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SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE
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Item 7 of the provisional agenda

DEVELOPMENT AND TRANSFER OF TECHNOLOGIES

Projects and programmes incorporating cooperative approaches to the transfer of technologies and responses on how the issues and questions listed in the annex to decision 4/CP.4 should be addressed, as well as suggestions for additional issues and questions

Submissions from Parties: Part Two

Note by the secretariat

1. At its fourth session, the Conference of the Parties (COP), by its decision 4/CP.4, invited Parties and interested international and non-governmental organizations to identify projects and programmes incorporating cooperative approaches to the transfer of technologies which they believe can serve as models for improving the diffusion and implementation of clean technologies under the Convention, and to provide information thereon to the secretariat, by 15 March 1999, for compilation into a miscellaneous document (FCCC/CP/1998/16/Add.1).

2. By the same decision, the COP invited Parties to submit to the secretariat, by 15 March 1999, their views on how the issues and questions listed in the annex this decision should be addressed, as well as suggestions for additional issues and questions.

3. Eleven submissions* have been received. In accordance with the procedure for miscellaneous documents, these submissions are reproduced in the language in which they were received and without formal editing. For technical reasons, ten submissions are contained in document FCCC/SBSTA/1999/MISC.5 and one submission is attached to the present addendum.

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* In order to make these submissions available on electronic systems, including the World Wide Web, these contributions have been electronically scanned and/or retyped. The secretariat has made every effort to ensure the correct reproduction of the texts as submitted.

GERMANY
(On behalf of the European Community and its Member States)

CO-OPERATIVE APPROACHES TO TECHNOLOGY TRANSFER

A compilation of best practices in the EU

Introduction

The EU together with developing country partners has gained extensive experience in technology transfer and technology co-operation. This experience is illustrated by the attached project briefs, which reflect the EU's views concerning technology co-operation on climate change issues. The submitted examples were chosen by individual EU members. They show a great variety of different options and scenarios, but are by no means statistically representative for the EU's climate change co-operation portfolio. This compilation focuses on what the respective EU members consider as promising approaches or success stories which may provide some orientation for future co-operation in the field of GHG mitigation. Due to the relatively short time to look for appropriate examples, not all EU members were able to answer.

The EU believes it essential to underline the openness of the consultative process and invites developing countries to come forward with examples for what they consider as best practice in the transfer of environmentally sound technologies. The EU is also looking forward to the upcoming miscellaneous documents which might provide additional insights to technology transfer and to the workshops of the Consultative Process which could provide an open forum for discussions and recommendations.

List of projects and activities presented:

Host country/region	Name of Project	Partner
● Asia:	COGEN – Biomass heat generation	EU-Commission
● Ethiopia:	Pico-hydro village power	
● Latin America:	Optimal Utilisation of Energy in Latin America (ALURE)	
● Southern Africa: (Lesotho, Malawi, Mozambique, Namibia, South Africa, Zimbabwe)	Regional Biomass Energy Conservation Programme	
● Sahel Countries: (West Africa)	Programme Régional Solaire (Regional Solar Programme)	
● Egypt:	Wind Energy	Denmark
● Egypt:	Wind Park Zafarana	
● Mulitlateral:	UNEP Collaborating Centre on Energy and Environment (UCCEE)	
● Multilateral:	Trust Fund for Rural and Renewable Energy	
● Nepal:	Energy Sector Assistance Programme	
● Niger:	Energy – Sustainable utilisation of firewood	
● Zimbabwe:	Photovoltaic Medical Refrigerators (Private Sector Project)	
● Central America:	Meteorology development programme in the Central American isthmus	Finland
● China:	District heating in Chinese cities	
● Indonesia:	Reforestation and natural forests management project	
● Nicaragua:	Support to the implementation on the UN Framework Convention on Climate Change	
● China:	Cement works, efficient grinders	France
● Mauritania:	Alizes projects – rural electrification	
● Mauritius:	Bagasse-coal power plant	
● Tunisia:	Energy efficiency program in building	
● Argentina, Brazil, Chile, Indonesia, Jordan, Philippines, Zimbabwe, Tunisia, Ethiopia	International Photovoltaic Pumping Program (PVP-Programme)	Germany
● China:	Advanced Technology Dissemination Centre for Electric Power Utility Management, TCPM	
● India:	Indo-German Industrial Energy Efficiency	
● Morocco:	Wind-Park Tangier	
● Nepal:	Biogas Support Programme	
● Turkey:	Biogas Power Plant Ankara	

Host country/region	Name of Project	Partner
● China:	Gasification of agro-industrial residues for energy production	Italy
● India:	Fire extinguishing agents substitutes to Halons	
● Korea:	High temperature recycling plants for waste of any kind with a patented process called "thermoselect"	
● Mediterranean: (Morocco, Algeria, Tunisia, Egypt, Israel, Palestinian Territories, Turkey)	INTERSUDMED – Prefeasibility Studies for Large Scale Projects in Renewable Energies	
● Nigeria:	Biomasses' cogeneration plants	
● SIDS:	Training Course on Energy planning for Small Island Developing States (SIDS)	
● Algeria, Egypt, Lebanon, Morocco, Tunisia and Palestinian Authority	SolarMed – Solar Water Heating in the Mediterranean Basin, with Guarantee of Results	Portugal
● Algeria, Egypt, Lebanon, Morocco, Tunisia and Palestinian Authority	Precious Planet	
● Angola, Cape Verde, Guinea Bissau, Mozambique, Macao, Portugal, S. Tomé e Príncipe	Utilization of weather forecasts and climatic modelling to support the sustainable development in the PLOP and Macao Territory	
● Brazil:	Demonstration of M&T and Development of Sustainable M&T Infrastructure	
● Portugal, Portuguese speaking countries in Africa and Macao	Wave Models for the PLOPS	
● Tunisia and other Mediterranean countries	Euro-Mediterranean Fair for Energy Efficiency and renewable Energies	
● India:	Environment Protection Training and Research Institute (EPTRI), Hyderabad, Andhra Pradesh	Sweden
● China:	Guizhou and Shanxi Energy Efficiency Demonstration	United Kingdom
● East Africa:	Commercialisation of Innovation Woodstoves (Research)	
● India:	Orissa Power Sector Reform	
● Czech:	In-situ Remediation of Oil Contamination	
● Middle East:	Effluent Treatment	
● Pakistan:	Sewerage System	
● Pakistan:	Environmental Impact Study, Port of Karachi	
● India:	Hydro-electricity in the Himalayas	
● East Africa:	Energy for Sustainable Development	
● Global:	Solar Medical Refrigerator	

Project title:	**COGEN**
Host region:	**ASEAN**
Partner:	**EU-Comission**
Contact person:	Mr. M. Pennington, e-mail: cogen@ait.ac.th
Executing agency:	COGEN Secretariat AIT, Bangkok
Project period and costs:	1991 – 1998 (current 5 MEURO programme) A new 25 Mio. EURO programme approved

Requested specific information:

- *What are the project's main targets?*
  What technologies are applied and how do they contribute to the targets?

The EC-ASEAN COGEN Programme is a co-operation programme between the European Commission (EC) and the Association of South East Asian Nations (ASEAN), co-ordinated by the institute of Technology (AIT, Bangkok, Thailand). Its aim is to accelerate the implementation of proven technologies generating heat and/or power from wood and agro-industrial residues, through partnerships between European and ASEAN companies.

Target groups

Since the primary objective is to transfer technology from Europe to ASEAN, the overall approach has, on the European side, been to identify relevant and interested equipment suppliers, and on the ASEAN side to identify potential equipment end-users and business partners, and to investigate overall market potential. The EC-ASEAN COGEN Programme is thus designed to support European companies producing biomass energy technology, who are interested in expanding their markets in ASEAN, but do not have sufficient capacity to cultivate the market alone.

The programme focuses on proven technologies only.

- *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology? Which instrument are used to improve the respective group's access to information and their knowledge of climate relevant technologies?*

Some technologies are technically and economically viable but are not implemented in ASEAN because they are not well-known and have not been tested under ASEAN conditions. To overcome this obstacle, the EC-ASEAN COGEN Programme will bring technical and financial assistance to implement FSDPs. An FSDPs can be defined as the implementation of a proven technology on a full scale basis in order to demonstrate its technical reliability and economic viability. Therefore, an FSDP constitutes a shop window in ASEAN, aimed at convincing other potential end-users to select the technology.

- *Which positive experience has been gained up to now (lessons learned / best*

practices) and how is it diffused / applied in other projects?

To ensure the maximum replication of the demonstration projects, an independent technical and economic monitoring of the equipment will be performed. The project results, including economic benefits for the end-users, will be widely advertised in the region, through media and printed material, as well as visits to the plants by public and private sector representatives from all ASEAN countries.

• *How does the project support access to financing of technologies?*

The EC-ASEAN COGEN programme can support:

- Investment assistance,
- Training in Europe and ASEAN,
- Monitoring by an independent organization.

The requirements are that the end-users must allow both technical and economic monitoring, diffusion of the technical and economic results of the project, and visits to the installation by interested parties throughout ASEAN.

• *With respect to technology transfer, which factors and conditions are crucial to the success of the project?*

The technology must already be proven elsewhere and must use biomass (wood or agro-residues) as fuel. The project must offer scope for an EURO-ASEAN partnership, it must not have negative impact on the environment, and finally, it must be replicable.

• *Do you know of other, similar projects? Please indicate.*

EU/SOUTH AMERICA
UNDP/ESMAP

• *Other ideas/information:*

Further to the approval of the Member states of the European Union, the EC-ASEAN COGEN programme will enter a new 5-year phase in 1999 with funding of 25 MEURO. The technical scope of the programme will be extended to include, not only biomass energy projects, but also clean and efficient cogeneration technologies utilizing gas and coal.

Project Title:	**Pico-hydro village power**
Host country:	**Ethiopia**
Partner:	**EU-Comission**
Contact person:	Dr. Nigel Smith The Nottingham Trent University Faculty of Engineering & Computing Burton Street Nottingham NG1 4BU Phone: 44-115-9486100 Fax: 44-115-9486567 E-mail: eeedept@ntu.ac.uk Artur Runge-Metzger European Commission DG VIII.A.6, G-12 5/10, 200 Rue de la Loi 1049 Brussels Phone: 32-2-299.98.42 Fax: 32-2-299.09.61 E-mail: Artur.Runge-Metzger@dg8.cec.be
Project Purpose:	Establish sustainable local manufacture and installation of innovative pico hydro systems
Executing Agency:	The Nottingham Trent University
Project period:	1998 – 2001
Financial support:	EC Environment in Developing Countries Budgetline: 0.1 mio. DfiD co-funding: 0.1 mio. ; Nottingham Trent: 0.05 mio.

- *Main Targets:*

The major objective is to develop the use of renewable sources of energy for sustainable economic growth. Specific targets are the installation of demonstration units and infrastructure to encourage manufacture, sales and productive use of standardized pico hydro systems.

- *Methods and Procedures:*

1. Transfer of pico hydro technology (up to 5 kW) to private workshops, so as to enable local manufacture to take place.

2. Instalment of two demonstration units and assess their socio-economic impact.

3. Appraisal of key markets for pico-hydro in Sub-Saharan Africa.

4. Identification of technical and non-technical barriers to technology transfer.

5. Production of guidelines for pico-hydro programmes in SSA.

6. Establishment of a network for information dissemination.

7. Publication of manuals and practical handbooks on pico hydro manufacture, installation and end-uses/income generation from pico hydro systems.

- *Experience*:

Similar programmes in Indonesia, Nepal and Sri Lanka have proven to be viable. The major advantages of Pico hydro systems are their affordability by local communities, low risks, low transaction costs, portability and easy to re-sell (can be used by banks as collateral), installation by purchaser possible. Usable for battery charging services. In Nepal, installations have increased from ten per year to more than hundred per year.

- *Access to financing:*

Pilot testing, training,

- *Crucial factors and conditions:*

Existence of natural hydro power resources and locally interested private sector manufacturers.

Programme title:	**Optimal Utilisation of Energy in Latin America (ALURE)**
Host region:	**Latin America**
Partner:	**EU-Comission**
Contact person: and address	Mr. J.F. Aguinaga European Commission DGIB, E-mail: jean-francois.aguinaga@dg1b.cec.be
Project purpose: (approach used)	ALURE is a co-operation programme between the EC and the Latin America which aims at bringing European and L.American energy actors closer to each other
Executing agency:	ALURE is made of different projects in various LA countries. There has been assigned to various executing agencies (mainly energy consortia from the EU)
Project period and costs:	1998-2002 50.000.000 Euro (EC contribution: 25 Mio .Euro)

Requested specific information:

- *What are the project's main targets?*

To bring in contact European and Latin American energy actors seeking the mutual benefit, taking into account both economic and environmental impacts.

- *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology?*

The programme aims at improving the performance of the energy companies at technical, economic and financial level with emphasis on the rapidly growing sub-sectors (electricity, natural gas,….)

It also contributes to the adaptation of institutional and regulatory framework

All of its activities are planned with a view to promoting sustainable development.

ALURE is demand-driven; it is based upon calls for proposals.

- *Which instruments are used to improve the respective groups' access to information and their knowledge of climate relevant technologies?*

We have established an outside information office (Alure Support Team) who has created a website (www.ALURE.NET) disseminating information in Spanish, Portuguese, French and English.

• *Which positive experience has been gained up to now (lessons learned / best practices) and how is it diffused / applied in other projects?*

The companies involved are interested primarily, in energy efficiency oriented projects which shows that this is a much promising area for co-operation in the region. Intended generally to promote rational energy use, this type of projects aim specifically to reinforce policy for more efficient energy by demonstrating the feasibility of new schemes at all different policy levels (federal, state, provincial and local). Some, examples, can be mentioned:

• Strategic support for energy efficiency in Brazil: In cooperation with ELETROBRAS and a EU consortium (France, Spain and the United Kingdom).

• Energy savings in industry, transport and services in Peru: Partners from Spain, Italy and the Netherlands are supporting CENERGIA in its cogeneration efforts.

• Establishment and enforcement of energy standards and rules in the Chilean building industry: The ministry for housing and town planning is receiving advice from partners in Spain, Greece, Italy, the Netherlands and Portugal.

• Development of a policy for rational use of electricity in Argentina: The energy board has partners from Denmark, Spain and France.

The experience gained by this programme in Latin America is transferred to other EC programmes in other geographical regions.

• *(How) does the project support access to financing of technologies?*

ALURE is not targeted specifically at technology financing issues. However, these issues can be part of a broader project.

• *With respect to technology transfer, which factors and conditions are crucial to the success of the project?*

To be successful, a technology transfer or know-how transfer must be done between actors able to assimilate this transfer (basically local private companies). A correct policy framework conducive to the right energy pricing is necessary for encouraging investment and innovation.

Project Title:	**Regional Biomass Energy Conservation Programme for Southern Africa**
Host countries:	**Lesotho, Malawi, Mozambique, Namibia, South Africa, Zimbabwe**
Partner:	**EU-Comission**
Contact person:	Dr. Agnes Klingshirn GTZ Dag-Hammarskjöld-Weg 1-5 65760 Eschborn Phone: 49-6196-793007 European Commission DG VIII.A.6, G-12 5/31, 200 Rue de la Loi 1049 Brussels Phone: 32-2-299.98.42 Fax: 32-2-299.09.61 E-mail: anne.deligne@dg8.cec.be
Project Purpose:	Enhance capacities and commitments of governments and institutions to plan and implement integrated biomass energy conservation programmes.
Executing Agency:	GTZ
Project period:	1998 – 2001
Financial support:	EC Tropical Forest Budgetline: 1.6 mio. GTZ co-funding: 0.5 mio.

Requested Specific Information

- *Main Targets:*

Fulfill energy needs of households and small-scale industries in a socially and environmentally sustainable manner.

A major aim is to increase energy efficiency of biomass energy through technology transfer and thereby to reduce

- the workload of women for collecting biomass fuel by 30 %,
- air pollution caused by cooking by at least 50 %,
- the consumption of biomass energy in small scale industries (e.g. tobacco curing, fish smoking, brick burning, bakeries) by at least 20 %.

- *Methods and Procedures:*

1. South-south exchange of information on good practice: A management information system about biomass energy demand and supply, energy-efficient

technologies, national biomass conservation strategies has been set up and is accessible to partner organizations.

2. Capacity building: Partner-country specialists are trained in planning, implementing and monitoring integrated and sustainable biomass energy conservation projects

3. Pilot projects: The introduction of integrated energy-saving measures for households and small businesses into interested projects in pilot areas is enhanced.

4. Advisory services for planning integrated biomass energy conservation measures are used by national policy and decision-makers of institutions/organizations.

5. South-south networking: A support network of local organisations in the region has been established and provides advisory services for the implementation of biomass energy conservation measures.

- *Experience:*

Similar programmes in West and East Africa were very successful in cutting down biomass energy requirements.

- *Access to financing:*

Training, pilot programmes, networking

- *Crucial factors and conditions:*

Strong local ownership of governments, development institutions/organisations and private sector is seen as essential.

Project Title:	**Programme Régional Solaire (Regional Solar Programme)**
Host region:	**Sahel Countries (West Africa)**
Partner:	**EU-Comission**
Contact person:	François Kabore CILSS PO Box 7049 Ouagadougou 03 Burkina Faso Phone: 226-30-6757 Fax: 226-30-7247 Pierre Peligry European Commission SCR.C.2, CHAR 03/186, 200 Rue de la Loi 1049 Brussels Phone: 32-2-299.32.17 E-mail: pierre.peligry@scr.cec.be Eric Donni European Commission DG VIII.A.3, G-12 5/97, 200 Rue de la Loi 1049 Brussels Phone: 32-2-295.12.59 Fax: 32-2-299.06.03 E-mail: eric.donni@dg8.cec.be
Project Purpose:	Village water supply and solar pumping in the Sahelian countries.
Executing Agency:	CILSS (Comité Permanent Inter-Etats de Lutte contre la Sécheresse au Sahel) and the national “Directions de l’Hydraulique”.
Project period:	1989 (signature of the financing convention) – ± 1997
Financial support:	European Development Fund: 64 Mio.

Requested Specific Information:

- *Main Targets:*

The Regional Solar Programme (RSP) has installed approximately 630 photovoltaic (PV) pumping systems, which provide water to over one million rural dwellers. Approximately, 1.300 kWp were installed in nine Sahelian countries (Niger, Tchad, Cap Vert, Gambie, Guinée-Bissau, Mauritanie, Sénégal, Burkina Faso, Mali).

The Programme was based on a rational use of natural resources with a global objective to successfully improve the overall living conditions of rural people. The RSP is a technology transfer programme with the specific goal to provide a cost-efficient safe drinking water supply service for the rural poor in the Sahel.

- *Methods and Procedures:*

The Programme is based on two important principles:

- A strong user participation,
- The promotion of the private sector in the Sahel.

Strong beneficiary participation was considered as the main element to guarantee the life span of the equipment. A financial contribution is made by the local population to pay for recurrent costs: salaries of watchmen and caretakers, maintenance and repair, and spare parts (except for solar panels).

The private sector plays an important role in the maintenance of the systems and the transfer of technology in the Sahelian countries.

- *Experience:*

The RSP is considered a success and a point of reference in terms of PV pumping. PV pumping is now considered a viable option for rural water supply in West Africa. However, this Programme has not yet created a 'snowball' effect and, for the moment, other donors have not replicated it.

- *Access to financing*:

The technology (PV panels) was financed by EDF grants. EDF financed also tests and monitoring of the PV panels to prove its viability under Sahelian conditions.

- *Crucial factors and conditions:*

As indicated strong participation of the users was considered as the main condition of success.

Project title:	**Wind Energy Project**
Host country:	**Egypt**
Partner country:	**Denmark**
Grant type:	Bilateral
Main target group:	The poorest population
Executing agency:	Ministry of Electrical, Government of Egypt ,New and Renewable Energy Authority (NREA)
Project period:	1991-97 (6 ½ years)
Danish grant / total project grant:	DKK 38,1 million / DKK 38,1 million

Requested specific Information:

- *Development objectives, including environmentally sound technologies:*

The long term *development objective* of the project is to improve the capacity of the Government of Egypt in the field of wind energy, which is a pollution free power production. The *immediate objectives* are:

i) to implement a national wind energy centre to produce electrical power. The centre is important for the future development and construction of a wind energy sector in Egypt. The centre will also include general training in wind turbines technology to improve institutional and technical capacity within NREA.
ii) to implement a demonstration wind farm;
iii) to demonstrate ability of local manufacturers to supply locally produced wind turbine components; and
iv) to produce a wind atlas concerning the coast of the Red Sea.

- *Best practices:*

There are different outputs and effects of the project. First of all NREA has obtained know-how on planning, design, implementation and operation of wind farms. Secondly, the demonstration wind farm has provided a demonstration of wind energy technology under Egyptian conditions and the average annual power output during a two years period has been close to the estimated output. Thirdly, NREA has established operation and maintenance organisations for wind farms and is planning future wind farms. Finally, locally manufactured towers and blades under supervision by Danish suppliers has been produced, and this show local capability to produce wind turbine components.

Overall, the project has demonstrated the technical viability of wind turbines in Egypt and the know how transferred via the project is relevant for development of future wind farms.

- *Available project documents:* N/A

Project title:	**Wind Farm Project Zafarana**
Host country:	**Egypt**
Partner country:	**Denmark**
Grant type:	Bilateral and mixed credit
Main target group:	The whole population (almost 93% of the population is grid-connected)
Executing agency:	Danida and the Egyptian New and Renewable Energy Authority (NREA)
Project period:	1999-2003
Danish grant / total project grant:	DKK 253.1 million / DKK 253.1 million

Requested specific Information:

- *Development objectives, including environmentally sound technologies:*

The development objective is to contribute to economic development through provision of clean, cost-efficient energy from large scale utilization of wind energy in Egypt.

The immediate objectives are:

- To demonstrate the viability of productive and economic potential of large wind farms at the Gulf of Suez

- To develop the institutional capacity to plan and implement wind energy project and to operate and maintain large wind farms in Egypt.

The project consists in two components:

- Installation of a 30 MW wind farm co-financed by a Danida grant for the the supply and erection of the turbines, the foundations and the control and monitoring system and by a Egyptian Government grant to cover the civil and electrical works.

- Installation of an other 30 MW wind farm which is financed by NREA via Danida's mixed credit facility.

- *Best practices:*

The project is only in the implementing phase, and there is therefore no available information.

Training in operation and maintenance of large wind farms is integrated in the Danish wind turbine manufacturers contract.

Project title:	**UNEP Collaborating Centre on Energy and Environment (UCCEE)**
Host:	**Multilateral**
Partner country:	**Denmark**
Main target group:	Developing countries
Executing agency:	UNEP Collaborating Centre on Energy and Environment (UCCEE) at Research Centre Risø
Project period:	1990-99 (9 years)
Danish grant / total project grant:	DKK 43.92 million / DKK 43.92 million

Requested specific Information:

- *Development objectives, including environmentally sound technologies:*

The UNEP Centre is a co-operation between UNEP, the Danish Ministry of Foreign Affairs and Risoe National Laboratory, Denmark. The *main objectives* is through research and planning to contribute to the reduction of the pollution of energy activities and accommodation of the growing need for energy services through a more effective use of energy in developing countries. The UNEP Strategy and Work programme on Energy is organized as three parallel and interlinked sub-programmes:

  - Promoting energy efficiency technologies and policies, and low environmental impact energy resources.

  - Catalysing use of methodologies, tools and approaches for incorporating environmental principles into energy sector analysis.

  - Analyzing social, environmentally and economic impacts of energy sector institutional restructuring.

In addition to the substantive programme activities the Centre maintains two general functions in terms of general support to the mandate of UNEP in the area of energy and climate change:

  - Scientific backup and programme support to UNEP (Especially Energy and Climate Change)

  - Information centre on energy, environment and climate change issues.

- *Best practices:*

The Centre has contributed to the transfer of environmentally sound technology in the field of renewable energy and capacity building.

- *Available project documents:* N/A

Project title:	**Trust Fund for Rural and Renewable Energy**
Host country:	**Multilateral**
Partner country:	**Denmark**
Grant type:	Multilateral
Main target group:	Populations in rural areas
Executing agency:	The World Bank
Project period:	1998-2000 (2years)
Danish grant / total project grant:	DKK 30 million / DKK 30 million

Requested specific Information:

- *Development objectives, including environmentally sound technologies:*

A Danish trust fund has been established within the framework of the World Bank with a view to promoting World Bank effects in the field of rural and renewable energy, thereby securely a greater use of renewable energy sources, especially the use of biomass.

- *Best practices:*

The project has yet not been evaluated, and it is therefore too early to comment on any best practices.

- *Available project documents:* N/A

Project title:	**Energy Sector Assistance Programme (ESAP)**
Host country:	**Nepal**
Partner country:	**Denmark**
Grant type:	Multilateral
Main target group:	The rural population
Executing agency:	Alternative Sector Promotion Centre (AEPC)
Project period:	5 years (1999-2003)
Danish grant / total project grant:	DKK 154 million / DKK 154 million

Requested specific Information:

- *Development objectives, including environmentally sound technologies:*

The *development objective* for the ESAP is to improve the living conditions of the rural population by improving its access to energy technologies with better performances in terms of productivity, use versatility and environmental impacts. The *immediate objectives* for the ESAP is to improve the availability, productivity and sustainability of the public and commercial infrastructure for planning, promotion, maintenance and financing of renewable energy sources like cooking stoves, micro- and mini hydropower, solar and wind energy. For the initial five years phase, the ESAP activities include:

  - Promotion of improved Cooking Stoves to enhance the kitchen environment and indoor climate of rural women.

  - Support for micro-hydro development in off-grid areas.

  - Promotion of Solar Energy, that aims at making electricity for basic household consumption available to rural household in off-grid areas.

  - Investment support and other activities.

- *Best practices:*

The project is only in the implementing phase, and there is therefore yet no evaluation on best practices.

- *Available project documents:* N/A

Project title:	**Energy – Sustainable utilization of firewood in Niger**
Host country:	**Niger**
Partner country:	**Denmark**
Grant type:	Bilateral
Main target group:	The rural people
Executing agency:	The Ministry of Water, Power and Environment and the Ministry of Mines and Energy in Niger
Project period:	3 years (1998-2002)
Danish grant / total project grant:	DKK 22.8 mil. / DKK 22.8 mil

Requested specific Information:

- *Development objectives, including environmentally sound technologies:*

The *main objective* of the project is to develop a sustainable forest management policy in Niger through a development of sustainable fuel wood utilization. The project is based on the following three main elements:

- Participatory development of wood resources (Rural Market) where exploitation, sale of products, and levying of taxes is entrusted to a Local Management Structure.

- Differentiating taxation on forestry products in order to levy higher taxes on fuel wood originated from zones which are not targets of forest development investments.

- Control of wood transport and control of the implementation of management plans financed through fiscal revenues.

This tax system makes it in the interest of the involved actors to participate in regulated firewood production and trading. A three times higher tax is imposed on firewood that comes from areas outside the regulated markets, and this provides an incentive to utilize firewood in a sustainable way.

- *Best practices:*

The project is innovative, is based on natural economic incentives for all involved, and provides a major contribution to the sustainable management of forest resources in Niger. The participatory approach will establish democratic institutions at the base, and will create jobs which will be a source of income to the rural environment.

- *Available project documents:* N/A

Project title:	**Licensed Production collaboration between Solarmatics (Pvt) Ltd, Harare, Zimbabwe and OI-Electric, Maarslet, Denmark.**
Host country:	**Zimbabwe**
Partner country:	**Denmark**
Grant type:	Bilateral, Private Sector Development
Main target group:	Health care clinics
Executing agency:	The Co-operation Partners
Project period:	1997-99 (3 years)
Danish grant / total project grant:	DKK 2.91 million / DKK 2.91 million

Requested specific Information:

- *Development objectives, including environmentally sound technologies:*

The *main objective* of the project is to establish in Zimbabwe the production of photovoltaic (PV) powered vaccine refrigerators primarily for the African markets, but also for the world-wide market of developing countries in need of primary health care facilities. The reason being that the storage of vaccines in health care centres requires stable temperatures ranging between 0-8 degrees Celsius. A Danish company will provide PV powered vaccine refrigerator technology in the form of technical data, key components and initial training in the technology and working environment of a Zimbabwean-owned company.

- *Best practices:*

The project has yet not been evaluated, and it is therefore too early to comment on any best practices.

- *Available project documents:*

General documents on The Danida Private Sector Development Programme.

Finland

Introduction

This document presents 4 examples of best practices of technology transfer in the context of mitigation of the Climate Change in Finnish Development Co-operation.

In reference to technology transfer, the following points should be emphasised:

Enabling Conditions and Capacity Building are Needed

Effective technology transfer definitely involves more than the acquisition and utilisation of new hardware. In many developing countries, the governments and enterprises do not have the human, institutional, technical and financial capacities needed to apply cleaner production approaches. Strong public preference is another key catalyst for cleaner production and products

Decision-makers in developing countries may not be aware of the technological alternatives available. The development of awareness and accessibility to information on appropriate technological solutions is, therefore, one of the first steps towards cleaner production. Training to provide the skills for cleaner production must be part of comprehensive efforts to improve the country's technological and scientific capacity.

Developing country governments themselves have an important role in establishing the enabling conditions for technological change. These include political, social, macro- and micro-economic factors. Environmental regulations need to be complemented by effective enforcement procedures. There should be an appropriate policy mix of regulatory mechanisms and economic instruments.

Consumers need to be informed, educated and motivated to orient their demands towards environmentally sound processes and products. Environmental awareness should be built at the household and community levels, and particular attention be paid at the role of women, who in many countries procure and manage an important share of household goods. NGOs have an important role to play in raising environmental awareness.

Cleaner Production or End-of-pipe Technologies?

Environmentally sound technologies may involve both preventive cleaner production and end-of-pipe pollution control. These two strategies are often complementary.

Cleaner production technologies reduce pollutants and the consumption of energy and natural resources by introducing changes to the core production technology. Thus climate benefit may be achieved in conjunction with financial and economic benefits and technological improvements. Cleaner production technologies may include goods and services, equipment, technical know-how, and organisational and managerial skills and

procedures.

In contrast, end-of-pipe (pollution control) technologies are those which involve the installation of equipment for treatment of pollution after it has been generated. These technologies often add to manufacturing costs without adding to production. End-of-pipe technologies may also create new environmental problems such as recycling and disposal of wastes from treatment facilities.

Development Assistance Can Be a Catalyst

Most technologies, including environmental technologies, are transferred to developing countries through regular commercial channels. Official development assistance (ODA) can not, and should not, substitute financing that the market should provide on commercial terms. Development assistance programmes can promote the spread of cleaner production in developing countries by strengthening their capacity to manage technological change, disseminating information on cleaner production, supporting policy reforms and helping to attract investment capital.

Foreign direct investment can play an important role in the process of promoting, developing, disseminating and financing environmentally sound technologies. Investment options include joint ventures, international sub-contracting, licensing and technology partnership arrangements, franchising, management contracts, and production and risk-sharing arrangements. Through such mechanisms, developing country firms can obtain access to their foreign partners' cleaner production technology.

Export promotion is one of the options available to governments for influencing the volume and type of goods and services exported. The potential instruments include e.g. export and concessional credits, guarantees, direct equity investment and grants.

Where commercial finance is not forthcoming, concessional finance can be justified on "development quality" grounds, such as positive externalities and demonstration effects. Donor-assisted financial mechanisms can only serve to mobilise, multiply or replenish existing and additional financial resources.

Aid agencies can assist developing countries in raising awareness about financial resources available for environmentally sound production. Assistance can be provided to improve access to commercial credits and banking sector's capacity to evaluate environmental projects in their lending activities.

On the other hand, financing agencies could also conduct environmental reviews of their export credit and promotion activities to determine whether the exports in question are environmentally beneficial or detrimental. General methodologies and procedures are available for screening such exports to ensure that they are environmentally and socially appropriate, and also that they encourage capacity development to the maximum.

In order to widely promote technology transfer, there is a need for technology policy

dialogue that involves all relevant stakeholders, i.e. governments, private sector, research community, donor agencies, non-governmental organisations and the civil society.

The aid agencies can assist in bringing together these different actors and so facilitate a national policy dialogue.

Furthermore, even though technologies often originate from industrialised countries, there is an ever increasing number of "indigenous" technologies emerging from developing countries that are environmentally and socially appropriate and offer practical solutions to mitigating local environmental problems.

Finland is at present supporting the development of industrial environmental management and cleaner production in Egypt, Nicaragua and Nepal. Finland is also strengthening environmental administration and monitoring systems in co-operation with Kyrgyz Republic, Namibia and Mozambique. A special environmental co-operation fund for Central Asia is being established jointly with the Asian Development Bank.

Finland has long traditions in forest sector co-operation and is currently supporting the improvement of forest management practices in Namibia, Tanzania, Vietnam and Central America to name but a few (*Project Brief 4*). Direct climate sector co-operation is carried out in Central America through the development of meteorological facilities and information management in the region (*Project Brief 2*), and support to the implementation of the FCCC in Nicaragua (*Project Brief 1*). Transfer of new technologies, such as waste water treatment and energy production, including district heating (*Project Brief 3*), combined heat and power generation and circulating fluidized bed boiler technology, has been supported through the concessional credit mechanism, China being the main recipient country.

Project title:	**Meteorology development programme in the Central American isthmus**
Host region:	**Central America**
Partner country:	**Finland**
Contact person:	Marianne Sågbom Finnish Meteorological Institution P.O. Box 503 FIN-00101 Helsinki Finland Tel: +358-9-1929 2210 Fax: +358-9-1929 4129 e-mail: marianne.sagbom@fmi.fi
Project purpose:	Rehabilitation and improvement of meteorological and hydrological services of the countries in the Central American isthmus.
Executing agency:	Ministry for Foreign Affairs, Department for International Development Co-operation Finland Financial and technical co-operation
Project period:	1991- 1999
and costs:	41,9 million FIM

- *What are the project's main targets?*

- *What technologies are applied and how do they contribute to the targets?*

The programme aimed to enhance the capability of the National Meteorological and Hydrological Services (NMHSs) of the Central American countries (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama) to provide information to the different sectors of development of the countries, as fundamental support to the socio-economic development of the Central American countries. Indirect effects or impacts can be found in sectors like environment, agriculture, water, tourism and public safety. Others sectors, like energy, human settlements, health and industry are benefiting indirectly as well.

- *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology?*

- *Which instruments are used to improve the respective groups' access to information and their knowledge of climate relevant technologies?*

  · Installation of various meteorological and hydrological observation stations in order to create a regional network (incl. upper-air stations, automatic stations)

  · Installation of a satellite based two-way telecommunication system to provide

the countries with real-time access to the data and products of the World Weather Watch system and to transmit the observations from the countries in real-time to the global telecommunication system

· Horizontal training for operators and system administrators

· Updating of software for climate data banks and statistical applications; acquisition of computers

· Training of local high-profile specialists (post-graduate studies at the university)

· National research and identification of the most appropriate sectors for starting the development of basic applications within each country

· Strengthening of the regional co-ordinating committee of water and climate, CRRH (Comité Regional de Recursos Hidrológicos)

· Evaluation seminar on the development potential of meteorological and climatological applications in the Central American isthmus

· Improvement of co-ordination with all parties involved

The programme established operational climate data management systems in all project countries. They made possible the old information to be rescued and become easily available for different applications among several socio-economic sectors, e.g. civil defence, agriculture, power generation, transportation, fishery, forestry, livestock, tourism and water resources management. In general, the programme supported the Central American countries' participation in international environmental conventions and provided them with the means to fulfil their obligations.

• *Which positive experience has been gained up to now (lessons learned / best practices) and how is it diffused / applied in other projects?*

The programme came in a situation when some of the National Meteorological Services in the region were completely down. After the implementation of the programme the services acquired an improved capacity in observing, telecommunication, data processing and data management systems to deal with the increasing demands of the society. The basic foundations laid down by programme activities proved to be a spin-off for further and faster development of National Meteorological Services and the CRRH. New regional initiatives have arisen exploiting the experience gained and infrastructure created with the programme. An initiative for a Central American regional water resources plan will be presented in Central American Parliament (PARLACEN).

The regional Climate Change Project, established in 1988, utilises the data bases provided by the programme to analyse time series as well as to conduct sensibility analysis on

climate variability. Furthermore, the results of the programme benefit the Support to the Implementation of the UN FCCC in Nicaragua (project brief above).

The influence of CRRH has increased in the region. It is participating actively in the activities of the Central American Integration System (SICA) and preparing studies for the Central American Commission of Environment and Development (CCAD) on climate change and water resources.

- *Does the project support access to financing of technologies (and how)?*

The development process initiated by the Project has served as a spin-off for other environmental co-operation programs, e.g. the Climate Change component of PANIF (Programa Ambiental Nicaragua - Finlandia), co-operation of the University of Costa Rica and the Belizean Meteorological Service with National Oceanic and Atmospheric Administration (NOAA), USA. Government recognition of and support to the NMHSs has increased in recent years because of the obvious contribution the NMHSs can make in drought monitoring, natural disasters preparedness, food security, climate change, El Niño, La Niña and environmental issues.

In Costa Rica, for instance, the studies produced by the strengthened National Meteorological Institute have been actively utilised promoting Activities Implemented Jointly. In Belize the programme results have served as a boost to other financing such as the US Country Studies Climate Change Program, the Storm Surge and Flood Mapping Project funded by the OAS and a Coastal Zone Project to Address Sea Level Rise also to be funded by the OAS.

- *With respect to technology transfer, which factors and conditions are crucial to the success of the project?*

Internal institutional capacity building is a key factor for the potential evolution of the Central American Meteorological and Hydrological services and their expected contribution to the needs of their societies. The NMHSs need also high-profile meteorologists in order to carry out planning and development processes or to improve forecast reliability.

An adequate capacity of the NMHSs to maintain the networks functioning after the external funding has finished is essential for long-lasting results. It is still difficult to get local commitment to assign high priority in terms of budget allocation. Local conditions must be well assessed, e.g. automatic observation stations may be convenient in sparsely populated areas, but they also need even more frequent and costly maintenance.

The international expert services related to real-time operational systems should be carried out in close co-operation with colleague institutions responsible and with recognition and up-to-date experience of running similar operational systems.

In order to use the improved meteorological information in the mitigation of the effects of extreme weather conditions, it is necessary to develop an adequate national

emergency preparedness system that would incorporate all the necessary actors from identification of danger through early warning to decision making and preventive action.

- *Do you have information on other, similar projects? Please indicate.*
  WMO/SADC Meteorology Programme in Southern African countries.

Project title:	**District heating in Chinese cities (Mudanjiang, Taiyan, Zhengzhou and Harbin)**
Host country:	**China**
Partner country:	**Finland**
Contact person:	Timo Kallio IVO Power Engineering Finland Tel: +358-9-85611 E-mail: timo.kallio@ivo.fi
Project purpose:	Provide new technical ideas and modern equipment as an impetus for the planning and constructing of more energy-efficient district heating plants and networks in the future in China
Executing agency:	Finnish Export Credit, Finland Technical and financial co-operation
Project period: **and costs**	Granted between 1988-1996, Loan amount 11,3-15 M FIM Interest subsidy 4,2-8,5 M FIM

Requested specific information:

- *What are the project's main targets?*

Four projects are here grouped together without formally belonging to the same programme. They can, however, be seen as links in a larger chain of efforts to provide new information and knowledge on modern efficient combined heat and power production and district heating technology to Chinese planners and operators in order to improve the efficiency of centralised heat production, distribution and use and thereby to achieve substantial financial, economic and environmental benefits. The purpose of the programme is also to attract more financial resources from all kind of sources for District Heating sector investments by demonstrating the economic benefits of them.

- *What technologies are applied and how do they contribute to the targets?*

There is a vast potential for efficiency improvement in Chinese district heating, and since DH is almost 100 % based on coal, there are also huge potentials for the reductions of CO2-emissions. At present, Chinese district heating and electricity productions utilise only a small part of the large potential for co-production. Increased co-production would reduce fuel consumption and emissions considerably.

The projects typically consist of the planning and design of a model district heating system for a limited part of a city and the supply of equipment, instruments, materials and spare parts for the heating system as well as consulting services and training of the personnel for the erection, operation and maintenance of the equipment.

Modern Scandinavian type technology and technical thinking, which represent the state of the art, is in the process of being accepted and adapted by Chinese design institutes, manufacturers and users. However, the transfer is a slow process.

• *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology?*

• *Which instruments are used to improve the respective groups' access to information and their knowledge of climate relevant technologies?*

Since these projects are not part of the bilateral development cooperation of Finland, but are financed through concessional credits and developed through business-to-business negotiations, the possibilities of the Finnish Development Co-operation to actually influence the objectives and scopes of the project are rather limited. The Finnish project developers strive to give as much information about the possibilities to solve various problems, but the final decision-making naturally lies with the client.

• *Which positive experience has been gained up to now (lessons learned / best practices) and how is it diffused / applied in other projects?*

The new technology for the district heating generation and distribution alone is expected to bring about a 10 % reduction in fuel use and CO2-emissions. Full utilisation of the co-production potential could bring about a further reduction of about 25% in the combined emissions from power and heat generation from coal, but so far the financial possibilities and prioritisation on the Chinese side have not made large scale converting of power plants possible.

• *Does the project support access to financing of technologies (and how)?*

There are good hopes that these model projects are serve also to attract more financial resources both from within China and from International Financial Institutions such as the World Bank and the Asian Development Bank. Better coordination between donors would be beneficial.

• *With respect to technology transfer, which factors and conditions are crucial to the success of the project?*

It is a time-consuming process. China is a large and in many ways rather conservative country. Persistency and tenacity are key properties. Perhaps some more mild conditionalities could be introduced also by bilateral donors.

• *Do you have information on other, similar projects? Please indicate.*

Doboj and Sarajevo district heating in Bosnia-Herzegovina.

Project title:	**Reforestation and natural forest management project**
Host country:	**Indonesia**
Partner country:	**Finland**
Contact address:	Reforestation Technology Centre (Balai Teknologi Reboisasi, BTR) Banjar Baru, Indonesia Tel: +0519 2085/ 2587/ 92587 Fax: +0519 92587
Project purpose:	1. Developing grassland reforestation methods. 2. Developing sustainable rehabilitation and management techniques of logged-over natural forests.
Executing agency:	Ministry for Foreign Affairs, Department for International Development Co-operation Finland Technical co-operation
Project period:	1995-1998
and costs	8 M FIM (phases V to VII) (Original start: 1981)

Requested specific information:

- *What are the project's main targets?*

- *What technologies are applied and how do they contribute to the targets?*

Indonesia, like many other countries in Southeast Asia, has faced severe problems due to rapid deforestation and subsequent expansion of alang-alang (*Imperata cylindrica*) grassland areas. The project aimed to develop reliable technology and methods for reforestation of alang-alang dominated grasslands and for rehabilitation of logged-over tropical rainforests in general in Indonesia. Since no reliable background information was available, the project developed basic methods for both nursery and reforestation techniques, such as species selection, silvicultural treatments and rotation trials. The development of nursery techniques for indigenous rainforest species, gap and line planting techniques and other silvicultural procedures gave valuable tools for the rehabilitation and sustainable management of logged-over natural forests in Indonesia.

- *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology?*

- *Which instruments are used to improve the respective groups' access to information and their knowledge of climate relevant technologies?*

The project included a Transfer of Knowledge sub-project in order to insure proper publication and dissemination of information collected during the life-time of the project. The aim was to make sure that all the main findings will be permanently recorded and made

available to both scientific and practical forestry organisations in Indonesia and elsewhere.

The methods used included:

· continuous on-the-job training by preparing scientific articles and reports together with Indonesian counterparts

· several international and national workshops and seminars

· upgrading of education of local Indonesian counterparts with studies abroad (MSc. level) financed by the project

· training courses on scientific analysis, writing and publishing

One component of the project was to develop agroforestry practices that could be used simultaneously while establishing fast-growing plantations on alang-alang grasslands.

• *Which positive experience has been gained up to now (lessons learned / best practices) and how is it diffused / applied in other projects?*

The project was carried out for almost 20 years and the new phases built on the bases created by the previous phases. The project has been a key factor in removing pressure from the utilisation of the still remaining natural rainforests by converting unproductive alang-alang grasslands to productive use. The project demonstrated that at least partial rehabilitation of a rainforest ecosystem is possible. The methods developed have been widely accepted and adopted by several Industrial Timber Estate companies in Indonesia, thus proving their usefulness and cost-effectiveness. Furthermore, the international research community and other relevant parties, such as environmental INGOs, have recognised the achievements of the project.

Resulting from the project, a new Indonesian research publication was born and the results of the project have been spread to interested Indonesian readers and researchers via this publication.

• Does the project support access to financing of technologies (and how)?

Not directly, but due to the long-term experience gained and the extensive amount of published material on the project, a clear raise in the interest of private investors and enterprises towards introducing sustainable forest management principles in Indonesia can be observed.

• *With respect to technology transfer, which factors and conditions are crucial to the success of the project?*

These are technologies whose success ultimately depends on how they are adopted by the private sector, which will be the key actor in reforestation and sustainable forest

management in Indonesia. In this, the following factors have contributed to the project success:

- For creating groundbreaking technologies from scratch, a long-term commitment of the project financier has been essential

- A multidisciplinary, yet practical approach in project implementation, so that the results would be attractive to potential investors. This entails:

    - Applicability of results in commercially oriented investment projects

    - Due observance of environmental impacts (positive and negative)

    - Developing a practical approach to combine afforestation with general rural development, taking into account the costs and benefits to different stakeholders (villagers, investors, contractors, etc.)

    - Economic and political stability as well as attractive investment climate

    - Financial and political commitment of the government and local administration for maintenance of the trial areas and in order to protect the areas from logging and uncontrolled burning

    - Transfer of knowledge to counterpart organization was hampered by counterpart staff rotation.

- *Do you have information on other, similar projects? Please indicate.*

This project has led to extensive economic and investment cooperation between Finland and Indonesia in the private sector.

Project title:	**Support to the implementation of the UN Framework Convention on Climate Change**
Host country:	**Nicaragua**
Partner country:	**Finland**
Contact person:	Mario Torres Ministerio del Ambiente y los Recursos Naturales de Nicaragua (MARENA) Tel: +505-263 2596/233 4690 Fax: +505-233 1868 E-mail: cambiocl@ibw.com.ni
Project purpose:	Hinder environmental degradation in Nicaragua. A specific aim is the promotion of effective implementation of the UN Framework Convention on Climate Change in Nicaragua
Executing agency:	Ministry for Foreign Affairs, Department for International Development Co-operation Finland Technical co-operation
Project period: **and costs**	1998-2001 12,9 million FIM

Requested specific information:

- *What are the project's main targets? What technologies are applied and how do they contribute to the targets?*

The project is part of a wider Environmental Support Project between Finland and Nicaragua. The support to the implementation of the Convention on Climate Change assists Nicaragua in organisational and institutional capacity building. Nicaragua has ratified the FCCC in 1995.

Nicaragua lacks effective organisation and co-ordination in and between political formulation and scientific and technical aspects of the FCCC. In order to work properly in the mitigation of climate change Nicaragua needs also improved climatic and hydrologic data networks, and a regular information and observation system for the research on climate change.

The project supports national organisation and institutional capacity building for the implementation of FCCC mechanisms, especially in MARENA (Ministry of Natural Resources and Protected Areas of Nicaragua). Basic information gathering in enabled by reinforcement of climatological and hydrological research and networks

- *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology?*

- *Which instruments are used to improve the respective groups' access to information*

and their knowledge of climate relevant technologies?

- Sectoral studies on the adaptation to climate change

- Seminars and work-shops for and between different stakeholders, such as universities, Members of Parliament, civil servants and technicians.

- Support to the Nicaraguan participation in the IPCC and COPs.

- Translation of relevant climate change material into Spanish; acquisition of books and equipment; access to Internet; a manual for the decision-makers; preparation of Climatic Atlas of Nicaragua.

- A monthly Climatic Newsletter providing information especially on the rainy season and La Niña.

- Public awareness campaigns on climate change through regular articles and advertisements in the main newspapers and journals.

• *Does the project support access to financing of technologies (and how)?*

- In general, through the project as whole, Nicaragua will have more structured and improved possibilities to participate in different financing mechanisms on the mitigation of climate change (such as the Clean Development Mechanism, CDM).

- Gathering of information on relevant experiences in other countries; assessment of the existing proposals on the trade of environmental benefits.

- Development of two pilot experiments in certificated greenhouse gas emission trading on energy and forest sectors.

• *With respect to technology transfer, which factors and conditions are crucial to the success of the project?*

- Integration and commitment of MARENA and normative, institutional and educational decisions at the Government level.

- Co-ordination with other projects and organisations working on the same sector and region.

Project Title:	**CEMENT WORKS, EFFICIENT GRINDERS**
	French Global Environment Fund (FGEF)
Host country:	**CHINA**
Partner country:	**France**
Project purpose:	Energy efficiency in industry
	Greenhouse effect
Executing agency:	French Minister of Economy
Cost and Funding:	Under study (50 to 100 MF for 1 or 2 units)
	Buyer credits + local funding
	FGEF participation < 0.5 MF (under study)

PROJECT SUMMARY

The cement sector in China

In 1995 China is the first producer and consumer of cement in the world. The production capacity is of 415 millions of tons and the consumption is about 400 millions of tons. The total number of cement works is 7000 units among which about an hundred with international standards (cement works producing 1000t/day and more).

For the year 2000 a consumption of 500 millions of tons is predicted, which leads to an annual additional need of 20 millions of tons. This corresponds to the building of ten units of 2000 to 4000 t/day per year and to renovations/extensions of existing units in the same amount.

The grinding systems and the project

The grinding system is the major electricity user post in cement works.

The equipments traditionally used in China are ball-grinders. They are reliable, cheap, but heavy energy consumers. Vertical grinders, principally used in raw grinding, have a good energy efficiency but are restricted to some materials.

With regard to these systems horizontal grinders present several advantages : low energy consumers, flexible (towards the diversity of materials and the different grinder thinnesses), reliable and simple (only one device type). Nevertheless they are more expensive than traditional grinders.

The supply of grinder workshops in different cement works is negotiated at the moment, in particular in the Province of Shanxi. The supply of two units of 2000 t/day is under discussion.

THE STAKES FOR GREENHOUSE EFFECTS AND THE FGEF INTERVENTION

Electricity in Shanxi is produced with coal and the Province is a big producer (about 300 millions of tons/year).

During the life time of the equipment CO2 reductions resulting from the introduction of horizontal grinders have a total of more than 300 000 tons (8 456 MWH/year electricity economy during 20 years). About an hundred of grinding installations of industrial size working in China exhibit an annual consumption of fast 6 millions of MWH, that is rejections of 5 350 000 tons of CO2. If the whole cement works industry is considered, rejections are probably three times larger. And the economy in CO2 deposit, related to the improvement of the grinding in cement works, is of several millions of tons.

The FGEF support aims to **reinforce the guarantee of success of the introduction of this technology in China and to facilitate its local integration**. The application points of the FGEF support would focus **on training, help to local manufacturing and assistance to the start of the concern**. **A follow up/evaluation of the installations** is also included.

Innovative aspects

The horizontal grinding technology was elaborated at the beginning of the nineties. The first industrial applications started in 1995.

The number of grinders working today is about ten, almost in OCED countries. The implementation of this technology in Developing Countries remains innovative. These grinders will be the first of this sort in China.

Project Title:	**ALIZES PROJECTS - RURAL ELECTRIFICATION**
	French Global Environment Fund (FGEF)
Host country:	**MAURITANIA**
Partner country:	**France**
Project purpose:	Decentralized Rural Electrification
Executing agency:	French Development Agency (FAD)
Cost and Funding:	Investment 30 MFF
	State (5 MFF), FAD (15 MFF), FFWE (5MFF)

PROJECT SUMMARY

More than 50 MFF are annually spent in small consumable products (batteries, candles, paraffin oil...) by the rural families non possibly linked to an electric grid in the mid-term (150 000 families spread out among 3000 villages).

The project aims at setting up a process of decentralised rural electrification, which mobilises these amounts in order to introduce, on an economic basis, an electricity service in the areas out of grids. It takes place into an operation launched in 1995 with the support of the UNDP/GEF.

The project is composed of two complementary parts: on a hand, the equipment of around 150 villages and 7500 families; on the other hand, the organisation of the DRE sector and the strengthening of the local capacities, including the settlement of technical, financial and juridical instruments, at various levels (State, local authorities, private operators).

The process will be developed in two phases : a first one, regarding fifteen villages and around 75 families to enforce the results of the pilot operation and set up the new management structures; a second one of dissemination which will allow around 6750 families in 135 villages to be equipped.

The equipment of the families is thought with « energy kits » composed of low consuming bulbs and fed by a mobile battery, with its regulation system.

The producing systems will be determined according to the size of the villages, to the consuming levels and to the local wind potential. They will associate wind-generators and solar equipment for the spread out housing, groups and mini-grids for the centres with concentrated housing.

The body supposed to ensure the implementation and the exploitation of the systems is a Decentralised Electrification Cell and village co-operatives, grouped in a regional association. Private operators have to install and maintain the equipment.

A Fund for the Decentralised Electrification will be created for the funding of the investments. The exploitation balance is ensured thanks to adapted tariffs, which allow the management and replacement burdens to be bore by the users.

THE STAKES FOR CLIMATE CHANGE AND INTERVENTION OF THE FGEF

This project allows to reduce the consumption of fossil fuel by developing a low-emitting in greenhouse gases electrification process. The savings in CO_2 result from the introduction of efficient electric consumption systems (average consumption 50 WH/day/family, for 0,5 to 1kWH/day/family with a conventional system), from equipment of electricity production using renewable energy, when they are economically sound.

The intervention of the FGEF aims at raising the obstacles which locks the dissemination of the process (« win-win » project, with a double dividend for the environment and for development).

The FGEF takes on board the additional costs for the training process, that are the costs of technical assistance, a part of the costs of the Decentralised Electrification Cell (launching and training), as well as the development costs/ experimentation, which remains necessary in order to continue with the adaptation of the solutions of DRE to the Mauritanian context.

Innovative aspects

The setting up of dissemination DRE programmes at a significant scale remain innovative in the developing countries. Very few African countries have began a process at the scale of several thousands of users. The building of DRE structures, national and local, (DEC, village co-operative organised in networks) are First experiences.

The dissemination of energy kits to answer the limited demand of the families(< 50 WH/day) is also an innovative element of the project.

The project is at the pre-dissemination stage, within a perspective of expansion of this sector, and together with expected evolution during the project : increasing implication of the private sector in the project, consolidation of the financial balance, durability of the financing instruments.

Project Title:	**BAGASSE-COAL POWER PLANT**
	French Global Environment Fund (FGEF)
Host country:	**MAURITIUS**
Partner country:	**France**
Project purpose:	Polycombustible biomass power plants
	Greenhouse effect
Executing agency:	French Development Agency
Cost and Funding:	100 M Euros
	Buyer credits, BEI, eigen développer funds
	FGEF participation : 0.5 M Euros

PROJECT SUMMARY

The electrical production capacity in Mauritius is of 364 MW, 256 MW coming from classic thermic power plants. In 1995 the electricity production raised from 383 GWH to 1047 GWH. An increase of the electricity request of 8% per year is predicted by the Central Electricity Board (ECB). This leads to an equipment need of 100 MW until 2000. In order to minimize energy imports (the hydraulic potential is entirely exploited), the government tries to promote bagasse using for energy purposes.

The project consists in putting in a coal-bagasse power plant near the Belle Vue sugar house. The financing and the exploitation are ensured by a private entity, the « Compagnie Thermique de Belle Vue (CTBV) », constituted by two project developers : the Harel group which is the administrator of the sugar house, the SIDEC, a subsidiary company of Charbonnages de France, which exploits two similar entities in Reunion; and the Sugar Investment Trust.

The thermic power plant comprises two identical groups, each constituted by a poly-combustible boiler of 130t/h of saturated vapour at 80 bar and 520° C, combined with a turbo alternator of 30 MW.

During the sugar production from July to November, the power plant uses bagasse for supplying the network and for providing energy to the sugar house (cogeneration). Out of the sugar production, the power plant runs like a standard coal-power plant (from December to June). The yearly expected production consists of 105 GWH coming from bagasse and 220 GWH coming from coal (consumption : 288 000 tons of bagasse and 150 000 tons of coal).

The exploitation will be ensured by CTBV, according to two contracts :

- the first one with CEB sets an agreement of annual collection of 325 GWH (during 20 years) ;

- the second one with the Harel sugar house plans the free disposal of all the bagasse and the modernisation of the sugar house (capacity increase of 200 to 300 T/hour and electrification of the mills) with free energy in exchange (vapour, electricity).

THE STAKES FOR GREENHOUSE EFFECTS AND THE FGEF INTERVENTION

With respect to a classic fuel oil power plant the introduction of coal induces an increase of the CO2 emissions. Nevertheless the use of bagasse allows a sizeable economy of fossil energies, which leads to a global positive reduction of CO2 emissions. Under the working assumptions adopted this economy will be of the order of 1.5 millions of tons (45 000 tons/year, over 35 years, the life time of the equipment).

Two indirect effects of the project are worth to notice : the increase of the energy efficiency of the sugar producer units (resulting from their modernization/concentration) and the improvement of their local environment.

The support of the FGEF aims **to facilitate technology transfers related to the settlement of this technology, which is innovative in developing countries ; and also to ensure a monitoring of the results** by analysing the conditions for its reproducibility.

The FGEF support will be on :

- **the formation of the Mauritian workforce** which ensures the working of the power plant (the power plant will employ about thirty persons) ;

- **the help to the implementation of the innovative technologies in the Mauritian context** (equipment for the regulation of the bagasse output, controls of the centre of electrostatic filters for the treatment of smokes ; high pressure cycles) ;

- **the follow up/evaluation of the environmental performances**.

Innovative aspects

With regard to the installations existing around the world, the Belle-Vue power station is characterised by :

- the bagasse combustion in boilers at high functioning point (thermic efficiency of 90%, overheated vapour : 80 bars, 525° C) ;

- the possibility of instantaneous change of combustibles, without any impact on the energy supply for the customer (from bagasse to coal and reverse) ;

- a continuous working all the year which ensures the economic viability of a much expensive solution relative to the investment ;

- the settlement of innovative technologies for the environment (removal of dust from the smokes, reduction of gaseous rejections and conditions for the storage of bagasse).

Project Title:	**ENERGY EFFICIENCY PROGRAM IN BUILDING**
	French Global Environment Fund (FGEF)
Host country:	**TUNISIA**
Partner country:	**France**
Project purpose:	Low energy consumer buildings
	Greenhouse effect
Executing agency:	French Development Agency
Cost and Funding:	100 M Euros for the investment
	+ 10 M Euros for energy improvements
	Promoters, State, UNDP/GEF and FGEF

PROJECT SUMMARY

The thermic regulation in Tunisia imposes a performance level for buildings in order to improve the level of thermic comfort. The ECA, the Energy Control Agency, is responsible of the progressive implementation of this regulation. This will fully in force in 2002, in order to let an adaptation period to the profession.

Until 2002 the ECA promotes an Experimental Anticipation Program (EAP) which operates on a significative number of property deals and which aims to :

- involve the different contributors of the profession, giving them tools for applying this regulation (software-aided conception, rules of the art) ;

- show the operational character of the regulation and possibly adapt it ;

- reduce the additional costs down to less than 3% of the current building cost.

It is planned that the ECA will operates on 10 tertiary buildings (hospital, school, hotel, office, commercial centre...) and on 36 housing operations (standing, economic and social). The private/public allocation is the following : 31 public and 15 private operations.

The energetic improvement of buildings will take place by means of restricting the additional investment costs to less than 6%. The owners will take part to the financing of these additional costs at a level depending on the building type (about 50%). They could transfer these costs to the final user.

The ECA includes activities for the elaboration of the tools needed for the realisations (labels introduction, sectoral application guides, formation and information for the operators...) and also for going with these realisations (campaign of measurements, communication and sensibilisation addresses to decision makers...).

The project management is ensured by the ECA, which will create a cell specifically devoted to this program and which will work in connection with the different actors of the profession : the Direction of Civil Buildings, the Direction of Housing, the National Property Tunisian Society, the main private promoters...

In order to manage the project, the ECA will gain by the technical assistance of experts with a sound experience in this field. Technical studies, education and training, measurement campaigns will be realized by Tunisian operators working together with specialized offices.

The project is planned for four years and the realisations will mainly take place during years 2 and 3. The assessed EAPcosts are of **10.6 MDT (53 MF)** which split up into **5.9 MDT (30 MF)** of realisation additional costs, of **0.9 MDT (4.5 MF)** of conception aid, **1.4 MDT (7MF)** of follow through/analyse of performances, **1.1 MDT (5.5 MF)** for general escort actions **and 1.1 MDT (4.5 MF)** for the project management of the EAP (technical assistance included).

The EAP represents an investment which amount is estimated to be more than 106 MDT (530 MFF).

The EAP financing is ensured by the participation of **the Tunisian owners (2.6 MDT), of the State through the ECA (2.1 MDT), of the FGEF (2.45 MDT) and of the PNUD/FEM (3.4 MDT)**.

THE STAKES FOR GREENHOUSE EFFECTS AND THE FGEF INTERVENTION

The energy stakes related to the building in South Contries are crucial. The economy of energy deposits are important, as shown by the progresses observed in the OCDE Countries during the last twenty years. In the Developing Countries the actions very often remained at the step of studies or of prototype experimentation.

The FGEF, in taking place into the investment process, will allow to raise the obstacles which hinder the spreading of new practices in the building sector in Tunisia.

The applications points of the FGEF will focus on **technical assistance for the management of the EAP, the thermic improvement studies, the follow through of performances and results** as well as **some technical accompaniment actions** (introduction of the labels and of the sectorial guides, formation sessions intended for operators and owners...).

The outstanding points of the operation which justifies the FGEF participation are :

- the joint implementation of the **regulation** and the **« experimentation at scale 1 »** at a significative scale;

- the existence of a real network of competences in Tunisia and **an acquired experience** of franco-tunisian co-operation in this field ;

- the **taking into account of the financial constraint**, with the goal of finding funds for the financing of additional investment costs, which are restricted in order to be accepted by the operators.

The project which is still at a pre-diffusion stage, has a vocation of being spread through the whole country. The action started up on the regulation of the three Maghreb countries with the support of the European Union would allow extensions in Morocco and Algeria.

Germany

Introduction

Climate protection and sustainable development have a high priority in Germany's international co-operation. The German government is currently (1999) launching the Initiative "Climate Protection for Our Global Future" in its bilateral co-operation with developing countries, which mainly aims at further strengthening renewable energies (wind, solar and biogas energy and small-scale water power). It is intended to commit approx. EURO 100 million (US$ 110 million) in 1999 for projects to promote renewable energies; that amount is one third above the level of previous years. The Initiative will be continued in the coming years.

Germany is hoping that this Initiative will make another significant contribution to the development, use and application of environmentally sound technologies world-wide.

The examples presented by Germany on the following pages provide an insight into best practices and conditions for successful technology co-operation, based on the following understanding:

- Technology co-operation deals with concrete technological solutions for all kinds of economic activities. These solutions may raise or lower GHG emissions. Therefore solutions have to take climate aspects into account, as well as social, economic and other environmental benefits and risks. There are no technologies that only address climate protection.

- Technology co-operation has to take into account countries' technological capacities in order to improve them effectively. These capacities are determined by four interacting factors: the company-level innovative capacities, general conditions (economic, political, administrative, and legal), the direct support provided by technology-oriented institutions (government, intermediary organizations, service enterprises), and the indirect support provided by training and education systems.

From the selected cases, we have drawn four conclusions:

1. The "right" policy framework and economic conditions are critical for the introduction of environmentally sound technologies. A reliable economic structure, minimal market distortions and an established system of environmental and general legal instruments are decisive elements of the framework. Furthermore, a well-developed financial market and the availability of reliable physical infrastructure (transport, energy, communication) are crucial.

2. There is an increasing awareness that "soft skills" (management and technical skills and communication capacity) are essential for the absorption of new technologies and that these skills have to be developed at the level of the end users of the technology. A central task in our projects is to enhance local personnel and institutional capacities, so

that technological issues can be dealt with locally, in an efficient and result-oriented manner.

To improve the soft skills to the extent required by users, different approaches, instruments and methods, adapted to specific tasks, are used. The most common ones are:

- Environmental and energy audits help to identify deficits and opportunities.
- Consultancy assistance to provide specific know-how.
- Setting up advisory services at local or national level to broaden local know-how.
- Training activities in workshops, seminars and on-site are major elements of all projects addressing the transfer of know-how in an integral manner.

The dissemination of information on relevant technologies fosters the understanding of technologies and creates a basis for selecting the most efficient and effective technology for a specific process in, say, an industrial production process or in energy conversion. Adapting and disseminating existing economically viable and clean technologies is a very effective way of using resources. Pilot projects and field testing offer opportunities to gain practical experience.

3. The way a project works matters. Demand-driven approaches based on the expectations of the users of the technology, as well as participatory approaches which focus on the capacities of the users tend to be the most successful.

The various instruments, methods and processes used in project implementation have to be applied in a flexible way. The approach chosen heavily depends on whether we deal with a technology that addresses many end users, or a large-scale set-up in a power company. E.g., in the case of a Solar Cooker Project in South Africa with many end users, field testing, development of marketing strategies, public awareness campaigns and promotion of local production were applied. Social back-up measures are helpful to ensure higher acceptance and better integration of the selected technology, particularly in rural and remote areas. In industry, initial organisational and efficiency improvements in the use of existing technologies create a solid basis for the successful application of new technologies. Business associations and trained consultants are often useful in providing information and advisory services.

4. The selection of efficient and environmentally sound technologies can be a complex process. A decision in favour of completely new technological hardware may only be one of the results. The innovative use and improvement of existing technologies has also shown good results when local conditions are properly taken into account.

The best practice examples presented by Germany range from the promotion of EST's and environmental management systems in industry, to rural and renewable energy systems, to large-scale thermal power plant rehabilitation. Apart from technology centres, partner organisations include ministries, national environment commissions and institutes, as well as national and regional power utilities, and in an increasing number of cases, Chambers of Commerce and Industry, business associations and consultants.

Environmentally sound technologies: informations and contacts in Germany:

1. Public-Private partnerships, market and business informations on EST's:

ITUT – International Transfer Centre for Environmentally Sound Technologies
Mr. Bernd Kitterer
Messealllee 2
04356 Leipzig
Germany
Tel: +49-341-6087-100
Fax: +49-341-6087-174
Email: itutleipzig@itut.de
Internet: http://www.itut.de

2. Bilateral co-operation programmes and projects (informations, contacts):

GATE-ISAT – Information and Advisory
Service on Appropriate Technology
Post Box 5180
Dag-Hammarskjöld-Weg 1-5
D-65726 Eschborn
Germany
Tel: +49-6196-793185
Fax: +49-6196-797352
E-mail: gate-isat@gtz.de
Internet: http://gate.gtz.de/isat/

Information on specific technologies

a) German Greentie Liaison Office

Mr. Werner Bahm
Fachinformationszentrum Karlsruhe
Post Box 2465
76012 Karlsruhe
Germany
Tel.: +49-7247-808350
Fax: +49-7247-808134
E-mail: wba@fiz-karlsruhe.de

Mr. Bahm is also contact person for the German IKARUS-technology data base on CO_2-reduction technologies.

Contact also Greentie liaison offices in more than 20 developing countries

b) "UMFIS-index"

More than 10.000 German suppliers of EST's, available as CD-Rom in German language, soon also as internet homepage.

Contact German Chambers of Commerce and Industry in Germany and overseas, see e.g.:

DIHT
Deutscher Industrie- und Handelstag
P.O. Box 1446
53004 Bonn
Germany
Tel. +49-228/104-0
Fax +49-228-104-158
E-Mail: diht@bonn.diht.ihk.de
Internet: http://www.ihk.de/

Project title:	**International Photovoltaic Pumping Program (PVP-Program)**
Host countries:	**Argentina, Brazil, Indonesia, Jordan, Chile Philippines, Zimbabwe, Tunisia, Ethiopia**
Partner country:	**Germany**
Contact persons:	Dr. Rolf Posorski, Andreas Hahn GTZ Postfach 5180 65726 Eschborn Germany Tel: +49-6196-79-1609 Email: rolf.posorski@gtz.de See also homepage http://www.gtz.de/home/english/index.html
Project purpose:	The purpose of field testing and demonstration activities was to selectively accommodate PVP technology to the users' needs and to the climatic conditions in the various countries of where it is deployed, the aim being to develop a marketable product.
Executing agency:	GTZ GmbH Germany Technical Co-operation
Project period:	1989 – 1998

Requested specific information:

- *What are the project's main targets?*

  What technologies are applied and how do they contribute to the targets?

In most countries, the provision of drinking water is seen as the responsibility of the governmental infrastructure. Due to a lack of affordability, its realisation often remains inadequate, particularly in rural areas. In regions with high insulation levels, electricity from solar cells opens up new options for pumping water. In remote areas, where it would be both expensive and troublesome to haul in fossil fuels, photovoltaic pumps offer a reliable, environmentally-sound alternative.

Especially for developing countries with no fossil fuel resources of their own, both the cost of importing such fuels and the fact that this dependence on imported energy also makes them politically dependent on its suppliers are a problem from the standpoint of development policy.

- *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology? Which instruments are used to improve the respective groups' access to information and their*

knowledge of climate relevant technologies?

The concept behind the PVP Program has supported co-operation and division of responsibilities between German equipment suppliers and contractors in the developing countries.

Within the PVP Program, training, community preparation and participation was an integral part of the project concept, usually going beyond the institutional practices in the various project countries.

Day-to-day and long-term performance of PVP systems was closely monitored by means of specially adapted automatic data acquisition systems. The data analysis has yielded a spate of field-relevant information which was presented at various international workshops and conferences and in the Internet.

Which positive experience has been gained up to now (lessons learned / best practices)?

A total of 100 Photovoltaic water pumps (PVP) were installed, operated and monitored at selected sites in nine developing countries. The standard-type PVP systems convincingly demonstrated their reliability within the applied power range. Economic efficiency analyses showed PVP to be competitive within the power range of small diesel pumps, where they often even constitute the least-cost option. Social back-up measures helped secure sustainably higher acceptance and better integration of PVP into project communities. With a view to generating added confidence in PVP technology and to promoting the dissemination of PVP, it is necessary to establish a well-functioning service structure and assured availability of spare parts by PVP suppliers in the project countries.

- *Does the project support access to financing of technologies (and how)?*

Some measures implemented in the project countries of the PVP Program were designed to strengthen the communal structures to the point that they are able both to manage the PVP systems themselves and to introduce socially compatible water rates with the capacity to at least cover the cost of maintenance and repair.

- *With respect to technology transfer, which factors and conditions are crucial to the success of your project?*

  - Intensive training measures of local project partners and local contractors;
  - Close co-operation and exchange of experience between GTZ and German equipment suppliers to improve and optimise PVP system components;
  - Intensified engagement of German equipment suppliers in developing countries with demand potential in terms of product representation and a building up of distribution and maintenance structures, including local partner companies.

- *Do you have information on other, similar projects? Please indicate.*

  Special Energy Programme

Project title:	**Advanced Technology Dissemination Centre for Electric Power Utility Management, TCPM**
Host country:	**China**
Partner country:	**Germany**
Contact person:	Zhangun Xie, Vice President Zhongneng Power-Tech Development Co. No.1 Chedaogon Haidian District Beijing 100081 / P.R. China
Project purpose:	One of the main purposes of the project is to provide the Chinese counterparts without biased advice on the benefits and limitations of the various technologies concerning coal fired power plants. By means of realisation a significant reduction of CO_2 emissions can be reached.
Executing agency:	GTZ GmbH, Germany Technical Co-operation
Project period:	10/1995 – 09/2002

- *What are the project's main targets?*
  What technologies are applied and how do they contribute to the targets?

The efficiency of most Chinese coal-fired power plants is far below those in operation in OECD-countries (in China 415 g coal/kWh in OECD-countries285 g coal/kWh). Therefore the CO_2-emissions per unit (kWh) are much above average.

The direct recipients are not only the power plants or utilities but mainly organisations which are carrying out consultancy and training themselves. These implementing agencies are special research and consulting institutions of the Ministry of Electric Power which offer consulting services to the utilities China-wide, such as TPRI (Thermal Power Research Institute, Xian).

The main idea is to improve the qualification and capabilities of these institutions so that they can carry out their work more effectively. They are to continue by themselves, beyond the project frame, the inputs introduced and trained in the projects to the benefit of all utilities. This is especially important for the poorer utilities and less developed regions who are not well equipped and do not have access to all necessary know-how. Often help is needed most here, for regional pollution is very severe.

Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology? Which instruments are used to improve the respective groups' access to information and their knowledge of climate relevant technologies?

Instruments of know-how transfer

Within the different projects a variety of measures is applied to find an adapted practical solution step by step and to promote the technical implementation. The major elements of this co-operation are:

- **Seminars** about the special subjects to transfer theoretical know-how and practical experience from Germany, addressing all experts and decision-makers in China;

- **Study tours** to investigate the specific situation and the state-of-the-art with the partner and to promote contacts with the relevant institutions to induce further exchange;

- Delivery of **technical equipment** and materials to enable the partner institute to carry out improved consulting to the utilities;

- **Training** of Chinese experts, especially for application of the delivered equipment;

- Practical in-plant **consulting** to apply the know-how, to train the partner and to provide a motivating example for other utilities or plants;

- **Documentation** about the activities or exemplary case studies which are distributed China-wide by the partner;

- **Technical information and contacts** to relevant institutions and firms are provided to support the work of the partner institute and the utilities;

- Joint **planning and design** of technical solutions as exemplary applications;

- **Studies** by Chinese experts in Germany of specific problems;

- **Joint consultancy** to utilities, especially in the case of introduction of new technologies financed by the German government to retrofit power plants, activities mainly carried by the counterpart organizations and continuing far beyond the German contribution;

- **Distribution** of the information and experiences China-wide by publications and by holding seminars and training workshops;

- **Application** of the know-how and the equipment by the partner institute in providing consultancy to the utilities and power plants;

- **Support** of utilities and the Ministry in connection with the introduction of new technologies and the **implementation of cost-effective and adapted solutions**;

- **Development** of adapted technologies available and feasible for China.

A very central task of these Chinese technical advisors within TPRI is to disseminate the information China-wide to those experts and institutions responsible and interested. This multiplier function gives the projects a very high level of efficiency and impact on development.

Every activity, such as seminars, consultations etc., is documented in booklets and distributed to all relevant institutions like ministries, utilities manufacturers, universities etc. This includes the practical experience gained with the demonstration applications which are intended to motivate others to follow suit.

Another aspect considered in the program is the applicability of any kind of assistance.

Chinese experts already have access to all published information world-wide. Many congresses are held to introduce the latest developments. However, it is necessary that the utility or the specific power plant knows how to improve the situation on the spot or how to realise and adapt new technologies. Therefore every problem should not only be dealt with theoretically but the know-how should also be transferred into practice. Demonstrating a concrete example of an application is not only practice and experience for the counterpart institution, but also motivates others to follow. Compared with other programmes, the GTZ approaches focus on the existing standard technologies as they are available today so that early adaptation of an application is possible.

Adaptation of know-how

The circumstances in China are different from those in Germany and most OECD countries. It is not possible to simply transfer modern technology. One of the major tasks of the technical assistance is to find appropriate modifications to be adapted to the Chinese situation.

In many cases highly sensitive technologies are not practical under the real operational conditions. Very often high investments or cost-intensive imports are restricted. Ways must be found to simplify processes and to implement production know-how in China so that only a minimum of imports become necessary. New technologies like flue gas desulphurisation plants only have a chance in the near future if the necessary know-how is widely available and low cost production is possible in China.

A very important factor when introducing new technologies is also the training of the operating personnel and the availability of service. To ensure this is the genuine task of the partner institutions which offer education and training for personnel, besides technical consulting services.

Instruments to improve access to information and knowledge of technologies:

- Rehabilitation of the combustion system of existing plants;
- Combustion optimization;

- Mill operation and design;
- Combustion problems with brown coal;
- Circulating fluidised bed combustion;
- Coal blending and handling

- *Which positive experience has been gained up to now (lessons learned / best practices)?*

About 3 to 5 seminars in China and 3 study tours to German utilities were organised every year by German experts together with their counterparts at the centre. The information to be transferred focuses on various special topics in the fields of utility and power plant management, operation improvement, energy saving measures, maintenance, reliability, network problems, monitoring and control technologies and many others.

More than 300 managers from all large fossil power plants and all utilities have already taken part and will participate in seminars and round tables as part of the project.

In addition to these information activities consultancy services were carried out in cases where new technologies can appropriately be introduced. Concrete help on the spot is supporting the Chinese utilities in realizing implementation.

Chinese leading power plant managers and chief engineers are acquainted with the newest technologies applicable for their specific needs in accordance with financial constrains.

- *Does the project support access to financing of technologies (and how)?*

No financing is focused as all measures are subject to Technical Assistance.

- *With respect to technology transfer, which factors and conditions are crucial to the success of your project?*

China has only limited funds to retrofit existing power plants with modern instrumentation and control systems.

Power plant operation personnel is still not motivated enough to provide best practice as skills are often lacking.

- *Do you have information on other, similar projects? Please indicate.*

KfW is rehabilitating three coal fired power plants to reach higher efficiency. This programme can not compared with the TA project as some millions Euro are required for the rehabilitation.

Project title:	**Indo-German Industrial Energy Efficiency**
Host country:	**India**
Partner country:	**Germany**
Contact person:	Dr. Albrecht Kaupp Tata Energy Research Institute IG-EEP Indo-German Industrial energy efficiency project 10/1, Palace Rd, Post Box No. 154 Bangalore 560 052 India Tel: +91-80 - 2255686 Fax: +91-80 - 2255760 Email: Nothinggtz.igeep@axcess.net.in Additional information see homepage: http://eta-team.com/
Project purpose:	To reduce in an economic way energy consumption and mitigate related environmental problems from burning of fossil fuels
Executing agency:	TATA Energy Research Institute – Bangalore Technical co-operation
Project period:	05/1995 – 10/1999 (4.5 years)

- *What are the project's main targets?*

  What technologies are applied and how do they contribute to the targets?

The specific energy consumption in industrial production is rather high despite high energy costs for power, coal and furnace oil. India's energy consumption is mostly based on coal and the share of coal will steadily increase in the future resulting in very large amounts of greenhouse gas emissions and air born pollution's associated with mining/ transport/and combustion of coal in industrial production and the power sector

- *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology? Which instruments are used to improve the respective groups' access to information and their knowledge of climate relevant technologies?*

We offer paid energy audit services to reduce energy costs in industrial production. Furthermore, workshops are conducted about best practices in energy management and an information service concerning energy cost reduction measures is offered. Also strategic alliances with banks to require bank clients to agree to an energy audit are part of the activities

The bulk of the information we draw from the INTERNET; local information we

query directly from hardware suppliers. In our opinion there is no specific climate relevant technology. All the technology we recommend and implement is very basic standard technology. State-of-the Art technology is not asked for by our clients except in process control and monitoring.

- *Which positive experience has been gained up to now (lessons learned / best practices)?*

The economics of energy conservation seems to be very high. Any one of the clients easily reduces energy costs by at least 5 % with little economic risk. About 50 % of the energy saving potential is based on better housekeeping measures. Payback period for ESCO service fees is only 1 – 4 months. Payback period for investments between 1 and 18 months. The potential for services to reduce energy costs is large, but not very well tapped.

- *Does the project support access to financing of technologies (and how)?*

There is no shortage of funds for our recommendations. We co-operate with local banks that are glad to finance any of our recommendations as long as the payback period is short (< 4 years) and the client can provide securities. We feel there is no shortage of funds at commercial conditions for any of the economic climate relevant investments of the industrial sector.

- *With respect to technology transfer, which factors and conditions are crucial to the success of your project?*

Technology transfer is not really a problem. The difficulty is that investors do not get fair, comprehensive, detailed and competent advice through local consultant groups. There is an emerging market for this type of service, but investors must get used to a system, where they should avail of external advise before they make a decision. The investors also must get used to the fact that these services cost money and are part of the transaction costs. High non-subsidized energy tariffs are crucial for us. Also crucial are reduced custom tariffs for standard technologies

- *Do you have information on other, similar projects? Please indicate.*

    - China
    - Thailand (ENEP, Dieter Brulez)

- *Other ideas / information:*

We should refrain from looking at the climate change as a problem of lack of financing or lack of technology transfer. All economic technologies related to GHG-Mitigation are available free of any restrictions and merely off-the-shelf equipment.

Project title:	**Wind Park Tangier**
Host country:	**Morocco**
Partner country:	**Germany**
Contact person:	Mr. Josef Gamperl KfW Palmengartenstr. 5-9 60325 Frankfurt Tel: +0049-69-7431-2273 Fax: 069-7431-3746 Email: Josef.Gamperl@kfw.de Other contacts see KfW homepage: http://www.kfw.de
Project purpose:	Energy supply for national grid
Executing agency:	KfW (Kreditanstalt für Wiederaufbau) Germany, Financial co-operation
Project costs:	5,8 million Euro

1. Brief Description of the Project

Morocco is working to reduce its strong dependence on imports of energy and to also develop its great wind energy potential. The wind-park will have an output capacity of 3.5 MW and an annual power production of at least 15 GWh, which shall be fed into the national grid. The park will be composed of 5 to 6 individual plants (capacity 500 to 600 kW each) and a transmission line of about 20 km. The selected site has the highest wind potential of the region with an average speed of more than 11 m/sec. The project has been in the implementation phase since 1995. Operation may start at the end of 1999.

2. Special Aspects of the Technology

This project is the first of its kind in the country and it therefore has demonstration character. There is no principal problem linked with the use of these installations. Nevertheless, it is planned to carry out training courses for the operating staff. Through this project the project-executing agency, which is exclusively responsible for public power supply, will enhance its general knowledge of this form of energy use. It intends to create another wind-park with a capacity of 50 MW under a BOT concept.

3. Relevance of Project Type

The technology of wind power plants is proven world-wide. From an economic point of view, it is advisable to concentrate on wind-parks that feed their power into a grid rather than on single unconnected plants. With German ODA wind power projects are also being implemented in China, Egypt and India.

Project title:	**Biogas Support Programme**
Host country:	**Nepal**
Partner country:	**Germany**
Contact person:	Mr. Josef Gamperl KfW Palmengartenstr. 5-9 60325 Frankfurt Tel: +0049-69-7431-2273 Fax: 069-7431-3746 Email: Josef.Gamperl@kfw.de Other contacts see KfW homepage: http://www.kfw.de
Project purpose:	Energy supply for rural farmer households
Executing agency:	KfW (Kreditanstalt für Wiederaufbau), Germany and Netherlands Development Organisation and Nepal financial and technical co-operation
Project costs:	15,6 million Euro (KfW share)

1. Brief Description of the Project

The objective of the programme (a continuation of a programme supported by the Netherlands) is the installation of 36,500 individual small biogas plants in rural farmer households over a period of three years (start was in 1997). The plants consist of a subsurface tank for the organic substances (mainly cow dung) and a pipeline system to the farmer's dwelling to convey the produced gas to cookers and lamps. The fermented sludge will be composted and can be used as fertiliser. The plants are built by private local firms, and farmers can participate in the construction to reduce the cost. Almost all construction material is manufactured in Nepal. The farmers will be supported by grant and credit funds for part of the construction cost. Additional training measures for the construction firms, the credit bank and the farmers are being considered.

2. Special Aspects of the Technology

More than 24,000 plants are already in operation in Nepal. The overall potential is judged to be about 1.3 million. The experience with older plants showed that the size of the plants did not always well correspond with the available dung, and construction companies tended to oversize the plant, which reduces the efficiency. For the minimum plant size dung of at least two cows must be available. Poorer families could benefit from biogas only through community plants. Above an altitude of roughly 2,000 meters it is too cold for dung fermentation. Cultural problems may arise if human excrements are also used.

3. Relevance of Project Type

The technology of small-scale biogas production has proven over many years in

various countries to be simple and robust; its application is especially advantageous in rural areas. Biogas plant output usually substitutes firewood from forest areas or kerosene for burning, as well as chemical fertilizers. Therefore it helps to avoid the deforestation and the emission of CO_2 from burning wood (unless the same carbon content is again absorbed by reafforestation) or kerosene, as well as from the production of fertilizer. The carbon in the biogas stems only from the natural CO_2-cycle and therefore does not increase the overall balance. Besides the benefit for the climate and local environment there are also positive effects for better health conditions in the farmers' houses.

Project title:	**Biogas Power Plant Ankara**
Host country:	**Turkey**
Partner country:	**Germany**
Contact person:	Mr. Josef Gamperl KfW Palmengartenstr. 5-9 60325 Frankfurt Tel: +0049-69-7431-2273 Fax: 069-7431-3746 Email: Josef.Gamperl@kfw.de Other contacts see KfW homepage: http://www.kfw.de
Project purpose:	Energy supply for waste water treatment plant
Executing agency:	KfW (Kreditanstalt für Wiederaufbau) Germany financial co-operation
Project period:	05/1995 – 10/1999 (4.5 years),
and costs	aprox. 11,8 million Euro (KfW share)

1. Brief Description of the Project

To meet the high demand of energy (heat and power) of the central waste water treatment plant of Ankara, a co-generation plant with a gas motor system will be installed (output capacity: 3.2 MW_{el} and 5.6 MW_{therm}, to be doubled in a final version). The fuel (natural gas) for the co-generation plant stems from the fermented sludge of the treatment plant. The varying seasonal need for heat can be met by appropriately operating the mixed generation. Depending on the mode of operation, any excess production of electrical power will be fed into the public grid. The project implementation started in 1996 (including training measures for the operating staff) and the plant went into operation in mid-1998.

2. Special Aspects of the Technology

This project is the first of its kind in Turkey and therefore has a pilot character for the numerous new treatment plants being planned in the country. The volume of biogas available depends mainly on the amount of sludge, suspended solids and proper control of the biological processes in the treatment plant. Due to the co-generation concept the plant efficiency is about 90%, which is much higher than the present rate of conventional power plants in the country. To avoid unacceptable emissions of NOx the gas motors will run with a higher content of air, and to reduce the sulphur concentration in the biogas, ferruginous sulphate will be added to the untreated waste water.

3. Relevance of Project Type

The concept of supplying energy to large waste water treatment plants by a biogas co-generation plant is already well known. The technology for the biogas plant has been time-tested and perfected. The naturally forming biogas can be used to substitute the production of power and heat from alternative sources (usually fossil fuels). The release of CO_2 or methane from the sludge, if not burned, into the atmosphere can thus be avoided as well as local environmental impacts also from these alternative conventional sources. Moreover, the energy supply by the project is economically cheaper than other alternatives.

Project title:	**Gasification of Agro-industrial residues for energy production**
Host country:	**China**
Partner country:	**Italy**
Contact person and address:	Dr.Pietro Marzetti ENEA - ERG/FORI CR.Casaccia Via Anguillarese, 301 00060-ROMA Tel: +39-06-30483281 Fax: +39-06-30486452 E-mail: pietro.marzetti @casaccia.enea.it
Project financing :	Financed by MAE, Italian Ministry of the Foreign Affairs and SSTC China, Chinese State Science and Technology Commission.
Executing agency:	ENEA, National Agency for New Technology, Energy and Environment, Rome, Italy. LIER, Liaoning Institute of Energy Resources, Yingkou, China.
Project period and costs:	Duration: 42 months, from January 97 to June 2000. Costs: 2,100 Million of Italian Liras + 5.6 million of Yuan by SSTC.

- *Brief description of the project*

The project is being carried out within the overall co-operation agreement between the Italian Ministry of Foreign Affairs and the Chinese State Science and Technology Commission on scientific and technological areas of common interest. Among these, one of the priorities were study and research activities for the development and use of alternative energies, particularly applied to the rural context. One of China's needs in the field of gasification technologies is to move from the research stage to practical utilisation. The project, therefore, has started in January 1997 focusing its activities on the "gasification of agro-industrial residues for energy production" and is articulated in two main goals:

- planning, designing, realisation and testing in Italy, in full co-operation with Chinese experts from LIER, of an experimental multifuel (wood residues and rice husk) fluid bed gasification plant of 160 kWe with motor and electro-generator, appropriately modified in order to use gas produced from waste. The plant will be set up at ENEA's Trisaia Research and will then be shipped to China and installed in a factory of Yingkou.

- supply of a 20-30 kWe fíxed bed gasifier fed by wood residues, realised with ENEA's know how, equipped with proper instrumentation necessary to perform experimental tests and laboratory analyses. The plant is now being built at ENEA's Trisaia Research Centre where Chinese experts are co-operating with ENEA's

experts in conducting experimental tests by means of data acquisition systems and other analytical facilities to verify the performance level of all auxiliary equipment connected with the gasification system. Following this stage it will be shipped and installed in the laboratories of LIER in China.

The project, therefore, constitutes a good example of bilateral co-operation on the identification, selection, building, testing and transfer of a technology chosen by the local counterpart on the basis of future replicability and diffusion in a wider context. To this effect, at the end of the project, a dedicated seminar is envisaged with the participation of local and neighbouring countries experts. An important part of the co-operation package has been the training and capacity building, both in Italy and China, of the Chinese scientific and technical personnel throughout the project cycle, from the scientific and technological stage to the Plant building and testing aspects with a strong emphasis on future technology use and dissemination.

- *Special aspects of the Technology*

The technology used in the gasifier of 160 kWe is "ICFBG", Internal Circulating Fluid Bed Gasification the traditional technology of "DFBG"(Down-draught Fixed Bed Gasification) is used.

- *Relevance of Project Type*

A substantial part of the Chinese population, 800 million people, live in the countries where the villages are mostly with short energy supply because of the elevated costs of the connection to the net even though, they could dispose great quantities of biomass available as renewable fuel and autochthonous for the local production of energy.

In China it is appraised in around 18 million tons the quantity of rice husk produced as residue of the corresponding crop and in around 60 million tons the woody residues that could be used in the same finality.

Such substantial quantity of biomass, corresponding to 24 TOE, if transformed in electric energy, would be able to produce over 40 billion of kWh per ear to satisfy the energy demand of a good part of the population that currently is deprived of it.

The Biomass gasification technology, that produces a combustible gas with which can be fed a motor-eletrogenerator, could effect this finality.

Project title :	**Fire extinguishing agents substitutes to Halons**
Host country :	**India**
Partner country:	**Italy**
Contact person and address:	Gianluca Indovino Safety Hi-Tech 14, Viale Gino Cervi 1-00139 Rome Italy Tel: +39 (6) 8713.4421 fax: +39 (6) 8713.2683 E- Mail: G.indovino@Mbox.it.net. The Trinity I Floor Kandigal Road Kattur Madras 600 076 India Tel: 0091 44 6256287 Fax: 0091 44 8522547
Project financing:	Safety Hi-Tech
Executing agency:	Safety Hi-Tech

- ***Brief description of the project***

NAF Extinguishing Agents have been developed as a replacement for Halon 1301 and 1211 in total flooding systems and portable extinguishers.

Although each potential hazard present a unique problem to the system designer, the installation of a NAF S III system would be advantageous in one or more of the following circumstances:

- When an inert, electrically non-conducting media is essential or desirable.
- When clean up of media would present a problem.
- When weight and/or space versus extinguishing potential is a factor.
- When there is difficulty in ensuring the safety of the personnel.

The extinguishing performance and low order of toxicity, together with low environmental impact, make the use of NAF agents particularly suitable for the following hazardous situations: computer and equipment rooms, electrical switch-gear, control rooms, chemical laboratories, military vehicles, aircraft engines, cargo and passengers compartments, microwave relay stations, flammable liquid storage or process areas, telephone exchange areas, transformers and conventional or nuclear plants, radioactive “caves” and hot cells archive storage.

- *Special aspects of the Technology:*

NAF SIII systems have already been installed in India in high value facilities including telephone companies and cement factories.

NAF SIII is the most cost-effective replacement for Halon 1301; NAF S III can be used in existing Halon 1301 without the necessity to undertake major changes to the system. The costs for replacement of Halon 1301 with NAF S III are minimal. The reduced quantity of NAF S III used, together with lower equipment costs, compared to other alternatives, results in a highly cost effective installation.

From an environmental standpoint, a key factor in evaluating the viability of Halon 1301 alternatives is the Global Warming Potential (GWP). The Kyoto Protocol to the United Nations Framework Convention on Climate Change binds signatory countries to reduce greenhouse effect gas emission including HFCs and PFCs. NAF S III has a GWP of 1444 (CO_2 - 100 years) which is the lowest of any HFC or PFCs being considered for use in normally " occupied areas" in addition, the Atmospheric Lifetime (ALT) of Naf S III is 12 years and the Ozone Depletion Potential (ODP) is only 0.036.

- *Relevance of Project Type:*

All personnel have been trained in order to design fire- fighting systems using the NAF SIII Computer Design Program. India is one of the most critical Article 5 countries in terms of population and ODS consumption , and therefore counts as an important testing branch to evaluate the implementation of the Montreal Protocol in these countries. Acquiring NAF environmental sound technology may signify an utmost turning over of Article 5 countries commitment to the Protocol and an anticipated accomplishment to the Halon phase out date of 2010. This changing attitude could also have a positive outcome in the light of the Climate Change debate considering the low GWP, ALT and TEWI values.

Project Title: **High temperature recycling plants for waste of any kind with a patented process called "thermoselect"**

Host country: **Korea**

Partner country: **Italy**

Contact person: **and address**

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Project financing: THERMOSELECT

Executing agency: THERMOSELECT

- *Brief description of the project*:

Refuse of all kinds is left untreated and compacted to around 10% of its original volume, and then press into a heated degasification channel. The high degree of compaction greatly reduces the residual air content, the air has not insulating effect, nitrogen does not need to be heated and subsequently cleaned, and heat conductivity is significantly improved. Liquids which escape during compaction flow into remaining cavities.

In an oxygen-free environment, the organic components in the refuse are degasified and converted into carbon as the temperature increases. The carbon-like product and the enclosed inorganic high components such as metals and minerals are continuously fed into a high-temperature reactor, where oxygen is added in measured quantities and the material is treated at temperatures up to 2,000°C and above. The carbon is gasified and the metallic and mineral components are melted. Chlorinated hydrocarbons such as dioxins and furans are

reliably destroyed along with other organic compounds, and all material conversion equilibria are assured.

Shock-cooling of the untreated synthesis gas prevents “de-novo” synthesis of dioxins, furans and other organic compounds. The synthesis gas then passes through a multi-stage cleaning process, during which the pollutants are absorbed or condensed. The clean synthesis gas can be used as a source of energy (e.g. electricity generation and heat recovery in generator blocks with gas motors). Pollutant emission is at or around the detection limits and is markedly lower than in conventional thermal systems.

Material conversion and homogenization of the mineral components is effected in a second high-temperature reactor directly connected to the first reactor. Oxygen and synthesis gas are added, and primary materials are created at temperatures of around 2,000°C which possess the quality of natural raw materials. The homogenized metals and minerals are separated out and discharged in a non-hazardous form following granulation in water jets. The minerals are suitable for the full range of standard applications.

• *Special aspects of the technology*:

The innovative THERMOSELECT technology proves many ecological advantages as compared to traditional waste treatment systems, no longer able to solve Korea’s waste problem and no longer accepted by the public.

Avoiding dangerous emissions threatening health, like dioxins and furans; avoiding landfilling and risking drinking water quality; fast realization period to solve waste problem in time; better acceptance of the public than conventional waste treatment.

Project title:	**INTERSUDMED**
Host region:	**Mediterranean Countries**
Partner country:	**Italy**
Contact person:	Mr Pietro Menna ENEA, Località Granatello, I-80055 PORTICI (Napoli) ITALY, and Paolo Paoli, ENEL, Italian partners within the larger Consortium (see below)
Project financing:	ENEA, ENEL for Italy within a larger project Consortium of electric utilities and research centres from the European Union and the Mediterranean Partner Countries with co-financing from the European Commission, DGXII- JOULE and INCO Programmes
Project purpose:	Prefeasibility study for the integration of renewable energies for electricity production in the southern Mediterranean Countries
Executing agency:	ENEA, Italian Agency for New Technologies Energy and Environment. ENEL, Italian Electric Utility Company, as partners for the PV component of the project.
Project period:	Duration: January 1996-January 1998

- *Brief description of the project:*

The project was designed to perform prefeasibility studies for large scale projects using Renewable Energies and to assess their related socio-economic and environmental benefits. The Italian partners, with their Southern Mediterranean counterparts have focused on Photovoltaics. As well known, life expectancy, infant mortality, food availability, literacy and all the other quality-of-life indicators are positively linked to energy consumption. Quality of life improves very rapidly as per-capita energy consumption increases from 0 to 75 GJ while the rate of improvement slows down significantly when consumption exceeds 100 GJ. In other words electricity investment in the rural areas of developing countries have a larger impact on quality of life than electricity investment in industrialized countries. Project experience shows that photovoltaic (PV) systems, in a variety of schemes, are an effective complement to grid-based power which is often too costly for sparsely distributed settlements in remote areas of less developed countries. The prospects for photovoltaic electricity generation in the countries from Morocco to Turkey have been analyzed. A potential for the installation of more than 350 MW of PV plants to electrify the almost 2.5 million off-grid households of the region has been reported. Due to their remote location and to the low average energy consumption, their electrification can be pursued best with photovoltaics. Furthermore, as a renewable energy source, PV systems are environmentally friendly, reducing the use of fossil fuels. The PV component of the project covered the analysis of PV potential, the selection of appropriate sites, the choice of PV systems as well as engineering studies. Moreover, specific issues like the institutional framework, socio-economic impacts and environmental impacts have also been investigated. Economic and financial evaluations

were performed to assess possible financing schemes to implement the specific projects selected in the pre-feasibility stage. On the industrial side, a specific task dealt with the possibilities for technology transfer of the components of the PV systems. The technologies studied were PV for decentralized or grid connected applications.

- *Special aspects of the Technology*

The schemes for the deployment of the photovoltaic installations as well as the economic and financing issues depend on the local socio-economic conditions and can be hardly generalized from one context to another. An enlarged customer base, while requiring relevant organizational skills, provides economies of scale in procurement, sales and servicing. Despite this, the cost of the electricity produced by photovoltaic single home systems remains high. The value of the electricity should be compared against its cost to assess the actual viability of a rural electrification project.

- *Relevance of Project Type:*

Small-scale, pilot projects using renewables are mainly focused on demonstrating the feasibility of the technologies. Sustainable, large-scale, rural electrification programs aim at maximizing the number of people that will get access to electricity by making the best use of the available resources. The transition from small to large scale implies a completely different organizational framework and a well founded methodological approach. This includes not only a comparison of investment costs but also technical, social, economic and environmental impacts. The implementation of large-scale PV projects requires the organization of highly scattered activities, because very extended areas are generally involved. The results of the project have demonstrated that several factors must be taken into account for the large scale deployment of PV systems. First, technological choices are strongly affected by local factors, like characteristics of the sites, distribution of dwellings, resources availability. At the same time, the modularity of PV systems and their standardization must be considered from the very beginning because they represent critical aspects for the affordability and reliability of the installations, and for the effectiveness of the operating and maintenance procedures, as well. Second, a strong coordination between the project management and the responsible for the electrification planning, to follow the medium-long run network evolution and identify the areas with lower probability of being provided with a centralized electric service. Third, the selection of the region for the PV installations need to be specified on a socio-economic basis, considering surveys of potential users. Fourth, the development of the technical framework must be accompanied by appropriate guidelines for the implementation of operational stage, identification of the concerned subjects, association forms, joint-ventures, partnerships, mixed public and private companies. The definition of financing forms and schemes, the evaluation of the business plan and the description of the relevant economic policies represent other essential factors to be taken into account.

Project title :	**Biomasses' cogeneration plants**
Host country:	**Ologbo – Nigeria**
Partner country:	**Italy**
Contact person and address:	Mr. F. Abbà Bono Energia S.p.a Via Resistenza, 12 20068 Peschiera Borromeo – Milano Italy Tel: 0039-2-55302848 Fax: 0039-2-5471955
Project financing:	Bono Energia S.p.a.
Executing agency:	UNDP

- *Brief description of the project:*

The utilization of renewable fuels in electric power cogeneration reduces the waste disposal, fuel oil utilization and pollution. Dedicated processes have been developed to utilize following residues wood waste, rice husks, olive husks, sunflowers etc. For Redco Inc. the cogeneration plant has been realized by burning wood wastes produced by wood processing.

- *Special aspects of the Technology:*

Cogeneration has been one of the most important technical issues for the past 10 years. The possibility to use alternative and renewable fuels, as well as availability of waste organic fuel free of cost, made the economic of this kind plants very attractive also for small/medium size industry.

- *Relevance of Project Type:*

Elimination of free disposal of wood wastes that are utilized in an industrial production of energy reducing VOC/CO emission.

Project title:	**Training Course on Energy planning for Small Island Developing States (SIDS)**
Host country:	**Several SIDS**
Partner country:	**Italy**
Contact person and address:	Anna L. De Carli Italian National Agency for New technology, Energy and the Environment (ENEA) Research Center, Casaccia Via Anguillarese 301, 00060 S. Maria di Galeria, Roma Italy Tel: 39 06 30483432
Project financing :	Italian Ministry of Industry, Handicraft and Commerce
Executing agency:	ENEA
Project period and costs:	Duration: 23/3/1998 – 17/7/1998 Costs: 125,000 ECUs

- *Brief description of the project:*

The training course was divided in two phases: the first was attended by 21 participants from SIDS and had a duration of six weeks. During this period, the training was focused on strong interaction and discussion among trainers and trainees in order to meet the demands of the latter. The subjects were: energy, environment and sustainable development; environmental effects of energy cycles; climate change; energy supply; renewable energy; electricity; efficient energy use and environmental protection in building and industrial sectors; energy and environment in the transport and agriculture sector; energy demand forecast. Several technical visits were organised to PV, wind, biomass, urban wastes and CHP plants and industries. The second phase was attended by 13 participants from SIDS who worked at ENEA laboratories on specific fields of their interest according to the technology needs identified in the first phase.

- *Special aspects of the Technology:*

All the technologies presented were appropriate to SIDS scale and included technology needs identification and technology assessment techniques. In addition, the importance of models for local energy use, taking into account the need of greenhouse gas emission reduction was stressed.

- *Relevance of Project Type:*

The general aim of the project was to improve the capacity building of the participants in the field of energy, environment and sustainable development. In addition, follow up

actions are envisaged to build upon the training experience in order to identify specific bilateral or multilateral co-operation projects on renewable energy to promote renewable energy technologies, the rational use of energy as well as climate friendly techniques and practices.

Project title:	**SolarMed – Solar Water Heating in the Mediterranean Basin, with Guarantee of Results**
Host countríes:	**Algeria, Egypt, Lebanon, Morocco, Tunisia and Palestinian Authority**
Partner country:	**Portugal**
Contact person:	Luís Silva CCE Estrada de Alfragide, Praceta 1 P – 2720 Alfragide Portugal Tel: 351-1-4722800 Fax: 351-1-4722898 E-mail: dmre.cce@mail.telepac.pt
Project purpose:	Reduction of fossil fuel consumption for water heating and mitigation of related emissions. Development of local economies, through creation of SMEs and a network of solar equipment installer technicians
Executing agencies:	ADEME – Agence de l'Environnement et de la Maîtrise de l'Energie (France) IDAE – Instituto para la Diversificacion y Ahorro de la Energia (Spain) Isnova/ENEA – Instituto per la Promozione dell'Innovazione Tecnologica (Italy) CRES – Center for Renewable Energy Sources (Greece) CCE – Centro para a Conservação de Energia (Portugal) ALME – Association Libanaise pour la Maîtrise de l'Energie (Lebanon) AME – Agence pour la Maîtrise de l'Energie (Tunisia) APRUE – Agence Nationale par la Promotion et la Rationalisation de l'Utilisation de l'Energie (Algeria) CDER – Centre de Développement des Energies Renouvelables (Morocco) OEPC – Organisation for Energy Conservation and Planning (Egypt) PEC – Palestinian Energy and Environment Research Center (Palest. Terr.)
Project period: **and costs**	3 years 2 055 022 Euros

- *Which is the main problem targeted by the project?*

In the near future, the increasing energy demand will become one of the main problems for the Southern-Mediterranean countries. In fact, population is expected to grow

from the current 200 millions to 350 millions in 2020. Together with the forecasted economy growth and the rise of the standards of living, this fact will result in tripling the energy consumption, which in 2020 will reach more than 450 Mtoe.

The Mediterranean basin has a high potential for the development of thermal solar energy, namely for water heating purposes. Thermal solar installations reduce the fossil fuels consumption and the related emissions. Moreover, despite the initial investment, these kind of installations are usually cost effective.

The Cyprus example is quite eloquent: about 60 % of the island houses are equipped with solar water heating, resulting in a 10 % saving in the total CO_2 emissions.

• *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology?*

In order to create a sustainable thermal solar market in the Southern-Mediterranean countries, it will be necessary surpass some barriers. Obviously, financial and information barriers, but also the low credibility of these technologies, which remains as a result of the commercialisation of low quality equipment in the past.

Within this project, the local markets will be studied and stimulated, through the organisation of seminaries and technical visits. Projectors and installers will also be trained.

Nevertheless, one of the most interesting topics is the implementation of a “GRS” system (Garantie de Résultats Solaires). GRS is a contract between the customer and the supplier, which certifies the quality of the installation and warrants its performance. Third-party Financing will also be encouraged.

• *Does the project support access to financing of technologies?*

The project does not comprise any financial instrument. However, interesting projects will be prepared and submitted for international funding.

The SolarMed project is supported by the European Commission with a 60 % contribution.

Project title:	**Precious Planet**
Host countries:	**Algeria, Egypt, Lebanon, Morocco, Tunisia and Palestinian Authority**
Partner country:	**Portugal**
Contact person:	Luís Silva CCE Estrada de Alfragide, Praceta 1 P – 2720 Alfragide Portugal Tel: 351-1-4722800 Fax: 351-1-4722898 E-mail: dmre.cce@mail.telepac.pt
Project purpose:	Awareness raising of youth in the Mediterranean countries for energy, environment and sustainable development
Executing agencies:	ADEME – Agence de l'Environnement et de la Maîtrise de l'Energie (France) CCE – Centro para a Conservação de Energia (Portugal) CRES – Center for Renewable Energy Sources (Greece) AME – Agence pour la Maîtrise de l'Energie (Tunisia) ALME – Association Libanaise pour la Maîtrise de l'Energie (Lebanon) PEC – Palestinian Energy and Environment Research Center (Palest. Terr.) APRUE – Agence Nationale par la Promotion et la Rationalisation de l'Utilisation de l'Energie (Algeria) CDER – Centre de Développement des Energies Renouvelables (Morocco) OEPC – Organisation for Energy Conservation and Planning (Egypt)
Project period: **and costs**	07/1998 – 07/2000 (2 years) 3850 000 Euros

- *Which is the main problem targeted by the project?*

The increasing use of fossil fuels is posing dramatic environmental, economic and social problems, namely climate change, acid rain and serious health problems, particularly in urban and industrial areas.

Reducing these impacts and achieving a sustainable development represents a considerable challenge. In this context, raising awareness for the youth is obviously a priority.

• *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology?*

The *Precious Planet Project* will extend the French and Tunisian experiences to other Mediterranean countries.

Posters, brochures and other deliverables will be produced and distributed in schools and youth associations. In parallel with the information campaign, animators and monitors will be trained and prepared for future training actions.

Project title:	**Utilization of weather forecasts and climatic modelling to support the sustainable development in the PLOP and Macao Territory**
Host country:	**Angola, Cape Verde, Guinea Bissau, Mozambique, Macao, Portugal, S. Tomé e Príncipe**
Partner country:	**Portugal**
Project purpose:	Agência dos Países de Lingua Oficial Portuguesa Para a Área do Clima e das Respectivas Implicações Ambientais – Agência CRIA
Executing agency:	ECSC
Project period:	Oct. 1999 – 2002 Total cost 6.999.131 USD

1 - Brief description of the Project

Most of Portuguese speaking countries in Africa are still operating a number of Meteorological activities, such as weather and climatological services in the same manner as during the pre-independence days, when the main users of the services were the civil aviation and government itself. However, since then rapid social-economic development has taken place, new requirements from different sectors are needed, and Meteorological Services are unable to respond in a suitable manner.

The present project intends to promote a better utilisation of weather forecasts for the support of social and economical activities.

The major objective of the project is to create conditions for improving the weather prediction quality in long and medium term in all Portuguese Speaking African Countries (PALOPs) and in Macao using numerical models and implementing an operational scheme of regional climate simulation, without resorting of high-speed computers.

A Regional Atmospheric Modelling System (RAMS) will be used as a numerical limited area model, as well as global models of large scale.

The final result of this project will be the implementation of RAMS, in operational mode, to be used in the weather prediction and climate characterisation, at present and in future, in all Countries/Territories.

For the weather prediction, RAMS will be forced by initial and boundary conditions obtained from ECMWF, as well as by radiosonde and surface observations taking place in those Countries/Territories and/also in neighbouring countries.

In studying the climate, future scenarios of large scale produced by the Melbourne University General Circulation Model will be used to force RAMS.

The project will be implemented in two phases and will take three years and an half (42 months)

2 - Special aspects of the Technology

In the present Project a Limited Area Model will be calibrated and validated for each synoptic region of the PALOPs and Macao Territory.

An experimental phase will be installed in Lisbon, and two persons for each country will be trained. At the end of the first year the project will be implemented in all countries under the responsibility of the person trained in Lisbon during the experimental phase.

The transference of technology in the area of numerical weather models is the major objective to reach for promoting a better utilisation of weather forecasts in the support of social and economic activities.

3 - Relevance of Project Type

The technology of limited area models are been used all over the world with the objective of obtaining the improvement of regional weather forecasts for supporting different social and economical activities. The modelling technology is an important aspect to be developed and to be improved in order to obtain a better understanding of the climatic system and to have long-term forecasts in a seasonal perspective.

Project title:	**Demonstration of M&T and Development of Sustainable M&T Infrastructure**
Host country:	**Brazil**
Partner country:	**Portugal**
Contact person:	Jorge Mendonça e Costa CCE - Centro para a Conservação de Energia Estrada de Alfragide, Praçeta 1 2720 Alfragide Portugal
Project purpose:	Encourage the widespread use of M&T to deliver sustainable energy savings to industrial companies in Latin American countries.
Executing agency:	March Consulting Group and CCE - Centro para a Conservação de Energia
Project period:	11/1997 -

Requested specific information:

- *Which is the main problem targeted by the project?*
- *How can the applied technologies assist in solving this problem?*

Reducing energy consumption in industrial companies is crucial at a global level, both economically, with reduced energetic costs increasing the competitiveness, and environmentally, contributing to the overall reduction of gaseous emissions.

M&T techniques can provide a sustainable way to achieve such savings. Being easy to implement, the widespread replication of these techniques can be relatively straightforward.

- *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology?*

- *Which instruments are used to improve the respective groups' access to information and their knowledge of climate relevant technologies?*

In order to achieve the proposed objectives, a best practice approach was selected. Working close to the federal government and local industrial associations, 5 representative sites were chosen, to be used as role models in the implementation of M&T systems. All M&T material, including energy audit, software and European consultancy were provided for free thus ensuring project success. The only economical effort required from the host sites consisted in metering acquisition and installation, but even this could be eased up by applying to a special low interest loan provided by the Federal Government.

Furthermore the project also comprises the development of other financial instruments, training local consultants to facilitate the replication, developing M&T material

in Portuguese and disseminate the main results throughout workshops and seminars.

• *Which positive experience has been gained up to now (lessons learned / best practices)?*

Although the project is not concluded, the first results from the sites with the M&T system already running are excellent, with the expected 5% energy saving being overtaken in most of them.

Another positive aspect is the increasing involvement of the employees as soon as the results start to show up, building up this way an effective and sustainable M&T system.

• *How does your project support access to financing technologies?*

The project also comprises a financial instruments development in order to enable other industrial companies to fund the installation of M&T systems. The Federal Government is the most adequate to co-ordinate at National level the World Bank funding. Being a very large country, regional co-ordination is also needed, and this can be either accomplished by government branches or local industrial associations.

• *With respect to technology transfer, which factors and conditions are crucial to the success of your project?*

The crucial factors to the success of this project are maintaining constant funding flow, in order to keep up the momentum in the selected sites, and to assure an efficient financial support since, from our experience, the lack of capital and high interest rates are the greatest concerns of the industrialists.

In order to achieve a fair replication rate, the effective training of local consultants is also a main issue. In a first phase this can only be reached by continuing to have joint demonstration projects or close support to their initiatives.

The dissemination of the results is also crucial. It is necessary to take those examples and turn them into best practices, enable people to share their experiences, presenting the local consultants and the existing financial instruments, as part of a series of workshops and seminars.

Project title:	**Wave Models for the PLOPS**
Host countries:	**Portugal, Portuguese speaking countries in Africa and Macao**
Partner country:	**Portugal**
Contact persons:	Sergio Ferreira Instituto de Meteorologia, Rua C ao Aeroporto 1700 LISBOA PORTUGAL
Project purpose:	Research
Executing agency:	CRIA - Clima e Respectivas Implicações Ambientais Financial and technical cooperation
Project period:	The expected period of duration for the Project is 4 years. The expected total costs are 80 000 000$00. The Project can also be implemented by phases with the execution in different countries differed in time.

Project Main Targets

The Project will develop and improve the capabilities of the Portuguese speaking countries in Africa and of Macao (PLOP) to provide meteorological support to the activities related with the sea, trough the use of numerical models for wave forecast, wave hindcast and wave climatology.

Waves have a large influence in the safety and efficiency of most activities at sea. In many cases there are large budgets involved in these activities and their relative weight in the country economy is considerable. So, this is one of the fields where the economic impact of meteorology can be much significant.

Instruments Methods and Procedures

The project will have two main components:

- Implementation of regional versions of a third generation sea wave numerical model;
- Courses on sea waves, training on the use of the wave models and on the interpretation of their results.

The project will have two phases.

The first phase will be held in Portugal and will involve the training of the national teams that will became, the national responsible for the wave models operation and maintenance. This phase will include:

- Development of the adequate regional version of the wave model;
- Courses in sea waves and sea wave models
- Training in the use of wave models

The second phase will take place in the different PLOP and will include the training of other meteorological personal that will use the results of the wave model. This phase will include:

- Operational implementation of the regional wave model;

- Courses in sea waves, their influence in the human activities at sea and in the use of wave models to provide the relevant information for the users.

Previous Experience, Success Factors and Other Information

The Portuguese experience in the development and use of sea wave models began in 1986 with the development and implementation of a first generation wave model named MAR211. The present third generation wave model MAR3G, was developed in 1992 and was implemented as an operational model for wave forecast in 1994. The present version of this third generation model can be run in microcomputers, and so, it can be easily implemented in developing countries.

The Portuguese experience has shown that wave models can improve dramatically the capability of providing reliable wave forecasts and that these forecasts can be used by shipping, fisheries, coastal and harbour operations, offshore activities, etc. The experience at the Portuguese Meteorological Institute has shown that the model wave forecast can be easily sold and became profitable to the Meteorological Institute.

The model results have also proven useful in wave hindcast cases and in wave climatology. This is even more important in the cases where wave data obtained form wave meters is lacking.

The success of the project depends mainly of eventual problems related to the political conditions in some of the PLOPS.

Wave models have been in use for several decades in many countries. In most cases these models were obtained by projects of transfer of technology. One of the components of the present project that can contribute to a successful achievement is the component of education and training.

Project title:	**Euro-Mediterranean Fair for Energy Efficiency and Renewable Energies**
Host countries:	**Tunisia and other Mediterranean countries**
Partner country:	**Portugal**
Contact persons:	Luís Silva CCE Estrada de Alfragide, Praceta 1 P – 2720 Alfragide Portugal Tel. 351-1-4722800 Fax 351-1-4722898 E-mail: dmre.cce@mail.telepac.pt
Project purpose:	Promote energy efficient technologies and renewable energies in the Mediterranean countries
Executing agencies:	CRES – Center for Renewable Energy Sources (Greece) CCE – Centro para a Conservação de Energia (Portugal) ANER – Agence National des Energies Renouvelables (Tunisia)
Project period:	09/98 – 06/99 (10 months)

- *Which is the main problem targeted by the project?*

It's now an evidence that greenhouse gases are inducing climate change at an alarming rate and thus posing serious environmental, economic and social risks. Given the need for environmental protection and also the increasing scarcity of fossil fuel resources, energy efficiency and renewable energies became central topics in energy policy. Therefore, the promotion of new energy technologies and renewable energy sources should be further encouraged.

- *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology?*

Two events will be organised in Tunisia, under the auspices of MEDENER, the Mediterranean Association of the National Energy Agencies:

- an exhibition of energy efficient technologies and renewable energies equipment;
- a conference presenting innovative technologies, in order to assist Mediterranean energy actors in defining technology priorities.

- *Which positive experience has been gained up to now?*

The project is still at an early stage and therefore no results are yet available.

Nevertheless, it is expected to create opportunities for technology transfer, commercial relationships and a dynamic partnership between the two shores of the Mediterranean.

- *Does the project support access to financing of technologies?*

The project does not comprise any financial instrument, since its main aim is to disseminate information about energy technologies.

The project is supported by the European Commission, under the THERMIE Programme (150 000 Euros).

Project title: **Environment Protection Training and Research Institute (EPTRI), Hyderabad, Andhra Pradesh**
Host country: **India**
Partner country: **Sweden**

- *What are the project´s main targets ? What technologies are applied and how do they contribute to the targets ?*

- *Which instruments, methods and procedures are applied by the project in order to respond to the concrete needs of users and beneficiaries of the respective technology?*

- *Which instruments are used to improve the respective groups access to information and their knowledge of climate relevant technologies ?*

Following an Agreement between the Government of Sweden and the Government of India in 1991, EPTRI was established at Hyderabad as an Autonomous Society in 1992.

Sida funded the setting up costs with equipment and Swedish consultancy support during a 4 years period.

The Government of Andhra Pradesh alienated land to set up the Institute´s permanent facilities and extended a grant for constructing the building and an initial start-up running expenses support. The MoEF-GOI provided financial support for institutional development

The Society´s aim was to extend technical training and consultancy services to polluting categories of industries.

The project completed its first phase by mid year 1996. With training support by the Swedish consultancy organisation ÅF-IPK, EPTRI´s core staff developed training and consultancy expertise in the following areas:

- Safety and Risk Assessment
- Micro-biological applications in wastewater treatment
- Waste audit and waste minimisation
- Air quality monitoring
- Wastewater monitoring and treatment

The project was evaluated by Sida in September-October 1996. The evaluation report was very positive with constructive criticism in the areas of management and the need for business orientation. It recommended a further period of assistance for the EPTRI.

The EPTRI-II project was initiated by April 1997 with the overall objective to strengthen investments already made and make the organisation self sufficient by the year 2000. The Project plan for the second phase defined the following purposes:

1. To conduct training programmes for industry and State Pollution Control Boards.

2. To make available environmental quality information to policy makers, students, researchers, industry, EPTRI faculty and NGOs.

3. To establish a mechanism of Joint Indo-Swedish business collaboration to extend environmental management services in India and abroad.

4. To assist industry in obtaining Environmental Management certification.

5. To plan, locate and design Hazardous solid wastes T.S.D.Fs.

6. To map environmental quality to assess carrying capacities, zone industrial locations and analyse impact scenarios.

7. To upgrade the laboratory.

8. To establish in EPTRI a professional management system.

- *Which positive experience has been gained up to now ?*

  - Competence development in consultancy services, for staff with basic technical knowledge, is best performed by experienced consultancy organisations in joint projects with the trainees working in hands-on situations.

  - The experienced trainee consultancy firms should, where available, primarily be selected from local sources. They will have a clear understanding of prevailing conditions and will normally offer more services for available money.

  - Whenever the competence development services are offered by two or more consultancy firms, the demands on monitoring the project are high.

  - Efficient and professional communication practises are one of the keys to success.

- *Does the project support access to financing of technologies (and how) ?*

Yes. According to the above the project is concentrating on a business orientation of EPTRI - in its widest sense. One of the main purposes is to establish collaboration with internationally well established consultancy organisations, resulting in ”financing of technologies”.

Another result of the project is the availability of up-to-date database information on projects sponsored by international funding organisations in EPTRI´s fields of activities.

- *With respect to technology transfer, which factors and conditions are crucial to the success of the project ?*

That the project period is long enough. For the project here described a period of 4+4 years might prove to be long enough. A 4 year project period was too short under the conditions.

That the trainees are senior professionals of highest caliber.

That yearly control stations are applied.
That the project is well documented.
That the monitoring of the project functions timely and with precision.
That the funding organisation is following the project closely.

Examples of energy efficiency projects

Project:	**Guizhou and Shanxi Energy Efficiency Demonstartion**
Partner Country:	**United Kingdom**
Country:	**China**
Commitment:	**£1,900,000**
Duration:	**1996 - 1999**

The Guizhou and Shanxi energy efficiency project aims to identify and implement a programme of activities which will encourage industry to introduce practical, cost- effective, affordable and immediately applicable energy efficiency measures. Phase 1, now complete, was primarily an assessment study examining the scope for industrial energy savings while determining the barriers to making such savings. Phase 2, scheduled for completion by the end of April 1999, set up a series of technical improvement demonstration activities supported by a major capacity building initiative. The ten demonstration projects being undertaken illustrate that energy efficiency measures can be of low capital cost (in absolute terms), can offer rapid and significant payback and have significant replication potential.

Project:	**Commercialisation of Innovative Woodstoves**
Partner Country:	**United Kingdom**
Country:	**Research (East Africa)**
Commitment:	**£132,899**
Duration:	**1996 - 1998**

DFID has funded research into the development of fuel efficient cooking stoves in East Africa, where woody biomass consumption for cooking by the public and private sector accounts for up to 15% of all biomass use. Production of the improved stoves was supported by a training programme to develop better business skills and practises. The design has increased the commercial viability of both public institutions and commercial establishments, while also contributing positively to the environment through reduced deforestation and reduced demand for fuel oil.

Project:	**Orissa Power Sector Reform**
Partner Country:	**United Kingdom**
Host Country:	**India**
Commitment:	**£12,050,000**
Duration:	**1996 - 1999**

Orissa was the first state in India to undertake radical energy sector reform and is regarded as a test case for similar reforms nation-wide. These reforms will ensure the long-term viability of the power sector by enabling the state to attract private sector investment; improving the quality of service for customers; and helping improve the state government's finances by eliminating the need for massive subsides. The reform paid by the Government of Orissa to the State Electricity Board and is now reaching a crucial stage with electricity

distribution companies scheduled to be sold into private ownership. A number of other states have followed suit, including Andhra Pradesh and Haryana where DFID has agreed to support their own reform programmes.

In-situ Remediation of Oil Contamination

Partner Country:	**United Kingdom**	
Industry:	**Property/Land Developers**	
Operating Company:	**Retail Developer**	
Supplier:	**Celtic Technologies Ltd**	
Address:	**CBT Centre**	
	Senghenydd Road	
	Cardiff CF2 4AY	
Contact:	**Ian Viney**	
	Tel:	**+44 1222 372311**
	Fax:	**+44 1222 645565**

Background

Land for development is often at a premium in heavily populated areas, particularly those which have a restriction on building in 'green belt' - land that is protected from development, usually in order to halt the spread of urbanisation into the surrounding countryside. Therefore, when land becomes available through the closure of an industrial operation, property companies are keen to investigate the opportunities for redevelopment. They are not alone in this; local authorities want to encourage reuse of industrial land because of the potential for employment, both during the construction stage, and afterwards, particularly if the site is re-used for another industrial purpose or for a commercial undertaking. They are also keen to see unsightly industrial wasteland redeveloped, thus improving the local environment.

However, land that has been used for industrial purposes, is often contaminated with the bi-products of whatever industrial process has been undertaken at that site. This is particularly true of older industrial sites, where environmental controls have not been as tight as they are today. Therefore, it is necessary to clean up or remediate the contamination, ideally before redevelopment begins.

The Problem

Construction of a new superstore was underway on the site of a former engineering works when it was discovered that the ground and groundwater was contaminated with diesel and kerosene. Measurements showed that 12000 litres of diesel and kerosene had leaked into the ground and groundwater to a maximum concentration of 70,000 mg/kg and 1000mg/l respectively.

Construction was in progress but the contamination was causing problems and needed to be removed. Celtic Technologies Ltd, based in Cardiff, South Wales, were appointed to undertake remediation as construction proceeded in order to prevent hold-ups to the construction contract.

The Technical Approach

Building work had commenced and so removal of soil was not practical. Therefore in-situ remediation using biological treatment and vapour extraction was integrated with the construction programme.

The treatment strategy involved the use of a combined system of in-situ enhanced bioremediation, vacuum extraction, vapour control and oil/water separation to treat oil contamination to safe levels and to remove volatile compounds. Documented certification of these were a key part of the contract in order to satisfy the requirements of the Regulatory Authorities.

Benefits

The contract lasted five months, cost £58,000 and saved the developers £300,000. The source of the groundwater contamination was treated and groundwater contamination concentrations were reduced to the satisfaction of the UK National Rivers Authority (now the UK Environmental Protection Agency).

Recent Overseas Projects

During 1996, Celtic Technologies was appointed by the Czech Republic's National Property Fund to study bioremediation of oil sludges. The contract involved the development of a destructive treatment strategy for oily tar wastes at an oil refinery containing some 28,000 m^3 of oil hydrocarbons high in PAHs. Laboratory studies and feasibility trials have been undertaken to improve handleability and optimise biological treatment processes. Celtic Technologies provides contracting services for the remediation of contaminated land and groundwater. The company has an extensive track record in the application of a range of low-cost in-situ treatment techniques, including biological treatment, vapour extraction, pollution containment, non-aqueous phase liquid (NAPL) recovery, groundwater "pump and treat" and contaminant source control.

Effluent Treatment Plant Brings Life to Arid Desert

Partner Country:	**United Kingdom**
Industry:	**Milk Processing**
Operating Company:	**Almarai Trading Company, Riyadh, Saudi Arabia**
Consultant:	**McDonald Stevens Associates**
Address:	**Kestrel House**
	Mill Street
	Trowbridge BA14 8BE
Contact:	**Nigel Stevens**
	Tel: +44 (0) 1225 774775
	Fax: +44 (0) 1225 751972
Supplier:	**ACWa Services Ltd**
Address:	**ACWa House**
	Keighley Road
	Skipton BD23 2UE
Contact:	**Mark Little**
	Tel: +44 (0) 1756 794794
	Fax: +44 (0) 1756 790898

Background

Milk processing, like every operation in the food & drink industry, requires a high level of hygiene and cleanliness. Every element in the production process - the pipelines, tanks and heat exchangers - has to be cleaned thoroughly after each cycle, sometimes two or three times a day. This ongoing cleaning process results in high-strength effluent from the plant, and a vast requirement for water - a scarce resource in many arid countries.

The Almarai Trading Company's central processing plant near Riyadh is the largest milk processing facility in the Middle East with the capacity to convert 1.4 million litres a day of milk into drinking yoghurts, set yoghurts, cream, pasteurised milk and a number of other milk-based products. The company has recently commissioned an innovative treatment plant which is turning the wastewater produced by the processing facility into a source of agricultural irrigation.

Technology

The treatment plant, designed by McDonald Stevens Associates of Trowbridge in Wiltshire, and built and installed by ACWa Services Ltd of Skipton, in North Yorkshire, has to handle 1,500 m^3/day volume of effluent which consists of dilute milk and dairy washings, with acid and caustic cleaning solutions, and small quantities of domestic effluent. The raw effluent has a chemical oxygen demand (COD) load of 4,100kg/day, a biological oxygen demand (BOD) load of 2,560 kg/day and a pH range of 5-11.

The key to the treatment process is the Effluent Monitoring System (EMS).
A network of floor drains and pipelines draws the waste water from all the different sections

of the factory to a central Floor Drain Measuring Box. Turbidity probes are inserted into the box to determine effluent strength and to highlight areas of product wastage throughout the dairy operation. Integral screens in the EMS remove anything greater than 5mm, such as bottle caps and other objects.

The EMS then directs the screened and monitored effluent to continuously agitating balance tanks. The waste water is then pumped through a pH correction tank, in which the effluent is dosed with an acid or alkali solution, before being treated in an activated sludge treatment process. Final effluent from the plant has an average COD concentration of 300mg/l and an average BOD concentration of 100 mg/l with a pH of approximately 7.4.

Advantages

The Manufacturing Manager at Almarai, Steve Perkins, commented, “Milk processing uses a very large amount of water, and in Saudi Arabia water is a scarce resource. The water used in the cleaning process can, once treated, be introduced into our irrigation system around the plant, thus reducing the overall amount of water Almarai consumes.”

The animal feed crops given sustenance by the treated effluent can, in turn, be fed to the dairy cows on Almarai’s super-farms to help them come full circle and produce the milk being produced by Almarai’s facility.

Pakistan sewerage system pumped into action

Partner Country:	**United Kingdom**
Industry:	**Municipal Waste Water Treatment**
Operating Company:	**Lahore Water & Sanitation Agency**

Supplier:	**Brain Associates**
Address:	**Redstone Plant**
	Redstone Road
	Narberth
	Pembrokeshire
	SA67 7ES
Contact:	**Mr Anthony Powell**
	Tel: +44 1834 860000
	Fax: +44 1834 860567

Background

The city of Lahore in Pakistan has been experiencing considerable problems with its trunk sewer network. The network, serving between five and seven million people, discharges directly into the local river and has had little maintenance since it was installed sixty years ago. Consequently sewers are heavily silted up with many of the 48” diameter runs blocked to half their depth.

In the past the problem was tackled by pumping the flows into surface drains originally designed to cope with monsoon flows. However these sewers were then left alone and the city has experienced extreme flooding in the monsoon period because of the blocked drains. The problem has been exacerbated by the city’s population using the sewers as rubbish disposal sites.

A pilot project supported by the UK’s Department for International Development (DFID) and run by Carl Bro International was initiated to clean the city’s trunk sewer network and avoid future blockage and flooding. Brain Associates was the main equipment supplier for this project and the company worked in close conjunction with Carl Bro International to provide the most efficient solution to the cleaning problem.

Technology

The section of the sewer network to be cleaned was 4.5km in length and is located in the densely populated walled area of Lahore, below the fort. This particular section currently accounts for only 5% of the network but serves 20% of the population.

The deposits of compacted silt and debris were manually broken down and then conveyed out of the sewer using the high vacuum and air flow of the Brain Power Pack 2000 system. The debris was pneumatically conveyed into the awaiting Self Filling skips and then taken to site by tractor for tipping whilst the next Self Filling skip was loaded, allowing a continuous cleaning operation. Following the removal of debris, the sewer was then cleaned

using the Brain 4@ 12 Trailer Jetter producing 4000 psi at 12gpm prior to any remedial work. Brain Associates have manufactured a modular cleaning system which incorporates a very powerful, low maintenance liquid ring vacuum system in conjunction with a number of rugged trailer mounted Self Filling skips. This system provides high production rates and gives horizontal runs of 150m and vertical lifts in excess of 10m. The system has been deliberately designed to allow the operator to continuously clean the sewer which in turn generates higher production rates.

Benefits

Carl Bro Group's Field Project Manager, Peter Rowley, utilised Brain Associates equipment to its full potential through integration with local manual labour. This on site management coupled with UK Divisional Director David Whiles persistence has proved that managed sewer cleaning using local contractors will provide the answer to the ever growing problem of blocked sewers across Asia.

Managed sewer cleaning has resulted in the following improvements:

- flooding incidents reduced
- complaints minimised
- reaction to emergencies minimised
- resources diverted to productive tasks
- community awareness of sewer cleaning and solid waste activities
- less environmental pollution and disease

The efficient cleaning of the trunk sewer system and the overall success of the project is leading the city's Water & Sanitation Agency (WASA) to call for the work to be extended and it may prove to be a model for similar work in cities across the region.

Environmental Impact Study for the Port of Karachi

Partner Country: **United Kingdom**
Industry: **Property Development**
Operating Company: **Karachi Port Trust**
Supplier: **AEA Technology**
Address: **NETCEN**
Culham
Abingdon
Oxfordshire OX14 3DB
Contact: **Ms Madeleine McDonagh**
Tel: **+44 1235 464040**
Fax: **+44 1235 463030**

Background

The port of Karachi is a major industrial centre for national and international trade, as well as a primary fishing port. When the port was earmarked for development there was a need to investigate sources of pollution in the port and harbour area, with a view to developing long term strategies to control pollutant discharges. The Karachi Port Trust commissioned an international collaboration to develop a strategic environmental plan for the port. NETCEN was one of the companies involved in the consortium which undertook the environmental impact study and developed an appropriate strategy. Other participating consultants were:

- National Engineering Services Pakistan (NESPAK)
- Frank Ayles & Associates (UK)
- Port of Liverpool (UK)
- HR Wallingford Ltd (UK)

The project was funded by the World Bank and took place during 1994-1995.

Problem

Pollution in the Port of Karachi comes from a variety of sources including:

- industrial and municipal wastes from Karachi city
- garbage and sewage from the port area itself
- oil spills from ships using the port
- organic waste from the fish harbour
- atmospheric emissions from local industry and vehicles

Increased trade and activity in the port would only add to these existing problems. It was therefore vital that the planned development of the harbour was completed with due consideration given to the potential impact on the environment.

Action

The impact of each waste stream needed to be quantified and therefore the work undertaken by NETCEN included careful investigation, measurement and assessment of pollutant levels in:

- water
- sediment

The level of noise and soil contamination was also assessed and advice on oil spill prevention and response was directly provided by NETCEN.

From the impact assessment NETCEN was able to suggest possible remediation alternatives and develop short, medium and long term strategies to control increased discharges into the sea. A plan for a Marine Environmental Unit, equipped to measure and monitor pollution in the harbour area, was also devised.

Benefits

Through early involvement in the project NETCEN was able to plan the development of the harbour with due regard for the potential environmental impact. NETCEN's wide range of knowledge and experience ensured that suitable proposals could be developed rapidly and implemented successfully.

The Port of Karachi will benefit directly from this project as arrangements for the effective disposal of sediments from the harbour will remove one barrier to the ratification of international maritime agreements of Pakistan.

The implementation of the recommended strategies will ultimately provide Karachi with a better quality environment within the port area. It is also hoped that the work will improve the commercial fishery operations in the port.

Renewable Energy - Power for the next generation

Predictions for Growth

Renewable energy (RE) is increasingly seen as a key growth market for at least the next 50 years. One reasonably solid indicator for this is that Shell - the 2nd largest company in the world - has recently made Renewables its 5th core business. Shell claims that "renewable energy sources could provide between 5 and 10% of the world's energy by the year 2025, possibly rising to over 50% by mid-century".

Banks, too, are now recognising renewable energy as a primary growth industry. The World Bank, for instance, is financing large renewable energy projects in Argentina and Indonesia, and has been interested in solar thermal power generation for a while. For example, through its Global Environment Facility the World Bank has funded the Hilly Hydro Project in India, looking at sustainable development of small hydro for the sub-Himalayan region. It is also instigating a Photo Voltaic (PV) Market Transformation Initiative (PVMTI) which plans to provide private sector firms with a chance to obtain grant funding to diminish the perceived risks associated with developing the PV business in developing countries. The PVMTI will start with three selected countries: India, Morocco and Kenya.

The recent White Paper for a European Commission (EC) strategy and action plan has committed to a target of 12% for the contribution by RE to the EU's gross inland energy consumption by 2010. Not surprisingly, a target like that needs financial and political support and Europe is supporting renewable energy developments in a substantial and pioneering way. The present UK Government has also expressed interest and commitment to the development of renewable energy.

At the moment, the UK produces enough renewable energy for the needs of over 800,000 households (around 600MW). This will need to increase enormously over the next decade in order to achieve the new UK target for renewable energy contribution to electricity consumption (10% by 2010). Within the UK, Wales is particularly well endowed with renewable energy resources with an abudance of wind and rain. More surprisingly it has two of Europe's largest roof-mounted PV systems - one on the new Ford Factory in the South and another at the Centre for Alternative Technology in the North. The Welsh renewable energy industry is among the European leaders in terms of manufacture, expertise and on-the-ground implementation.

Continuing growth for UK renewable energy developments is inevitable however developing countries represent even greater potential. Around 2 billion people, roughly half of the world's population, do not yet have access to electricity. Many of these people will get access over the next 50 years and a significant proportion of these will be electrified off-the-grid (i.e. with stand alone generating systems). In this vast market, which extends to rural industries as well as households, renewables such as solar PV, wind, micro hydro and biomass, will compete with increasing success as costs drop in relation to rising economies of scale.

Review of Sustainable Energy Technologies

The major sustainable energy technologies are biomass, wind, solar and hydro power. It is impossible to deal with all of these in any detailed way here in this article, but an overview would help readers understand the overall renewable energy mix which is likely to be part of the global energy future for us all. One other technology - wave power - has vast future potential for electricity generation, particularly in island situations (which includes the UK, but more significantly countries like Indonesia which has a huge population spread over more than 17,000 islands). Wave power has not yet reached the market technically or commercially, therefore it is not covered in any detail in this article.

Biomass

Sustainable energy from biomass comes in a number of guises and is already well utilised in most parts of the world. In fact, in its simplest version for cooking and heating i.e. open fires, biomass has been in use since the discovery and manipulation of fire by humans over 100,000 years ago.

Today biomass comes from commercial forests (including the chippings after clearing for timber), crop residues, specially grown energy crops and even industrial wood waste. It can be used to provide heat for domestic or industrial processes and it can also be used to generate electricity.

Biogas also has a large potential mainly from agricultural manure, by-products of the food processing and other bio-degradable industrial wastes.

Wind

Wind power, too, has a long tradition. It has been used in sailing boats and, of course, old fashioned windmills which utilised cloth sails on a horizontal axis from which mechanical power was taken to mill flour or complete other heavy tasks. For a large part of this century, in places like the great plains of North America, multiblade wind machines were a common sight, normally utilised for water pumping. In the last 30 years wind turbines have been developed to produce electricity. Today these are among the most economic of all renewable energy sources which is why large scale wind farms are springing up in the UK, Europe, Argentina and India. Wind energy, however, is very dependent on having a good average wind speed at the location of a wind farm. Calculations for wind energy resources are a vital tool for wind energy developers and utilities considering wind power as an option. Wind resource monitoring is one of the services eminently exportable from specialist UK companies.

The scale of wind turbines has increased rapidly in the last 10 years or so. Most commonly, today, commercial wind turbines for linking to the grid are in the scale of 300kW to 1MW per machine and the wind farms more and more frequently combine between 50 and 100 turbines. The next generation of wind turbines will be in off-shore positions to minimise their visual impact and to optimise wind capture.

Solar

In some ways all renewable energies arise from solar power. Biomass needs the sun to grow plant matter, winds require the sun to give them energy and, without the sun's input to global evaporation there would be no water available in the form of rain for hydro power. Even ignoring all these renewable sources, there are still several main forms of solar power.

Solar thermal, or heat, power for instance, uses the direct sunlight to heat water. This can be for domestic or industrial hot water requirements, for swimming pools in the leisure trade, or even to generate electricity from steam powered turbines.

Passive solar technology is also an important aspect of renewable energy, though it relates most to architectural design and building integration. Again, this has a long history. In Northern countries glass houses are used for horticultural purposes, and glass glazing (now double or triple glazing) has been utilised to maximise light and incoming solar warmth for space heating.

One of the most exciting new developments in renewable energy, however, has to be solar photovoltaics. Many of the large oil companies - such as BP and Shell - now have solar divisions. In fact, there are few PV manufacturers which are not oil companies. The market for PV is vast and 1997 saw, for the first time, a shortfall in supply to match demand. Several European countries, Japan and the USA have government instigated PV-roof schemes encouraging and subsidising domestic and industrial implementation of building integrated and sometimes grid-linked PV arrays, however the real need is in developing countries.

PV is well suited to off-grid electrification requirements and is already cost-effective in many situations where the required electrical load is relatively low, such as lighting, refrigeration, water pumping and radio communications for small, remote communities. It also has the advantage of being easy to install, highly portable and modular. All of these factors can be seen as benefits in highly rural and relatively poor socio-economic environments.

Hydro

Hydro power is often thought of exclusively in terms of massive projects involving the construction of major dams. These are not always appropriate in social or environmental terms most of the best large scale hydro sites are already utilised. Where there is still significant room for development at a more appropriate level for the electrification of rural off-grid villages is in small or micro hydro power developments.

Mini and micro hydro schemes have enormous potential as cost effective solutions to the provision of environment-friendly energy. In many regions of the world, hydro power is abundantly available and will never run out. It can provide a reliable ,and efficient source of power for small, independent systems, schools, hospitals, hotels, entire communities, remote agricultural/industrial needs or for feeding into a national electricity grid. Such schemes can generate income as well as providing a long lasting and reliable source of power.

Mini hydro power - typically grid connected schemes of up to a few MW in capacity - are valuable, cost effective tools for providing environmental friendly electricity.

Micro hydro power - typically stand alone systems in the range 1 to 50kW - have been proved useful by UK companies in powering remote domestic loads and as part of development projects in countries such as India, Peru and Ethiopia. A number of UK companies manufacture micro hydro turbines and supply technology for assembly in developing countries.

The utilisation of micro hydro electricity for small scale industry and productive processes can often reduce the payback period on capital investment from over 20 years (for simple domestic uses) to less than 5 years. Hydro powered agro-industrial projects frequently involve a wide range of practical end-uses, often in milling, crop drying, carpentry, lighting, refrigeration or light engineering.

Sustainable Energy for Developing Countries

The arrival of electricity and other forms of industrial power has had a significant impact on societies, similar to the arrival of other major harbingers of social, economic and environmental change, such as steel, gunpowder and an international money-based economy. One of the main benefits of renewable energy technologies compared to their competitors in power and heat supply, such as coal and nuclear, is the range of applications where they could be considered as 'appropriate'. Unlike conventional fuels, renewables offer both small and large-scale energy supply, they can be used in both grid and off-grid situations, they can be portable and modular and they can supply electricity, heat/cooling loads and fuels for transport purposes.

The consequence of this is that the nature of their use, especially in developing countries, is beneficial across a very diverse set of applications, including:

- rural electrification (domestic and agro/industrial processing)
- telecommunications
- transport fuels
- social provision (especially in health and educational)
- bulk power/heat supply (mainly for light industry and agro-processing)

With these uses, renewables are able to contribute to the 'development' of the economies and societies within the developing country. This is not only at the level of energy sector development, but also environmental protection and sustainable development, industrialisation of economies, alleviation of poverty, agricultural reform, health/education/welfare, plus, of course, the macro economic aspects associated with rural migration/depopulation and other policy areas.

CASE STUDY 1

In the field of small and micro hydro power, this case study takes a look at one major

international consultancy project which involves a wide ranging collection of specialists and consortiums. One of these consortiums is the Mini Hydro Power Group (which incorporates two UK companies - ITDG and Dulas).

Hilly Hydro - India

Small and micro hydro schemes are utilised by remote communities for community facilities, domestic lighting (ocassionally cooking) and small scale industrial or processing requirements. A case in point is the Hill Hydro Project which the Mini Hydro Power Group are engaged on as international consultants. This project is the very first UNDP-GEF funded project in the field of small hydro power.

Hilly Hydro aims to develop a national strategy and master plan for the utilisation of small hydro electric sources in the Himalayan and sub-Himalayan regions. This will involve the installation and commission of up to 20 working demonstration hydro schemes at a number of selected sites. A national strategy will be developed for the optimum utilisation of small hydel resources of the Himalayan and sub-Himalayan regions. The demonstration hydro will offer the necessary experience to local partners for the development of appropriate models of ownership, management and maintenance of the schemes, through a people-centred and participatory approach.

Devastating environmental damage is presently caused in the Himalayan regions of India by people collecting firewood. Forests are disappearing quickly; people cook in smoke-filled homes; irreplaceable flora and fauna disappear with the forests; and, of course, valuable topsoil is lost through deforestation. The introduction of small hydro turbines to generate electricity for heating and cooking in remote Himalayan villages will alleviate these environmental problems significantly.

As well as installing and commissioning up to 20 hydro schemes, this project also encompasses the establishment of the necessary expertise and capability at local and national levels in India for the sustainable development of the small-scale hydro electric industry in that country. This technology transfer has involved the training of Indian engineers in the UK as well as on the ground in the region itself. In many ways, the Hilly Hydro Project is a preferred option to larger hydro installation schemes which are viewed suspiciously in terms of their social and environmental costs. Small hydro schemes are more appropriate to remote mountain communities both in terms of the scale of the technology and as their effect on local issues of control and supply of power.

CASE STUDY 2

Another UK company - Energy for Sustainable Development (ESD) - has been working in Africa with local counterparts to develop energy efficient commercial cooking. Woody biomass energy consumption by schools, hospitals and other ‘institutions’, and by restaurants, hotels and other ‘commercial’ establishments, accounts for up to 15% of all biomass use in East African countries. Virtually all this consumption is for cooking, and almost all foods are cooked on highly inefficient three-stone fires or very inefficient fuel-

stoves.

With the help of the UK Department for International Development, ESD is carrying out a pilot activity to develop and commercially sell improved institutional and commercial woodstoves. This project is building on work previously undertaken in Kenya with a view to extending the developments into Tanzania, Uganda and Ethiopia. The project works on the principle that commercial stove producers in each country will learn from each other, exchange ideas and improve their own designs. In turn this will improve their products, boost sales and, of course, reduce the quantity of biomass consumption required for the present given energy outputs. This latter point should offer significant environmental benefits.

Consumer surveys showed that there is considerable demand for new improved stoves and a willingness to pay. Nine producers were brought together with four regional and international specialists in a four day workshop in Nairobi in January 1998. Training was held on improved commercialisation, sales, promotion and business practices. These commercial producers also received training on simple testing techniques, and agreed that the results from these tests should be an integral element in their marketing and promotion programmes.

The project has now entered its second phase where producers begin pilot-testing new designs, refining new commercial approaches, and developing better business practices.

Solar (PV) power is one of the major buzzwords in developing country rural electrification as we approach the 21st century. Solar photovoltaic (PV) power certainly is an increasingly preferred energy source utilised often for mainly environmental and policy reasons by international donor agencies like the World Bank and the EC. Many remote communities prefer, however, to use PV as a power source simply because it requires no constant supply of fuel and is simple to maintain (due to the absence of moving parts).

In 1997, the World Bank announced its intention to invest over $25 million in a PV Market Stimulation project focusing on Kenya, Morocco and India. The project aims to implement the first genuinely "successful" PV rural electrification programmes while at the same time stimulating economies of scale in PV production. Integral to their plan is to build the capacity of these countries indigenous solar energy industries.

Often the first services to be electrified by renewables are those basic facilities like health centres, schools and community buildings in remote, off-grid villages. Solar powered medical refrigerators, for instance, have helped extend the cold chain into areas beyond the reach of most facilities. These systems have a reputation for being reliable and, over the lifecycle of the equipment, less expensive than other refrigerators (such as kerosene or LP gas powered ones) which require a constant supply of fuel.

CASE STUDY 3

The DULAS VC150F solar medical refrigerator was developed over 10 years ago to fulfil the needs of the cold chain. These provide a well-tested, high reliability storage of vaccine or blood products with an integral ice pack freezing facility. It was amongst the first

solar compatible medical refrigerators to be produced and, once again, it is one of the leaders as a guaranteed CFC-free model. The design of the refrigerator provides excellent high performance at relatively low cost. Originally designed for the WHO Expanded Program of Immunisation, the refrigerator has proved remarkably versatile, also used for blood banking because of its ample internal volume.

After 11 years of manufacturing this product mainly for the African market, 1997 saw the first 100 DULAS solar refrigerators imported to India and 1998 saw the first arrive in South America. In both cases the training of local operatives is considered essential and has formed an integral part of the export package. Similarly, sophisticated equipment such as solar medical refrigerators requires in-country technical support which is generally provided by local agents.

There is an increasing demand for reliable and cost-effective electricity supply or generation for remote medical and health care applications throughout the world. Analysing costs over the design life of a health care project, solar powered medical equipment is one of the most economical options available. Diesel generators are often used but have the significant drawback of requiring fuel, oil and spare parts which make them expensive in the long run. Ensuring a continuous fuel supply is as unpredictable as the future cost for fossil fuels. Without diesel for generators, remote health clinics have no power for lights or refrigeration systems. Vaccines and blood products, in particular, only remain safe to use for a few hours without reliable cooling.

The use of state-of-the-art solar photovoltaic technology can overcome these problems and help extend power and appliances to communities otherwise seen as beyond the range of modern health care. The sun offers an abundant, inexhaustible, silent and non-polluting source of energy. Photovoltaic panels convert this directly into electricity which can be stored in deep cycle. Solar power incurs lower recurrent costs than diesel, avoids the danger of running out of fuel and requires very little maintenance.

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