cooperation with other organizations (such as Kovet-INEM) or through its own effort:

- OKOPROFIT Handbook (translation and adaptation)
- EMS training handbook
- Environmental Auditor training handbook
- Cleaner Production Policy (Best Practice Manual)
- IPPC handbook for the corporate sector
- Eco-mapping guide for Oko-Reg offices (toolbox)
- Integration of CP and EMS – policy guide

Some of the manuals were prepared also in English (the Best Practice Manual was prepared under a separate contract for UNIDO with the intention of using it in the NCPC network).

Assessment: More than planned

4.1.7 Policy advice

The project envisaged increased CP awareness among key policy makers and financial institutions. A number of research papers and studies on environment, environment management and cleaner production were prepared by HCPC staff. This work benefited considerably from the linkage to the university. Even though some papers may have an academic tint, they provided a useful background for the policy work of ministries, particularly in harmonization of the Hungarian environmental regulations to those of the European Union. The Ministry of Environment highlighted in particular the Evaluation of Environmental Management Practices of Hungarian Companies as direct contribution to their policy work on accreditation scheme for certification companies.

There has been a very close contact and cooperation with the Ministry of Environment and Ministry of Economy due to the high appreciation of the Centre's expertise so that the Centre staff participated also in some working groups on selected policy issues.

HCPC was active in elaboration of some tools of preventive environmental management, in particular environmental reporting. In this context HCPC engaged in a pioneering step of bringing together representatives of industry, NGOs and local administration representatives to review and agree on a standard contents of a corporate environmental report.

HCPC also assisted Ministry and the Hungarian Central Environment Fund in setting up a separate Chapter for CP and the criteria system which is currently in use.

Also for the future the Ministry of Environment envisages cooperation with HCPC in preparation of the EU accession process, in adaptation and implementation of international laws, in elaboration of tools for EMS, in introducing EMAS, in elaboration of voluntary agreements especially in the context of global warming programmes, etc. Although there is a budget in the Ministry for such topics there is no bianco allocation of funds for HCPC as all applicants have to pass a bidding procedure. However, with the qualified staff and backing of the university the chances for continuous involvement of HCPC in policy work is good.

Assessment: As planned

4.1.8 Integration of CP in University curricula

This output was not foreseen in the original project document.

CP topics and related issues like Sustainable Development were included to the curricula at BUESPA and the other universities hosting Regional CP Centres. Annually, at BUESPA 60% of the enrolled students (360-400) plus some (150) part-time students receive basic education on preventive approaches, including 2-3 lectures on CP. Out of these, about 50 students receive more in-depth lectures on CP for 14 hours per year and about 10 graduates work during their thesis on CP topics.

At the technical universities hosting Regional Centres the numbers of students exposed to basic information on CP are lower (such as 100-150 at Gyor, approximately 100 in Veszprem, etc.) but these universities have more intense training in CP (30-40 hours) for selected training courses (approximately 15 students in Veszprem, approx 30 students in Gyor). In Gyor alone the annual number of thesis with CP topics ranges between 5 and 10.

The above can be considered as a very successful integration of CP in university education which, no doubt, is facilitated by universities hosting the centres. As the Director of Department at BUESPA (and Director of HCPC) put it, "without the UNIDO project I would not have taught what I teach now".

4.1.9 Strategic studies on national and international level

Similar like SCPC, HCPC did not implement CP projects abroad (like CCPC) but managed to get contract work for preparation of studies for some international organizations, including UNIDO. HCPC also managed to become implementing agency for some other foreign-funded projects in Hungary (such as the UNIDO project TEST). International contacts of HCPC were very extensive as evident from numerous international conferences organized or co-organized by HCPC (see 4.1.2).

4.2 Achievement of the Purpose

Project objective (purpose) as formulated in the prodoc reads as follows:

To build a national capacity in CIP in Hungary by transferring international and UNIDO/UNEP experience in CIP and adjusting it to the local context to enable a wide scale and sustainable application of cleaner industrial production for industry through establishment of a National Cleaner Production Centre.

As mentioned already in the Chapter on Project Design, the formulation is rather blurred. It tries to describe the whole project, amalgamating several levels of objectives. National Cleaner Production Centre was established but it is not the purpose of the project, it is one of its outputs. National capacity in CP was achieved. Similar like in the other two countries, "wide-scale and sustainable application..." was not achieved.

Thus the assessment depends on the choice of the objective. Considering the fact that "wide-scale and sustainable application of CP" was qualified in the analysis of project design of the other two projects as too ambitious it is fair to take "national capacity in CP" as the realistic purpose and conclude that this purpose was achieved.

4.3 Impact

Implementation of CP options identified during demonstration projects at company level and resulting environmental and financial benefits were not monitored by HCPC so that no estimation of impact of the project at company level can be made. However, HCPC was in a position to provide an overview of CP measures identified during the EKOPROFIT and Young Graduates projects, their status as regards implementation and break down by CP categories (see Annex 6.3). On the basis of that information the following table was compiled:

Table HUN-3: CP measures identified by HCPC

| Category | Identified | Implemented | % |
|------------------------------------|------------|-------------|---|
| Housekeeping | 6 | 4 | X |
| Input material change | 7 | 4 | |
| Better process control | 3 | 3 | |
| Recycling | 15 | 7 | |
| Equipment modification/replacement | 13 | 10 | |
| Change of technology | 1 | 1 | |
| Production of useful by-products | 2 | 1 | |
| Total: | 47 | 30 | |

Detailed review of the identified measures indicates that a few of them could be reclassified but in general the table provides a proper picture. Most of the CP options belonged to the recycling category and equipment modifications with surprisingly low share of housekeeping measures. More than half of

the CP measures were implemented or are under implementation, which is a frequent standard also in other NCPC projects.

The companies participating in HCPC projects were both large and small. The evaluation team visited three companies, two of them were very large and foreign owned. Generally it was difficult to find typical examples of CP with high environmental and financial impact in the visited companies. In the two large companies changes and improvements in environmental performance were significant but they resulted from numerous interventions (including advisory services from mother companies). It was apparent that HCPC provided advisory services on various environmental management issues not necessarily linked to CP alone (environmental reporting deserves to be highlighted in particular) but attribution of changes/impact to HCPC was difficult. In the smaller company (Herend Porcelain) the contribution of the HCPC support was much more visible and easier to identify. Though the impact in quantitative terms was not conspicuous, it represented a definite improvement and was, therefore, well recognized by the company.

The overview does not include CP options identified under the POEMS (TisoT) projects nor does it provide any information on indirect impact which might result from application of CP options induced by new university graduates or independent environmental consultants exposed to CP through the activities of HCPC or its regional centres.

5. SUSTAINABILITY

HCPC has good potential for sustainability. First, it has a team of competent CP trainers and consultants which results from the Director's policy "to have experts, not organizers". Second, hosting of HCPC by the university has a double advantage: through part-time employment of HCPC staff by the university the funding pressure on HCPC is to some extent relieved. (However, this advantage is partly lost due to some administrative hurdles, including financial ones.) Further, close links of HCPC with the university bring benefits in terms of access to and transfer of topical information and knowledge. Thus HCPC is well placed to be in a position to discharge public functions and be at the forefront in the field. In principle the Centre is interested primarily in new (innovative) projects which allow for learning. (Success indicator of the Director: "At least 40 new slides every year".)

In practical terms there are problems, though. The experiences of the last years showed that it was generally difficult to access companies. Main reason for reluctance was the opinion that they would not need help and could, with enough money, solve their problems themselves. However, there were also some deficits of the part of the Centre in involving the company employees in their projects. Thus a closer teamwork between HCPC staff/consultants and the companies' staff will present one of the practical challenges for the future.

In financial terms completion of the UNIDO project represents a distinct reduction of resources (among the three Centres, HCPC indicates the highest share of the UNIDO project in its total resources) which can only partly be offset by mobilizing other external resources (such as the TEST project). Therefore the budget for 2001 is reduced (with domestic income mainly from policy related studies for the public sector) but it guarantees enough resources for the core group and, thus, for the Centre's survival.

As discussed with the staff of the Centre, future activities will have to consider the following developments:

- EMS implementation will increase
- SME will continue to face problems in installing an EMS
- CP principles need to be introduced in environmental policy documents
- Hungary estimates the access to the EU in 2003-2004

Integration of CP into EMS will therefore become one of the main activities for the next years. Hereby a better inclusion of the company staff and its management in the formulation of the project is recommended.

To access SMEs an information network and some financial support for SMEs on their way to certification will be required. The information should be disseminated to the companies by regional or local authorities.

Increasing time to policy advise and policy studies may be required as during the EU accession process a lot of work to adapt regulations and to investigate the potential in branches will be needed. For that close contacts to respective institutions in the EU member states should be used to remain in the leading position. A neutral position between public bodies and industry backed up by technical and methodological expertise from national and international work is the best guarantee for continuous recognition and sustainability.

6. ANNEX

6.1 Persons met and interviewed

Monday 28 May 2001

Staff of the HCPC

Prof. Sándor Kerekes, Director
 Gyula Zilahy, Managing Director
 Mária Csutora
 Miklós Galli
 Szilárd Podruzsik
 Beáta Borsos
 Krisztina Bársonyi

Tuesday 29 May 2001

Herend Porcelanium

Mrs. Edit Mizsei-Tóth, Environmental representative

Veszprém University, Regional Centre of CP

Dr. László Tamaska, Director
 Réka Vörös, Assistant

Wednesday 30 May 2001

DUNAFERR Share Holding DUNAÚJVÁROS

Dr. Péter Sándor, Deputy executive director for development
 Dr. László Hári, Chief environmental expert

DWA Ltd.

György Nagy, Technology director
 István Pózer, Head of development and investment
 Ferenc Wolf, Head of manufacturing
 Dr. Miklós Kováts, Environmental director

KÖVET-INEM

Gergely Tóth, Director

Thursday 31 May 2001

Budapest Power Plant

Ms. Katalin Urbán, Environmental representative

Consact Ltd.

Mr. Szilárd Csorba, Consultant

Ministry for the Environment

Ms. Beatrix Kiss, Head of division, Waste-management and environmental technology
 Ms. Jánosné Oroszlány, Senior Counsellor, Waste-management and environmental technology
 Ms. Alojzia Horváth Lakosné, Head of department of International Relations
 Dr. István Pomázi, Senior advisor department of strategic planning and cooperation

Friday 1 June 2001

DUNAPACK

Dr. Zoltán Szikla, Deputy Director General
Dr. István Debreczeny, Director of Communication

6.2 Visits in Companies

6.2.1 Herend Porcelaine Manufacture

Herend Porcelaine Manufacture (exporter of high quality chinaware, approximately 1500 employees) was certified against ISO 14000 (primarily due to customers' requirements) three years ago (prior to contacts with HCPC). Upon initiative of a student from the Technical University Veszprem (who was backed by the Regional CP Centre) the company got involved in the Young Graduate programme and shortly thereafter also in the EKOPROFIT programme. (It was rather exceptional that a company participated in two programmes concurrently.) Annually, within EMS, the company reviews technical possibilities to further improve operations from environmental point of view. It was in this context that the initiative of the student and Regional CP Centre found support of the top management.

The young graduate stayed with the company for 6 months, paid a token salary to get insurance coverage, and supported financially by HCPC. There was no fixed team established but the graduate was in working contacts with approximately 6 staff, primarily with the Environment Specialist of the company and the technical director. The clear target was a survey of the situation and identification of options for improving the situation. As the technology could not be changed as it is traditional and typical for the product, there was hardly any possibility of changing the process. He, therefore, carried out material flow analysis focused on water management, as treated water is an expensive resource in that industrial branch.

In consultation with company staff the graduate identified and formulated 3 CP measures. The most important was recycling of used water of low quality for cleaning processes, which is now under implementation. The measure requires 2.5 million HUF in investment and saves 13 m³ of treated water per day and 0.7 mil HUF operating costs annually.

The second identified option, the heat recovery out of the waste gas poses organisational obstacles and was not seen as economically viable at that time. The third option concerned the utilisation of used gypsum (reduction of consumption through better monitoring by individual employees) but it was opposed by the employees as more hand work was needed.

The company appreciated the role of the young graduate. His main advantage – apart from technical qualifications – was seen in absence of operational blindness usually developed by insiders. There was some in-house resistance to be overcome but thanks to the support of top management and advice by HCPC at monthly meetings of all young graduates the work could be concluded with tangible results.

After completion of this Young Graduates programme the company continued in the EKOPROFIT programme which is experienced by them more as a training programme, with workshops organized at the Veszprem Regional Centre. The reason for continuation was expected better focus on water and energy management as well as expensive raw materials to save costs. At the same time EKOPROFIT demonstrated the process of continuous improvement within EMS.

6.2.2 DUNAFERR Rt, Dunaujvaros

DUNAFERR Rt is a large metallurgical estate (established in 1956), after 1990 broken down in several autonomous companies, some of them having created a joint venture with Voest.

The companies themselves have undertaken several structural and investment measures to reduce air and water pollution. Some of them started introducing EMS, certification against ISO 14000 is expected in November 2001.

HCPC carried out EKOPROFIT project with 6 companies of the group. Six workshops were organized with lecturers delivered by HCPC staff and external consultants. The project supported and strengthened the on-going environmental efforts of the group. Management of the group highlighted the following contribution of HCPC to their own activities:

- increased awareness of the CP concept among participants of the workshop
- new information about approaches in EU
- clarification of the concept of environmental reporting followed by a decision to do it
- advice on environmental accounting
- confirmation of "what they knew and wanted to do"
- speeding up on-going processes.

Thus cooperation of HCPC with DUNAFERR within the EKOPROFIT project went beyond CP objectives and dealt with corporate policy issues important for the companies, particularly with issues related to accession to EU. For HCPC this cooperation was a challenge, a test of HCPC competence to provide advice to a large company, and at the same time a reference for promotion of HCPC.

6.2.3 DUNAPACK Ltd.

DUNAPACK is a large foreign-owned company producing packaging materials (corrugated base paper, natron paper, corrugated cardboard, corrugated boxes, corrugated rolls, paper bags and sacks, etc.) primarily from waste paper. The company consists of three large manufacturing plants ("divisions"), a separate affiliated company for collection of waste paper, some affiliates abroad and shares in a few other companies. The company processes 85% of all waste paper collected in Hungary. All divisions of the company were certified against ISO 9000, two divisions were certified against ISO 14000, the others are preparing for certification. There exists explicitly stated environmental policy of the company, management strongly supports measures aiming at environmental improvements. Results achieved in terms of reduction of water and energy consumption, waste water (and labor productivity) are remarkable. Technical advice was received from experts from the mother (Austrian) company, from consultants linked to that company or from Budapest-based affiliates of some foreign consulting companies but DUNAPACK themselves have a core of highly qualified technicians and engineers including one director with 8 years experience from Finland. Under such circumstances HCPC can not offer any technical advice that would add value to what the company possesses. Yet, HCPC cooperation with DUNAPACK was appreciated by the management for the following roles they played:

- clarification of the concept of a corporate environmental report; participation at a seminar with potential stakeholders (NGOs, local government);
- assistance in preparation of the DUNAPACK environmental report with complex but reader-friendly diagrams and figures: due to its professional level the report can be referred to as a model and serve training purposes;
- organizing a platform for policy discussion on packaging regulations;
- short-term ad hoc consultancies on ISO 14000.

On the other hand, participation of DUNAPACK at events organized by HCPC increases visibility of HCPC in the country.

6.3 Table HUN-4 : Categories of selected Cleaner Production measures of the Hungarian Cleaner Production Centre

1. Good housekeeping

| Project | Company | Description | Note |
|----------------------------------|---|---|----------------------|
| ECOPROFIT | Balaton Volán Inc. Public transportation | Daily examination of the vehicles reduces the risk of soil and groundwater contamination. | Continuous |
| ECOPROFIT | Kisalföld Volán Inc. Public transportation | Using energy saving light bulbs. | Continuous |
| CP assessment Young Graduates | - FCI Connectors Hungary Ltd. Electronic industry | Action plans for decreasing the quantity of faulty products by inspection and adjustment. | Under implementation |
| CP assessment Young Graduates | - Falco Forgácsológépgyártó Inc.. Furniture manufacturing | Checking the water-meters. Difference between the main water-meter and the sub water-meters. The factory can save approx. 50.000 m ³ /year water. | Under implementation |
| CP assessment Young Graduates | - Farbax Számítástechnikai és Kereskedelmi Ltd. Print cartridge recycling | Using specially designed plastic bottles could reduce evaporation of chemicals (mostly alcohol). | Suggested |
| CP assessment Young Graduates | - Farbax Számítástechnikai és Kereskedelmi Ltd. Print cartridge recycling | Reduction of energy loss by examining joints and sealing of the compressor system. | Suggested |

2. Input material change

| Project | Company | Description | Note |
|------------------------------------|---|---|-------------|
| ECOPROFIT | DUNAFERR INC. Iron producing industry | Using carbo-hydrogenates instead of coal for heating. SO ₂ emission reduction to one third of previous emissions. | Implemented |
| ECOPROFIT | Balaton Volán Inc. Public transportation | Utilisation of rain water for vehicle cleaning. | Implemented |
| ECOPROFIT | Dunaferr Lemezalakító Ltd. | Using reused paper instead of plastic as protecting packaging material. 20 Million HUF/year savings plus increased customers satisfaction. | Implemented |
| ECOPROFIT | Salgótarjáni Üvegyapot Inc. Glass fiber manufacturing | Using anhydrous borax instead of borax with cristal water to reduce the dust emission, but the investment costs are higher than the rate of dust emission reduction. | Planned |
| ECOPROFIT | Városgazdálkodási és Üzemeltetési Ltd. Waste management and services | Purchasing better lubricants, this way extending the time periods of oil-changes, resulting in less used oil. | Implemented |
| CP assessment - Young Graduates | Dreher Sörgyarak Rt- Food manufacturing | Using paper neck-label instead of aluminium neck-foil. | Suggested |
| CP assessment - Young Graduates | Bakony Művek Autóalkatrészgyártó Rt. Car-parts manufacturing | <i>Discharge of the trichlorethylene degreasing agent with new agent. energy saving (1.14 M HUF in 2000) better working conditions Good oil and fat absorb capacity, it can be applied on low concentration</i> | |

3. Better process control

| Project | Company | Description | Note |
|------------------------------------|---|--|-------------|
| CP assessment - Young Graduates | CHIO-Wolf Hungary LTD. Potato chips manufacturer | Purchase of process control equipment, which makes the production controllable. The input and output data can easily be controlled this way. | Implemented |
| ECOPROFIT | Kisalföld Volán Inc. Public transportation | Using dusk-switch to reduce the time of lighting. 3,2% reduction of electricity consumption. | Implemented |
| ECOPROFIT | Kisalföld Volán Inc. Public transportation | Using digital adjusting system to set the required temperature in the heated areas, 31.2% reduction of natural gas consumption achieved. | Implemented |

4. On-site recovery and reuse of waste (recycling)

| Project | Company | Description | Note |
|----------------------------------|--|---|----------------------|
| CP assessment Young Graduates | - CHIO-Wolf Hungary LTD. Potato chips manufacturer | Water reuse (approx. 50%): used water is cleaned on site and lead back to the technology. | Implemented |
| CP assessment Young Graduates | - CHIO-Wolf Hungary LTD. Potato chips manufacturer | Vapour heat utilisation: reducing the environment's heat burden and money savings. | Planned |
| ECOPROFIT | DUNAFERR INC. Iron producing industry | Benzol recovery and reuse at the coking plant; more than the 90% of the benzol vapour can be reused this way. | Implemented |
| ECOPROFIT | DUNAFERR INC. Iron producing industry | Reduction of hazardous waste | Implemented |
| ECOPROFIT | Balaton Volán Inc. Public transportation | Cleaning and reuse of vehicle washing water. 85% of the water is reused. | Implemented |
| ECOPROFIT | Kisalföld Volán Inc. Public transportation | Cleaning and reuse of vehicle washing water. 65% of water use reduction. | Implemented |
| ECOPROFIT | Kékkúti Ásványvíz Inc. | Utilisation of excess cleaned process water as communal water. At the moment the cleaned water is used for irrigation only during four months of the year. | Planned |
| ECOPROFIT | AUDI Hungaria Motor Ltd. | Using reusable oil-wiping textiles. 6850 Euro/year savings. | |
| ECOPROFIT | Dorogi Hulladékégető LTD: | Separated collection of rain water, which this way does not have to be cleaned. 3500 m ³ /year water can be saved this way (about 875 000 HUF saving/year) | Under implementation |
| CP assessment Young Graduates | - Dreher Sörgyárok Rt. Food manufacturing | Implementing a vapour energy recovery system in the brewing house. 34800 GJ energy could be stored in the system, 54% of which is used for beer pre-heating. | Implemented |
| CP assessment Young Graduates | - Dreher Sörgyárok Rt. Food manufacturing | The condensed water (8064 m ³ /year) is reused as pre-washing water. | |
| CP assessment Young Graduates | - Dreher Sörgyárok Rt. Food manufacturing | Lime mud is used for painting. (40,000 kg/year) | |
| CP assessment Young Graduates | - Herendi Porcelán Manufaktúra Inc. | Water reuse, 18 m ³ /day. | Planned |
| CP assessment Young Graduates | - Herendi Porcelán Manufaktúra Inc. | Waste heat utilisation (3114 GJ/year/ furnace) | Option examined |
| CP assessment Young Graduates | - Farbox Számítástechnikai és Kereskedelmi Kft. Print cartridge recycling | The ink-tainted cleaning solution could be recycled into production. (300-350 l/month) | |

5. Equipment/hardware modification/replacement

| Project | Company | Description | Note |
|----------------------------------|--|---|----------------------|
| CP assessment Young Graduates | - CHIO-Wolf Hungary LTD. Potato chips manufacturer | Replacement of the fryer: The amount of specific oily waste generated during the cleaning of oil is reduced significantly by the new fryer. The stack is placed at the end of the fryer and on the side of. The vapour is pulled through an oil-separator by a ventilator, this way removing 99% of the oil content of the vapour. | Implemented |
| CP assessment Young Graduates | - CHIO-Wolf Hungary LTD. Potato chips manufacturer | Purchase of substandard chips selecting equipment: it double checks the substandard chips this way reducing the amount of waste chips. | Implemented |
| ECOPROFIT | DUNAFERR INC. Iron producing industry | Furnace reconstruction to reduce dust and CO emission. | |
| ECOPROFIT | Balaton Volán Inc. Public transportation | Replacement of conventional vehicle engines with D10- converted engines and purchasing buses with this type. Reduction of emissions: CO - to 10%, HC - to 20%, NOx - to 80% of a new conventional motor's emission. | Implemented |
| ECOPROFIT | Balaton Volán Inc. Public transportation | Reconstruction of the heating system: reduction in use from 290988 m ³ to 205367 m ³ from 1996 to 2000. | |
| ECOPROFIT | Kisalföld Volán Inc. Public transportation | Replacement of conventional engines with environment friendly engines and purchasing buses with this type. | Implemented |
| ECOPROFIT | Dunaferr Lemezalakító Ltd. | Replacing the valve compressor with screw compressor, the oil content of the yearly 250 m ³ compressor condense water is reduced so that it can be treated in a sewage plant. | Implemented |
| CP assessment Young Graduates | - Bakony Művek Autóalkatrészgyártó Rt. Car-parts manufacturing | <i>Desiccation of paint-sludge: The 70-75% water content sludge can be desiccate to 60-65 % dry material content. (8300 kg/year sewage water) Rental centrifuging would be economical too.</i> | Under implementation |
| CP assessment Young Graduates | - Budapesti Vegyiművek Rt. Chemical industry | Renovation of the condense water collecting system: The quantity of recycled water (25 %) would be increased by about 40-70%. | Under implementation |

5. Equipment/hardware modification/replacement – Continued

| Project | Company | Description | Note |
|------------------------------------|---|--|-----------------------|
| CP assessment - Young Graduates | Budapesti Vegyiművek Rt. Chemical industry | <i>The isolation of steam network system: The steam-pipe is mostly insulated, so the payback time would be less, than one year. The heat loss can be reduced.</i> | Partially implemented |
| ECOPROFIT | Városgazdálkodási és Üzemeltetési LTD. Waste management and town services | Installation of through-flow meter into the vehicles. Reduction of fuel consumption by 13%, the engines' defects can be easily and quickly detected. 85% of the vehicles are equipped with through-flow meter. | Implemented |
| ECOPROFIT | Városgazdálkodási és Üzemeltetési LTD. Waste management and town services | Purchasing new, more efficient vehicles with less environmental burden. | Implemented |
| CP assessment - Young Graduates | FCI Connectors Hungary Ltd. Electronic industry | Reduction of noise by covering the machines. 83-85 dB was reduced to 66-70dB at the workplace. | |

6. Change of process technology

| Project | Company | Description | Note |
|-----------|--|--|-------------|
| ECOPROFIT | DUNAFERR INC. Iron producing industry | Building of a smelter torch: CO emission reduction by 4000 t/year. | Implemented |

7. Production of useful by-products

| Project | Company | Description | Note |
|------------------------------------|---|--|-------------------|
| CP assessment - Young Graduates | Dreher Sörgyárak Rt. Food manufacturing | The lime hydrate recycling to soil amelioration. | Implemented |
| CP assessment - Young Graduates | Budapesti Vegyiművek Rt. Chemical industry | Purification and marketing of hydrochloric acid: If the HCl would be purified and sold not only the quantity of calcium carbamide could be reduced but significant could be encountered too. The factory would like to build a HCl-purification-system. (32,402,900 kg 30% HCl solution/year) | To be implemented |

**8. Product modification
no projects**