GEF

Global Environment Facility

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August 10, 2001

Dear Council Member:

I am writing to notify you that we have today posted in the GEF's website at www.gefweb.org, a medium-sized project proposal from UNEP entitled *Global (China, India, Vietnam, Czech Republic, Slovak Republic, Hungary): Promoting Industrial Energy Efficiency through a Cleaner Production/Environmental Management System Framework.* The GEF will contribute $950,000 towards a total cost of $2,715,000.

The project objective is to reduce the emission of carbon dioxide by improving energy management practices and identifying investments in SMEs through a structured approach. Specifically, the project will:

- Identify and implement Energy Efficiency improvements as an integral part of CP-EMS audits
- Integrate energy efficiency concepts into CP-EMS approaches
- Train and develop CP-EMS professionals in conducting energy audits

The project proposal is being posted for your information. We would welcome any comments you may wish to provide by August 31, 2001, in accordance with the procedures approved by the Council.

If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to download the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please confirm for us your current mailing address.

Sincerely,

Mohamed T. El-Ashry
Chief Executive Officer and Chairman

cc: Alternates, Implementing Agencies, STAP

Medium-Sized Project Brief
Global Environment Facility

United Nations Environment Programme

PROJECT SUMMARY

Project Identifiers	
1. Project name: Promoting Industrial Energy Efficiency through a Cleaner Production / Environmental Management System Framework	**2. GEF Implementing Agency:** UNEP
3. Countries in which the project is being implemented: China, India, and Vietnam in Asia; the Czech Republic, Hungary, and Slovak Republic in Central Europe	**4. Country eligibility:** China - 5 January 1993 Czech Republic - 7 October 1993 Hungary - 24 February 1994 India - 1 November 1993 Slovak Republic - 25 August 1994 Vietnam - 11 November 1994
5. GEF Focal Area: Climate Change	**6. Operational Programme:** Removal of Barriers to Energy Efficiency (OP5)

7. Project linkage to national priorities, action plans and programmes:

By ratifying the UNFCCC, countries agree to promote the application of technologies, practices, and process that reduce or prevent emissions of greenhouse gases. Improving end use energy efficiency in industries is one way to meet this obligation while simultaneously reducing local and regional air pollutants.

The six project countries have all emphasized the need to improve industrial energy efficiency in their national environmental policies and programmes. The Czech Republic addresses the need to improve energy efficiency in Governmental Decree 252 (1991) and mentions the importance of energy conservation explicitly in its State Environmental Policy. Slovakia revised its national energy policy in 1999; the policy recommends 'optimization of State support to rationalization of energy use and minimization of energy consumption'. India has since the mid-1970s emphasized the need to improve industrial energy efficiency and has a number of government programmes that support investments. China has established a National Energy Conservation Information Centre and is investigating how enterprise interest in environmental management system certification (particularly ISO14001) can be linked to energy conservation. Hungary and Vietnam similarly have made energy efficiency in industry a national priority.

All six countries also have existing National Cleaner Production Centres, each established with government support and operating under a UNEP/UNIDO framework. That in China is attached to the State Environmental Protection Agency (SEPA), while India's centre is supported institutionally by the National Productivity Council, a semi-autonomous body affiliated with the Ministry of Industry that is well known for its expertise in energy management. The Vietnamese Cleaner Production Centre is supported by both the Ministry of Planning and Investment and the Ministry of Science, Technology and Environment, while the Deputy Minister of Industry and Environment sits on the Czech Centre's Steering Committee to ensure coordination with Government policies and programmes. In Slovakia, the Cleaner Production Centre is constituted as an NGO but the Deputy Minister for Environment and officials from the Ministry of Economics sit on its Steering Committee. Finally, the Hungarian Cleaner Production Centre has departmental status within the Department of Environmental Economics and Technology in Faculty of Business Administration, Budapest University of Economic Science and Public Administration, which is a government institution.

The project responds to specific information needs of industry identified by NCPC directors in their work, particularly needs of Small and Medium Enterprises. The proposed approach harnesses the private sector's demonstrated motivation to make investments that yield a financial return and its current interest in the ISO 14001 Environmental Management System. It will use these to promote in industry an EMS approach that includes best energy management practices and investments that reduce GHG emissions.

8. GEF national operational focal point and date of country endorsement:
China; Li Guanghui; World Bank Department; Ministry of Finance – 30 May 2000
Czech Republic; Libuse Deylova; Ministry of Environment – 29 July 2000
Hungary; Tibor Farago; Ministry for Environment & Regional Policy – 30 May 2000
India; D.N. Raju.; Ministry of Finance, Department of Economic Affairs – 31 August 2000
Slovak Republic; Ivan Mojik; Department of Air Protection; Ministry of the Environment – 2 June 2000
Vietnam; Nguyen Dac Hy; Vietnam National Environment Agency – 17 July 2000

Project Objectives and Activities

9. Project rationale and objective: The project objective is to reduce the emission of carbon dioxide[1] by improving energy management practices and identifying investments in SMEs through a structured approach. The approach will be built on and consistent with the Environmental Management System framework embodied in UNEP's Cleaner Production programme. Project services are to be delivered through selected National Cleaner Production Centres, drawing on their extensive networks in industry and experience in promoting environmental management with a preventive, cost-effective focus. The project will fund activities needed to bring energy management into the package of CP/EMS advisory services currently being offered by NCPCs. Once this is done NCPCs will be able to provide, on a recurring basis, comprehensive environmental management services to industry that include energy efficiency and energy management components. The extensive networks and professional reputations of the NCPCs will allow them to reach industrial clients that will be difficult to reach through other mechanisms.	**Indicators:** - GHG emission reductions enabled and verified through post-implementation auditing (target: at least 225,000 tons)
10. Project outcomes: a) Energy audits conducted by participating National Cleaner Production Centres (six Centres times an average of 15 audits each). b) For each audit, at least one investment proposal for equipment with improved energy efficiency. c) National versions of an Energy Audit manual prepared from an EMS/Cleaner Production perspective available to NCPCs and similar institutions. The core manual, already being produced in English as a joint UNEP/UNIDO activity, will be adapted/translated for use in the six project countries as part of the project. d) Trained personnel in the six NCPCs capable of conducting energy audits as an integral part of a Cleaner Production - EMS audit. e) Personnel in the global network of NCPCs and other in – country stakeholders (e.g., Energy Manager Associations and Business Councils) aware of opportunities that EMS can provide if integrated into the NCPC business advisory practices and aware of methods for doing so. Proposed MSP goals and activities are closely related to the	**Indicators:** a) Number of audits conducted by participating NCPCs (target: 90 audits). b) Number of proposals prepared and submitted to financing institutions (target: 90 proposals). c) Energy Audit Manual available in English and adapted to six national conditions/languages. d) Number of professionals in the NCPCs capable of managing/conducting energy efficiency audits in industry as part of a Cleaner Production/EMS programme (target: 18 persons). e) Number of professionals in the global network of NCPCs and other in-country stakeholders (e.g., Energy Manager Associations and Business Councils) aware of methods for providing EMS (target: global network of NCPCs) f) Published articles on EMS methods that NCPCs can adopt in UNEP Industry bulletins and other information dissemination channels.

[1] Refer to Annex 2 for a calculation of the estimate.

objectives and the emerging UNEP-GEF clean technology transfer network. The MSP will help to pilot innovative tools and services to promote energy efficiency enhancements in selected countries. Provided that their effectiveness can be proven during MSP implementation these instruments will gradually integrated into the UNEP-GEF network, which will aim to disseminate them to wider stakeholder audiences on a sustained basis.	
11. Planned activities to achieve outcomes: a) At the start of the project, consultations will be held within each country between the NCPCs and on-going related projects to ensure that duplication does not occur[1]. b) Each of six NCPCs will conduct energy audits in 15 different industrial enterprises and prepare investment proposals for bankable energy efficiency investments (US$ 2.06 million total; GEF portion US$ 450,000). Supporting this activity: c) UNEP/UNIDO will prepare an Energy Audit Manual that can be used either as stand alone manual or integrated with existing CP-EMS audit materials, such as those developed for ISO 14,000 (US$ 50,000 total; GEF portion US$ 0). d) NCPCs will adapt the manual to local conditions in each of the six countries, including translation into national language and adaptation to local circumstances (US$ 80,000; GEF portion US$ 60,000). e) UNEP will organize and conduct a training workshop for professionals from the six NCPCs on conducting energy audits as an integral part of the Cleaner Production-EMS approach they are now promoting (US$ 145,000; GEF portion US$ 120,000). e) UNEP will organize workshops for NCPCs in each of four regions (Latin America and the Caribbean, Africa, Asia and Pacific, and Eastern Europe) and include other in-country stakeholders such as Energy Manager Associations and Business Councils to more widely disseminate the lessons learned by NCPCs carrying out energy audits. This will help replicate the use of such services throughout the global network of NCPCs and NCPC-like institutions (US$ 260,000; GEF portion	**Indicators:** a) National reports on the outcome of consultations at national level in each country outlining the precise niche of this medium sized project with clear delineation of the lessons that can be learned from related projects that will be of use to NCPCs. b) Total of 90 energy audits planned and conducted as per project schedule in suitable enterprises in such a way that it does not duplicate the existing work of energy auditing programs. c) Energy audit manual prepared and available for use in audits. d) Manual translated and adapted for use in national circumstances, available in six national versions. e) Training materials prepared and training workshops organized and conducted with suitably selected participants; minimum of 18 trained staff from NCPCs; f) Workshops held for NCPCs in other countries and other stakeholders such as Energy Manager Associations and Business Councils in each of four regions (Latin America and the Caribbean, Africa, Asia and Pacific, and Eastern Europe) on dissemination of methods and lessons learned by NCPCs in providing EMS. g) Articles published on methods that NCPCs can adopt for carrying out EMS including in UNEP's Industry bulletin.

[1] In China, there is the China End Use Energy Efficiency Program Framework (EUEEP) funded by GEF via UNDP, Energy Foundations' project on EE, Dutch funded Energy Efficiency and Conservation initiative. In Vietnam, there are the World Bank's DSM project and the UNDP's SME project. The issue of frequent changes in production processes (for SMEs) and the small scale of EC and EE projects are among the barriers that will be addressed in the UNDP-GEF PECSME Project. The PECSME project will address this by carrying out capacity building in promoting ESCOs to SMEs and enhancing the application of energy management tools like energy auditing. The UNEP EMPRESS PDFB proposes audits in industry. In addition to GEF projects, there are several Hungarian federal programs that support industrial auditing. Hungary, Czech Republic, and China -- have an active ESCO sector. In the case of China, a World Bank GEF project is supporting the work of regional ESCOs to conduct audits and prepare investment proposals in industry. In Hungary and the Czech Republic, multiple private ESCOs currently work on industrial audits and efficiency projects.

US$240,000).	
12. Estimated budget:	
GEF:	US$ 950,000
Co-financing (UNEP, direct and in-kind):	US$ 175,000
Co-financing (NCPCs and companies; in-kind)	US$ 1,590,000
Project Total:	**US$ 2,715,000**
Associated Baseline Financing (allocations to UNEP's Cleaner Production activities)	US$4,500,000

13. Information on project proposers:

This proposal has been prepared by UNEP-DTIE in association with:

China National Cleaner Production Centre, Beijing; Duan Ning, Director
Czech Cleaner Production Centre, Prague; Anna Christianova , Director
National Cleaner production Centre of Hungary, Budapest; Sandor Kerekes, Director
Indian National Cleaner Production Centre, New Delhi; P.K. Gupta, Director
Slovak Cleaner Production Centre, Bratislava; Viera Feckova, Director
Vietnam Cleaner Production Centre, Hanoi; Tran Van Nhan, Director

UNEP's Division of Technology, Industry and Economics (DTIE) directs UNEP's efforts to integrate environmental considerations into private sector activities. DTIE brings together industry, non-governmental organizations, and governments to promote environmentally sound industrial development and management of existing enterprises. The Division's goals include: defining and encouraging the adoption of environmental criteria in industrial operations through training programmes and provision of information on a broad range of industrial environmental issues.

The National Cleaner Production Centres have been established under a joint UNEP/UNIDO programme. Seventeen Centres are currently operating worldwide, of which the Centres in Asia and Central Europe will participate in the project.

14. Information on proposed executing agency (if different from above):

UNEP will execute the project with the six NCPCs.

15. Date of initial submission of project concept

16. Project Identification Number:

17. Implementing Agency contact person: Mark Radka, Energy Programme Coordinator, UNEP

18. Project linkage to Implementing Agency programmes: UNEP's Cleaner Production programme catalyzes the implementation of policies and strategies that support a preventive environmental management approach, including the utilization of energy. The proposed intervention complements UNEP's Cleaner Production Programme and builds on the organization's strong industry base, particularly its ability to reach a diverse range of small and medium enterprises through the NCPC network. The project also complements and will benefit from existing projects concerning the financing of cleaner production investments (funded by the Government of Norway), and the provision to financial institutions of advisory services regarding climate friendly investments (funded by the GEF). For Hungary, the Czech Republic, and Slovakia, there exists the possibility that energy efficiency investments identified in the project can be funded by Monitoring & Targeting ESCOs likely to be established as a result of GEF support in Central and Eastern Europe. Some of the outputs can be used immediately by other centres; the results and experiences gained will be shared with all the centres participating in the NCPC Network

The project complements well other GEF efforts in the six countries, including *Energy Conservation and Pollution Control in Township and Village Enterprise Industries* (China); *Energy Efficiency Co-Financing Programme* (Hungary); *Efficient Industrial Boilers* (China); *China Energy Conservation Project* (China); *Efficient Lighting Initiative* (Czech Republic, Hungary); and *Energy Efficiency* (India). All of these efforts would benefit from improved understanding and commitment to energy efficiency efforts on the part of SME entrepreneurs and managers and an expanded pipeline of good investment projects.

PROJECT DESCRIPTION

Project rationale and objectives:

The objective of this project is to reduce emission of greenhouse gases by identifying and implementing Energy Efficiency (EE) improvements as an integral part of Cleaner Production - Environmental Management System (CP-EMS) audits in industrial enterprises six countries. The project will integrate energy efficiency concepts into CP-EMS approaches, and train/develop CP-EMS professionals working in the existing UNEP/UNIDO network of National Cleaner Production Centres (NCPCs). This will allow the Centres to include, on an ongoing basis, energy efficiency activities as a comprehensive part of their core programmes, which are primarily aimed at small and medium enterprises (SMEs).

Energy consumption in the industrial and commercial sectors accounts for a large percentage of greenhouse gas emissions in CEITs in the more industrialized developing countries. Poor energy efficiency is of concern to governments, and many have undertaken programmes to improve end use efficiency in industry, often focused on small and medium enterprises (SMEs), where the advantages of improving energy efficiency are often not appreciated and gains are large.[1] Stand-alone EE improvement programmes, however, have often not been sustainable for a number of reasons, including:

- lack of a structured methodology that would overcome interrelated and cross-cutting energy and environment areas simultaneously;
- lack of professionals having the multiple skills needed to integrate energy management with other issues of management concern;
- declining financial attractiveness due to low energy prices; and
- lack of interest in enterprises due to the small contribution of energy to total manufacturing cost in many industrial sectors.

Environmental management systems (EMS) approaches, exemplified by ISO 14001, have during the past decade become a strong force for systematic environmental improvement in industry, including enterprises in developing countries.[2] Forces driving the voluntary adoption of EMS include competitive advantages in domestic and export markets, reduced costs, easier compliance with government regulations, and reduced pollutant and waste emissions. Companies interested in ISO 14001 see it as an investment, and often hire specialist firms to guide them through the certification process.

UNEP has since 1987 promoted the concept of Cleaner Production as an overarching rationale for reducing the environmental effects that come from the production of goods and services, and recommends EMS as one management tool to help achieve this end. As part of its Cleaner Production programme UNEP, with UNIDO, has established a network of 17[3] National Cleaner Production Centers in developing countries and CEITs, and supports their efforts to promote CP approaches nationally. The Centres, each of which has been established with government support, provide information and training on CP, conduct

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[1] For example, China's industrial energy consumption is on average 40 percent higher than in other countries on a unit output basis. A recent study of 10 of India's industrial sectors funded by the Asian Development Bank and Industrial Development Bank of India revealed an investment potential of over US$1 billion in industrial energy efficiency projects having a payback period of four years or less.

[2] Annex 4 shows global ISO 14001/EMAS certifications as of January 1999.

[3] Current plans call for the establishment of 20 centres by the end of 2000.

assessments and audits with industry partners, and work with governments on policy reforms that reinforce CP approaches.

Given industry interest in Environmental Management Systems, the Centres have found it advantageous to present Cleaner Production approaches in an EMS context. The two are not incompatible: EMS provides the framework for an ongoing, *systematic* approach to environmental management and a label that has value to an enterprise, while CP provides a guarantee that environmental benefits realized in an EMS programme are real and measurable. NCPC Directors in effect exploit the interest in EMS to sell CP approaches to industry.

Although energy management is not explicitly mentioned in various EMS statutes, including it in the EMS cycle (as proposed in this project) is fairly straightforward and yields additional benefits from the GEF perspective. Marrying energy efficiency concepts with the already accepted and demanded programmes for CP-EMS will help persuade enterprises to identify and implement EE measures on a sustained basis. The integration will improve the energy and environmental performance of industry, reduce GHG emissions and waste generation, and establish a structured system that ensures continuity and sustainability. The comprehensive, integrated approach will improve the competitiveness of SMEs by improving their resource utilization, thereby reducing manufacturing costs.

Conducting the project within the established network of NCPCs will lead to faster adaptation and replication by other enterprises because of the many outreach and information dissemination activities they already have underway. The NCPCs participating in the project are among the oldest in the Network and have both strong relationships with industrial enterprises in their countries and among the best staff capabilities in CP-EMS. The Centres are in many ways already 'mentoring' newer Centres and the project will allow them to do so for energy management issues as well. Although the project involves only six of the NCPCs, UNEP and UNIDO will extend the approach to the other NCPCs and NCPC-like institutions operating in the larger CP Network. The potential for replication is large.

The project proposed here will also help strengthen the acceptance of Cleaner Production-EMS principles by industry. A typical SME undergoing a cleaner production audit identifies a number of energy efficiency measures that can be implemented at low or no cost; these tend to serve as 'starter' investments, generating enthusiasm for greater attention and commitment to a full programme of EE-CP-EMS activities, with benefits to other areas of GEF concern. A 1995 study of 67 Norwegian companies[1], for example, determined that including energy elements explicitly in cleaner production audits more than doubled the average investment (to 530,000 ECU) while reducing the average payback time of all implemented measures by almost 25 percent. Including energy issues in the audits and analysis made the overall effort more attractive to industry.

The successful approach anticipated could form the basis for a larger strategic partnership between the private sector, NCPCs (or NCPC-like institutions) as executing partners, and UNEP as a GEF Implementing Agency. The Knowledge-Management Clearinghouse included as a part of the UNEP/GEF Strategic Partnership provides an additional mechanism for sharing the approach with CP/EMS intermediaries and individual enterprises.

The ultimate objective of the project is to help demonstrate an approach to energy management in industrial settings that is more wholly incorporated in environmental management approaches attractive to

[1] *Energy Conservation in Cleaner Production Assessments – Norwegian experiences from emphasis on energy conservation carrying out cleaner production assessments*, Institute for Energy Technology; November 1995.

managers and is hence sustainable. The project will practically demonstrate the financial attractiveness of including energy issues in EMS programmes (thereby spurring demand for comprehensive, integrative approaches) and develop the capabilities of CP/EMS professionals to provide these services. Practiced on a wide scale, this would help transform the existing market for EMS services.

Current situation:

SMEs are an important industrial segment in all developing countries, both in terms of their contribution to the national economy and in their share of industrial energy consumption. Most SMEs in the project participating countries (China, India, Vietnam, Hungary, the Czech Republic, and the Slovak Republic) use outdated manufacturing technologies that are poor energy performers. Lancashire boilers for steam generation, winches and jiggers in textile processing, box type forging furnaces, and down draft kilns in the ceramic industry are just a few such examples. Consequently SMEs in the project countries tend to use far more energy per unit output than do their western counterparts.

Lack of information and skilled personnel are too often barriers for the uptake of energy efficiency measures. The SME entrepreneur, already saddled with the problem of too many functional pressures and too little time, finds it difficult to cope with the demands of different government agencies regarding energy, environment, safety, workers' health, and similar non-production issues. The result too often is an aversion to change unless forced by regulation or some other external pressure.

Prevailing approaches to improving energy efficiency have mostly been task oriented and prescriptive in nature, and have thus become external to day-to-day business management. Quite often an EE improvement programme ends as soon as the EE advisor moves out the factory. Consequently EE programmes have mostly remained sporadic and of short duration. EE programmes are mostly based on the economic attractiveness of reduced energy consumption. With declining energy prices this attraction has also declined. In a parallel vein, CP-EMS programmes have been mainly environment-driven and generate little interest where environmental issues are not sensitive or important.

Professionals with skills in the fields of EE and CP-EMS today find themselves in separate compartments. Instead of drawing strength from each other they tend to compete. Building multiple skills in individuals and institutions would allow them to provide one point, comprehensive services to industry. Although the energy-environment linkage is well recognized, its complementary nature is rarely exploited. Integrating EE-CP-EMS would create an approach that is stronger than its parts. In summary, combining energy efficiency with environmental management in a systematic manner would have greater appeal to industrial entrepreneurs and managers, generating initial interest in energy management issues and increasing the likelihood that they would continue programmes.

Baseline Activities

UNEP's Division of Technology, Industry and Economics promotes environmentally sound management and builds corresponding capacities in governments and the private sector. The objective is to encourage decision-makers to develop and adopt policies, strategies, and practices that are cleaner and safer, make efficient use of natural resources, and reduce pollution and risks to humans and the environment. As part of its global work programme, UNEP already provides information on environmentally sound technologies, prepares training materials, organizes and conducts training workshops, and maintains an outreach programme on a broad range of industrial environmental issues.

In 1987 UNEP started a Cleaner Production Programme to give its preventive environmental management approach a firm programmatic structure. Early efforts focused on raising awareness about the economic and environmental advantages of CP, but in 1994, UNEP and UNIDO agreed to establish a network of National Cleaner Production Centres, 17 of which are now functioning in as many countries. These Centres, set up in existing institutions, have the broad objective of promoting and helping implement Cleaner Production practices in industries. The operational strategy of the Centres comprises awareness raising, training, demonstration projects, and policy level interventions.

Initially the Centres were fully supported by UNEP and bilateral donors with the understanding that they should increasingly become self-supporting by selling services to industrial clients. This has occurred and most of the older Centres are able to generate income that covers much of their direct operating expenses.[1]

The Centres have been able to set up demonstration projects in over 500 enterprises (most of them SMEs), train over 2,000 persons in conducting CP audits and sensitize several thousand personnel from diverse economic sectors. The Centres have also built strong alliances with other organizations including academic and research institutions, consulting companies, financial institutions, government departments, and NGOs to help promote the concept of Cleaner Production and CP approaches.

The focus of CP efforts in the beginning was on reducing the use of toxic raw materials and water, and minimizing generation of wastes. Energy management has not so far been stressed as a component of CP but individual centres have included energy systems in their CP audits on an ad hoc basis.

Active Energy Service Companies have been established in many countries worldwide. At least three of the countries in this project -- Hungary, Czech Republic, and China -- have an active ESCO sector. In the case of China, a World Bank GEF project is supporting the work of regional ESCOs to conduct audits and prepare investment proposals in industry. In Hungary and the Czech Republic, multiple private ESCOs currently work on industrial audits and efficiency projects. However, the long term nature of conventional ESCO contracts is a major barrier in industrial situations because production processes so frequently change. This makes it difficult for the ESCO to monitor savings accurately and most therefore prefer to invest in more stable environments such as buildings (especially public sector) and co-generation schemes. Hence most ESCOs focus on large complex projects, such as district heating upgrades, co-generation, or major process redesign. These are large individual projects that usually require significant levels of investment and achieve significant energy savings. Payback periods for these large investments are typically in the range of three to five years, sometimes much longer, and government involvement of some sort is usually involved to reduce the risks to the ESCO or its funders.

Other relevant projects include the China End Use Energy Efficiency Program Framework (EUEEP) funded by GEF via UNDP, Energy Foundations' project on EE, Dutch funded Energy Efficiency and Conservation initiative. In Vietnam, there are the World Bank's DSM project and the UNDP's SME project. The issue of frequent changes in production processes (for SMEs) and the small scale of EC and EE projects are among the barriers that will be addressed in the UNDP-GEF PECSME Project. The PECSME project will address this by carrying out capacity building in promoting ESCOs to SMEs and enhancing the application of energy management tools like energy auditing.

[1] All of the Centres also provide services that have some characteristics of public goods, such as education, training, and awareness raising; hence there is a rationale for continuing partial support by national or donor governments.

Small projects related to improved process control, monitoring, maintenance, or 'house keeping' have not been a target of much ESCO activity, and are often seen as requiring a greater input of engineering effort to ensure sufficient attention to detail. They are the neglected market that this project is attempting to reach. The project proposed here builds on this baseline and aims to bring energy management more centrally within EMS approaches, which are internal to companies. The project emphasis is on management and people issues within the target companies. The premise on which this is built is that UNEP's experience in Cleaner Production is that management systems and changed operating methods (through training, mentoring and motivation) are central to anchoring Cleaner Production, including energy management, within a company.

The increasing awareness in industry of links between energy use and climate change – and interest in Environmental Management Systems – has made NCPC directors aware of the advantages of addressing energy, Cleaner Production, and EMS issues through a common framework. As a first step, in 1999, UNEP and UNIDO started to prepare a technical guide that combines energy audit procedures with cleaner production/environmental management system approaches. The guide will be published in early 2000 in English, and will form one of the core resources to be used in the project. The outline of the guide is shown in Annex 3.

While several manuals currently exist on energy auditing for industrial energy managers in transition countries these are designed for energy managers who already have a good understanding of the issues at hand. Manuals for non-energy specialists do not exist for this issue other than the guidebooks for the Central European region; viz., Evans, Meredydd. 1999. An Energy Efficiency Guide for Industrial Plant Managers in Ukraine, prepared for the U.S. Department of Energy, Pacific Northwest National Laboratory, Richland, Washington, which is available in English, Russian, and Ukrainian, which will be consulted as a first step in the process of adapting the manual for national purposes.

This project will therefore help managers and senior staff who are not energy specialists become better managers of energy issues, including the management of energy specialists. Often the difficulty is knowing what can and should be done internally and what is best left to specialists (including those that might be retained under some agreement with an ESCO). By setting energy management within the broader environmental and resource management context, the project will increase the likelihood that energy management becomes firmly anchored in companies.

Expected Project Outcomes:

The main project outcome is the development and application of an integrated energy-environment management approach through the route of EE-CP-EMS aimed at overall improvement in the environmental performance of enterprises. The integrated EE-CP-EMS approach will lead directly to GHG emissions reduction through both improved operating practices (so called 'good housekeeping' measures) and investments in equipment through internal or secured finances. Energy efficiency measures typically identified in audits are financially attractive and can be developed into well prepared, 'bankable' investment proposals, as is proposed as one of the project activities.

The project essentially supports a one time effort to pull energy management issues within the CP-EMS services currently offered by NCPCs. One this is done the NCPCs will be able to offer, on a continuing basis, an integrated package of energy-environment services to industrial clients through the EMS framework that is currently attractive to and demanded by enterprises.

At the end of the project, the following direct outcomes are expected:

- an estimated annual reduction of 225,000 tons of CO_2 based on the experience of the six NCPCs participating in the project,;
- at least 15 Energy Audits conducted by each of the six participating Centres (a total of 90 audits) following consultations held within each country between the NCPCs and on-going related projects to ensure that duplication does not occur;
- financing proposals for medium-cost energy efficiency investments (an average of one proposal per audit for a total of 90 proposals);
- national versions of the UNEP/UNIDO CP-Energy Audit manual that are specifically integrated with the CP and EMS materials already being used by the six National Cleaner Production Centres. Particular attention would be given to consider the value of integrating information on procedures relating to (i) the environmental aspects of how energy is used in the various energy systems in industrial plants; and (ii) include energy–environment links of energy systems or guidelines for selecting energy saving alternatives based on environment conservation aspects, into the manual;
- trained personnel in the six NCPCs capable of conducting an energy audit, either as stand alone activity or as part of CP-EMS audit;
- Personnel in the remaining NCPCs in the global network and other in-country stakeholders, such as Energy Manager Associations and Business Councils ,will have increased awareness of the opportunities and methods for integrating EMS in their operations.

The longer-term outputs include:

- continued delivery by partner CP Centres to their private sector clients of CP-EMS advisory and training services with an energy efficiency component;
- improved co-ordination and links between the NCPCs and on-going related projects (such as existing ESCOs, Energy Manager Associations and Business Councils) on energy auditing;
- increased levels of identification and implementation of EE measures by the industrial enterprises and thus continued contribution to GHG abatement;
- expansion of the approach to the other NCPCs and NCPC-like institutions operating in the UNEP/UNIDO Network.

Activities and Financial Inputs:

The project will last for 20 months, and consist of the following activities:

a) At the start of the project, consultations will be held within each country between the NCPCs and on-going related projects to ensure that duplication does not occur.
b) On behalf of the six NCPCs, UNEP will organize a planning meeting to discuss adaptations needed to the EE-CP-EMS manual integrating energy audits and energy management principles with CP-EMS approaches. The meeting will also give a chance to review the overall project objectives and schedule. To reduce costs, this planning will occur in conjunction with the annual NCPC Director's meeting scheduled for May 2000.
c) The six participating NCPCs will translate and modify the manual as required to make it suitable for use in their national circumstances. Particular attention would be given to consider the value of integrating information on procedures relating to (i) the environmental aspects of how energy is used in the various energy systems in industrial plants; and (ii) include energy–environment links of

energy systems or guidelines for selecting energy saving alternatives based on environment conservation aspects, into the manual. In addition, prior to this exercise, existing guidebooks for the Central European region; viz., Evans, Meredydd. 1999. An Energy Efficiency Guide for Industrial Plant Managers in Ukraine, prepared for the U.S. Department of Energy, Pacific Northwest National Laboratory, Richland, Washington, which is available in English, Russian, and Ukrainian, will be consulted as a first step in the process.

d) Concurrently, UNEP will organize and conduct a two-tier training programme; 1) a three day basic training for six NCPC Directors followed by 2) an intensive, two week training for two to three additional personnel from each NCPC. The latter individuals would actually work in the field conducting the energy audits with selected enterprises.
e) The most important activity in the project relates to conduction of field-level energy audits and preparation of investment proposals. This activity can be broken down into several sub-activities:

- Identify industrial sectors and industries based on factors such as potential for GHG emission reduction, possible multiplier effect, willingness of the industry to participate, etc.
- Conduct energy efficiency audits based on the structured methodology presented in the manual; these will be conducted as part of planned CP/EMS audits.
- Prepare audit reports and help the participating enterprises prepare investment proposals suitable for presentation to financial institutions;
- Follow up with the enterprises on implementation of energy efficiency measures identified in the audits;
- Expand the approach by conducting sectoral workshops disseminating the results, preparing sectoral guidelines, compiling case studies, and so on (including publishing articles for dissemination through various channels including UNEP's Industry Bulletin).
- Conduct workshops in each of four regions worldwide (Latin America and the Caribbean, Asia/Pacific, Africa and Eastern Europe) to disseminate the results to other NCPCs and induce other NCPC-like institutions to take similar steps integrating CP with energy efficiency in an EMS framework. These workshops will include other in-country stakeholders, such as Energy Manager Associations and Business Councils (e.g., the Czech Energy Managers Association and the Hungarian Energy Efficiency Business Council).

In selecting industrial enterprises for the audits, UNEP and the NCPCs will secure written commitment that cost effective energy efficiency improvements will be undertaken by the enterprises. Enterprises will be selected from industry sectors that have high potential for reducing GHG emissions through improved energy utilization. The participating NCPCs are all experienced in selecting good partner enterprises and securing their firm commitment for a joint programme of work.

Sustainability Analysis and Risk Assessment:

Knowledge and perception barriers, once removed, are unlikely to return. By upgrading institutional capacities, the project will bring about the mainstreaming of EE and CP-EMS in the NCPCs participating in the project and the enterprises where the initial set of audits are undertaken.

The project has been prepared at the suggestion of the NCPC directors at their annual meeting, and is being submitted by UNEP on their behalf. NCPCs stand to gain from the project as their professional

capabilities will be enhanced. This will enable them to provide a more useful, comprehensive service integrating energy and environment to their various clients on a fee or cost recovery basis.

Private sector borrowers, banks, and providers of energy efficient technologies all stand to gain if the project leads to an opening up the market of integrated EE-CP-EMS services.

There exists some risk that private sector enterprises will not join as project partners and agree to cooperate in conducting integrated audit services in view of the costs that they would be required to bear. However, past experience shows that such audits result in financially attractive measures that pay for the costs incurred several times over. The existing rapport NCPCs have with enterprises will help overcome any initial resistance to joining the effort, and it is with the purpose of overcoming this risk that the project will be carried out by the well-established Centres. Careful selection of private sector partners by the participating NCPCs will reduce this risk further.

Stakeholder Involvement and Social Assessment:

This project comes from a request of NCPC Directors expressed at their annual meeting. During the course of their activities, particularly conducting CP demonstration projects, NCPC personnel have often been constrained in taking up areas related to energy efficiency improvement for want of technical expertise. Prior to the formulation of this project proposal several NCPC Directors were contacted and their views sought on the desirability of the project and its design. All the Directors strongly endorsed the idea and mentioned their keenness to be associated with the project. The draft proposal has been prepared by one of the Centre Directors working with UNEP, with input provided by the other participating NCPCs.

Positive social and environmental impacts are expected to occur from the project. Outputs would lead to the development of an integrated, comprehensive approach for bringing about environmental improvements with significant economic gains. The project will improve the competitiveness of participating enterprises and the well being of their employees, managers, suppliers, and customers.

Incremental Cost Assessment:

In the current baseline, a global network of National Cleaner Production Centres has been established worldwide, 17 of which are now functioning in as many countries within the UNEP/UNIDO framework. These centres have the broad objective of promoting and helping implement Cleaner Production (CP) practices in industries. The focus of CP efforts has been on reducing the use of toxic raw materials and water, and minimizing generation of wastes. Energy management has not so far been stressed as a component of CP but individual centres have included energy systems in their CP audits on an *ad hoc* basis. EMS training offered through this project and the network of CP activities are highly complementary and will cross-fertilize each other. The MSP will pilot the delivery of a number of innovative services. If successful, core CP services may integrated in the global network set-up and delivered to wider regional audiences. Steps will be undertaken in this MSP to promote replication of successful experiences and lessons learned generated through this project.

The project would support the adaptation of an Energy Audit manual being prepared by UNEP and UNIDO as part of their joint cleaner production activities underpinning the project. UNEP has committed $50,000 to this effort, which forms part of the project baseline. The project would also support training of

personnel and conduction of energy audits in industry. The project draws heavily on the existing infrastructure and network of NCPCs. The baseline costs for running the Centres are already being supported by other agencies or by the Centres themselves. If the Centres did not exist the cost and time required for implementing the project would be much greater. The NCPCs already have a base level expertise in conducting CP Audits, and incremental inputs would be provided under the project to integrate energy efficiency aspects. The project would support incremental costs of conducting energy audits in the participating enterprises. Direct labor costs would be provided by the enterprises and the NCPCs; project funds would cover such expenses as travel and per diem, field expenses, equipment, costs of laboratory analysis. In particular situations such as in the Czech Republic, where recent regulations will require energy audits for all large enterprises, the incremental funding of the project will be targeted to focus on building capacity at the NCPC to work with SMEs.

In the India situation, the National Productivity Council (NPC) has been working for quite some time in the field of advisory and training services in the field of EE. In parallel, the National Cleaner Production Centre has been providing advisory and training services in the field of Cleaner Production. Both the set ups have SMEs as their primary focus although NPC has also addressed a good number of large industrial enterprises (Aluminium plants, power stations, cement etc.). NPC is the host institution for NCPC and in future, NCPC has to beocme a self-sustainable autonomous institution and need to be strengthened in the field related to CP like EE,other international conventions and protocols. The added value of this project is that so far, NPC's energy services have focussed almost exclusively on energy related issues. NCPC on the other side has focussed on material resources and evironment related issues. It is being increasingly realised that both the energy and material resources as well as environmental issues need to be addressed simultaneously for comprehensive solutions. This project would fulfil this precise need. It will provide a methodology to address the abovementioned issues simultaneously. It will provide an opportunity to energy specilaists to incorporate Cleaner Production in their work and vice-versa. The audit studies would, apart from providing practical experience, reflect the merits of integrating CP and energy efficiency. In the alternative situation proposed in this project, the project would therefore act towards bridging the existing gap between CP and EE and develop a cadre of specialists who will be able to provide integrated CP-EE services to the industries.

The NCPCs also have established very strong linkages with industries, NGOs, government departments, and other institutions that would further support the project. The international network of NCPCs and similar institutions will help in replicating the programme in other countries. The incremental cost of the project arises from preparing manuals integrating energy management in CP-EMS, providing specific training, and partially supporting the EE-CP-EMS audits in SMEs. In other words, the incremental costs of the project are those associated with activities needed to overcome lack of tools and technical expertise. Once this barrier is removed the NCPCs will be able to conduct energy audits as part of the mainstream CP/EMS business activities on a cost recovery basis.

Budget:

The total project budget is US $2,715,000 and project implementation will cover a period of 20 months. The in-kind contributions of the NCPCs, their host institutions, and enterprises participating in the audits are estimated at $1.6 million. UNEP's energy programme and related programmes on which the project will draw (the Implementing Agency baseline activities) have a combined annual budget exceeding US$4.5 million.

A detailed breakdown of the budget is presented in Table 1.

Table 1: Project Budget (in US$)

#	Component	GEF	UNEP[2]	NCPCs[3]	INDUSTRY[4]
1	Development of Energy Audit Manual integrated with CP-EMS structure[1] This includes: • Consultant fee for reviewing existing literature and existing related manuals; preparation of draft manual • Editing, management oversight • Documentation and printing		 30,000 10,000 10,000		
2	Adaptation, translation of the manual to meet the local requirements of the participating NCPCs from six different countries, reproduction (@ $10,000 per country)	60,000	20,000		
3	Two tier training programme on energy/EMS integration: Programme 1: 3 day basic training for 6 NCPC Directors Programme 2: 2 weeks intensive training for 18 NCPC Deputy Directors and national associates/experts • Costs of travel & DSA of participants and trainers • Professional fees of trainers	 90,000 30,000	 25,000		
4	National consultations between NCPCs and existing related projects in each country at start of project plus energy audits in conjunction with CP-EMS Audits: 15 per country in 6 countries, totaling 90 audits	450,000[5]	20,000	600,000	990,000[6]
5	Experiences with energy audit services tested at NCPCs in this project disseminated to the global network of CP centres through regional workshops, publications, and other relevant channels. (4 workshops per region x US $60,000 per workshop)	240,000	20,000		
6	Other project direct costs (travel communication, etc)	40,000			
7	Project publicity and outreach activities	20,000	40,000		
8	Project evaluation	20,000			
Sub-total		950,000	175,000	600,000	990,000
TOTAL		**$2,715,000**			
	Associated UNEP baseline activities supporting project				$4,500,000

[1]This part of the overall project is being undertaken by UNEP and constitutes a baseline activity.
[2]Value of UNEP in-kind and direct cash contribution.
[3] Value of NCPC in-kind contribution estimated as follows:

work days for field audits: 15 days x 2 persons per audit @ US$ 200 per day	= US $ 6,000 / audit
Total for 90 audits	= US $ 540,000
infrastructural and support services (for six Centres)	= US $ 60,000
sub-total	**= US $ 600,000**

[4] Value of enterprise in-kind contribution is estimated as follows:

work days for field audits: 15 days x 2 persons per audit @ US$ 200 per day	= US $ 6,000 / audit
Total for 90 audits	= US $ 540,000
low cost EE measures @ US $ 5,000 per enterprise for 90 enterprises	= US $ 450,000

sub-total = **US $ 990,000**

[5]Project funds would support direct and indirect costs of conducting each audit, excluding labor (which is provided as an in-kind contribution by the NCPCs, the enterprises, and UNEP). Examples include travel, per diem, equipment, laboratory analysis, etc.)

[6]The estimate of US$5,000 investment in low cost measures resulting from the project activities is based on NCPC experiences in conducting more than 500 cleaner production audits in small and medium enterprises in the six countries.)

IMPLEMENTATION PLAN

Project Implementation Plan:

The project will be executed by UNEP's Division of Technology, Industry and Economics and National Cleaner Production Centres in China, India, Vietnam, the Czech Republic, the Slovak Republic, and Hungary.

The time schedule of the project is as follows:

Activity	PROJECT MONTH (total 20 months)									
	2	4	6	8	10	12	14	16	18	20
Organize and convene national consultations in each country between NCPC and existing related projects to identify lessons learned and ensure complementarity between the MSP activities[1]										
Organise / conduct project inception meeting (in conjunction with annual NCPC meeting)										
Prepare working adaptations of existing energy-EMS audit manual following review of existing literature										
Conduct two-tier training programme for NCPC personnel										

[1] In China, there is the China End Use Energy Efficiency Program Framework (EUEEP) funded by GEF via UNDP, Energy Foundations' project on EE, Dutch funded Energy Efficiency and Conservation initiative. In Vietnam, there are the World Bank's DSM project and the UNDP's SME project. The issue of frequent changes in production processes (for SMEs) and the small scale of EC and EE projects are among the barriers that will be addressed in the UNDP-GEF PECSME Project. The PECSME project will address this by carrying out capacity building in promoting ESCOs to SMEs and enhancing the application of energy management tools like energy auditing. The UNEP EMPRESS PDFB proposes audits in industry. In addition to GEF projects, there are several Hungarian federal programs that support industrial auditing. Hungary, Czech Republic, and China -- have an active ESCO sector. In the case of China, a World Bank GEF project is supporting the work of regional ESCOs to conduct audits and prepare investment proposals in industry. In Hungary and the Czech Republic, multiple private ESCOs currently work on industrial audits and efficiency projects.

Conduct energy audits in selected industries, prepare audit reports, prepare investment proposals																				
Adapt generic manual, based on the experience gained from conducting audits, to suit the local situations																				
Outreach to industry based on experiences/outcomes																				
Monitor project																				
Evaluate project																				

Public Involvement Plan:

Stakeholder identification:

The project involves directly and was prepared with the stakeholders who stand to benefit from the project, namely the NCPCs and the participating enterprises. UNEP has discussed the project concept with officials from UNIDO, NCPCs, industry and trade associations, private companies, consultants, and the GEF Secretariat. Their suggestions influenced the project design and this proposal.

Other relevant stakeholders include those in existing related projects who will be consulted during the start up phase of the project to ensure complementarity and the exchange of lessons learned. This includes in China, those involved in the China End Use Energy Efficiency Program Framework (EUEEP) funded by GEF via UNDP, Energy Foundations' project on EE, Dutch funded Energy Efficiency and Conservation initiative. In Vietnam, there are the World Bank's DSM project and the UNDP's SME project. There are several Hungarian federal programs that support industrial auditing. Hungary, Czech Republic, and China -- have an active ESCO sector. In the case of China, a World Bank GEF project is supporting the work of regional ESCOs to conduct audits and prepare investment proposals in industry. In Hungary and the Czech Republic, multiple private ESCOs currently work on industrial audits and efficiency projects. Other in-country stakeholders, such as Energy Manager Associations and Business Councils (i.e. the Czech Energy Managers Association and the Hungarian Energy Efficiency Business Council).The stakeholders in these projects will be consulted at the start up of the project as per the project implementation plan.

Monitoring, information dissemination and consultation:

The project directly aims at overcoming information and knowledge barriers, and undertaking the bulk of the project will require the active participation of the direct project beneficiaries. Consultation with stakeholders and their direct participation lies at the core of the project.

The National Cleaner Production Centres (NCPCs) are the lead national executing agencies for this project and their mandate has from the beginning been to reach out to as broad a constituency as possible.

A major part of the project has been designed to spread the message about the approach and its results. It should be noted that NCPCs involvement of wider groups in their activities is central to their mode of operation.

UNEP will monitor the project impact and publicize the results of the project through its normal communication and information dissemination channels as well as through the NCPC network. The NCPC Listserve and NCPC newsletter are among the dissemination means to be used. UNEP is strongly interested in helping overcome barriers to environmentally sound technologies and has underway several initiatives linking the financial and environmental communities. Disseminating results from a successful project widely so as to influence other decisionmakers is a crucial element of the project from UNEP's perspective.

Annex 1: LogFrame Matrix

GEF MSP: Promoting Industrial Energy Efficiency through a Cleaner Production / Environmental Management System Framework

Problem Statement Wide-scale improvements in energy efficiency in industries, particularly small and medium enterprises, is not taking place due to several barriers; prominent is lack of a structured energy audit methodology and management approach consistent with related concepts, such as EMS-Cleaner Production that are of more interest to industrial enterprises.			
Project Objective Promote GHG mitigation by removing barriers (related to information and lack of trained manpower) that prevent the integration of energy efficiency improvements and energy management practices with general environmental management approaches.	**Objectively Verifiable Indicators** Number of metric tons of greenhouse gases not emitted as compared to the projected, non-intervention baseline.	**Means of Verification** Evaluation reports on actual enterprise energy consumption post-project as compared to pre-project baselines.	**External Factors/Assumptions** a. Companies will maintain new energy management approaches. b. Companies will make identified investments; energy efficient technologies will perform as expected. c. Overall economic situation in the countries will not deteriorate. d. General environmental policy framework and enforcement of regulations will not deteriorate below present levels.
Outputs (project deliverables) a. *Ninety energy audits* conducted with full documentation; presentation of results/recommendations to management. b. Development of 90 financing proposals for *investments leading to reduction in energy consumption* and thus reduced GHG emissions. c. *Energy-EMS Audit Manual adapted for national circumstances in six countries* that enable energy audits to be conducted in a systematic, methodological manner consistent with CP-EMS audits. d. *Trained personnel* from CP Centres and their counterparts (trained on conducting	**Objectively Verifiable Indicators** a. Audit reports. b. Financing proposals in formats suitable for local financial institutions. c. Energy-EMS Audit Manual in six adapted versions for use six participating countries. d. Number of trained professionals from NCPCs.	**Means of Verification** a. Project progress reports, including individual audit summary reports, filed by NCPCs. b. Project progress reports filed by NCPCs c. Project progress reports filed by UNEP. d. Training event participation lists.	**External Factors/Assumptions** a. NCPCs will retain qualified staff; host institutions will continue to support NCPCs. b. Lending institutions will extend credit for energy investments if these are demonstrated to be financially viable.

energy audits and capable of including an energy audit as an integral component of a CP-EMS audit).			
Main UNEP Activities a. Manage the project with NCPCs to enable delivery of project outputs. b. Oversee the adaptation of the Energy-EMS audit manual: preparation of adapted versions, field testing/verification, final adaptation by providing expertise and support. c. Organize training programme for NCPC personnel: make physical and logistic arrangements, hire trainers, run training programme. d. Follow up the Energy-EMS Audits conducted by the NCPCs, preparation of format for reporting, format for preparing bankable proposals, compilation of results to estimated the GHG emission reduction already achieved and likely to be achieved with the multiplier effect in other industries. e. Undertake the M&E work and provide annual PIR reports.	**Inputs** a. Administrative, technical, and partial financial support from UNEP. b. Technical input from NCPCs. c. In-kind contributions from NCPCs and their host institutions. d. Staff time provided by cooperating enterprises. e. GEF funds to support project activities.		

Annex 2: Estimation of GHG Emission Reduction Potential in Selected Industrial Sectors (SMEs) – Example of India[1]

Industrial Sector	Number of Enterprises	Energy Consumption Mtce/Year	GHG Emission Reduction Potential[2]	
			Percent	Tons/Year
Breweries	40	0.16	10 %	30,000
Dairy	400	0.537	10 %	100,000
Secondary steel processing:				
Foundries	1000	0.72	4.5 %	65,000
Forging	500	0.3	8 %	50,000
Re-melting	900	5.7	5 %	500,000
Re-rolling	600	1.1	15 %	300,000
Pulp & paper	300	5.1	7 %	750,000
Edible oil	200	1.1	10 %	200,000
Wire galvanizing	45	0.2	15 %	60,000
Total	**3,985**			**2,055,000**

Based on the Indian experience, CO_2 emissions reduction potential for a typical SME are approximately 500 tons per year. NCPCs in the other project countries have confirmed that this estimate is reasonable. Extrapolating to the 90 SMEs for which audits are conducted and energy efficiency enhancements undertaken and assuming emissions reductions continue over five years, total GHG emissions avoided as a result of the project are 225,000 tons.

Since NCPCs will continue to include energy management issues in their baseline CP/EMS activities after the project is completed, the actual GHG emissions reduction potential is much greater.

[1] Based on energy audits conducted in India by the National Productivity Council, India.
[2] Reductions made possible by improving end use energy efficiency (fuel oil, coal, and electricity).

Annex 3: Coverage of the UNEP/UNIDO Manual Integrating Energy Efficiency and Cleaner Production/EMS Approaches

1. Energy Efficiency as an Element of Cleaner Production and Environmental Management Systems
2. Basic Concepts: type and form of industrial energy usage, energy terminology, units and measurements
3. Brief profile of major energy conversion and utilization equipment; boilers, furnaces, refrigeration systems, fans, pumps, motors, major unit operations (distillation, evaporation, drying)
4. Principles and techniques of energy efficiency improvement in:

   Thermal Energy:
   I. Fuel conversion and combustion systems: boilers, furnaces, kilns
   II. Steam distribution and utilization
   III. Condensate recovery, thermal fluid systems
   IV. Waste heat recovery systems
   V. Refractors and Insulation

   Electrical Energy:
   I. Motors (drives)
   II. Major electrically driven equipment; fans, pumps, compressors
   III. Lighting systems

   Other Systems:
   I. Compressed air systems
   II. Refrigeration and air-conditioning

   Note: In all the above areas the coverage should include; description of the systems, areas and causes of energy loss, formulas and techniques for measurement and quantification of energy loss (including tables and charts), preparing energy balances, techniques for improving energy efficiency

5. Associated intervention areas:

   - Energy substitution; renewable energy sources
   - New/emerging energy technologies
   - Demand side management
   - Co-generation
   - Energy cascading
   - Pinch analysis; energy network design

6. Energy Efficiency improvement measures in respective industry sectors:

   SME sectors (more relevant to NCPCs)
   - Textiles
   - Glass and ceramics
   - Secondary metal processing; remelting, rerolling, forging
   - Pulp & paper
   - Food processing
   - Dairy

- Laundries
- Plywood / sawmills
- Edible oil industries

Large Scale industries:

- Integrated iron & steel
- Cement
- Fertilizer
- Petroleum refineries
- Chemicals
- Thermal power stations

7. Sources for further information

Annex 4: Global ISO 14001/EMAS Certifications