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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 One

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 to this decision should be addressed, as well as suggestions for additional issues and questions.

3. Eleven such 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 of the submissions are attached, and the eleventh is issued separately as an addendum to the present document.

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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.

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PAPER NO. 1: AUSTRALIA

DEVELOPMENT AND TRANSFER OF TECHNOLOGIES

Australia welcomes the opportunity to submit its views on the development and transfer of technologies, especially as they relate to climate change. Australia sees the private sector playing the key role in technology development, diffusion and transfer; the public sector, however, has a significant role in designing the legal, institutional and policy frameworks to facilitate private sector investments and in ensuring that adequate education, training and research and development frameworks exist and are enhanced.

Practical steps to promote, facilitate and finance, as appropriate, transfer of, and access to, environmentally sound technologies and know-how

Promote the removal of barriers to technology transfer

Australia suggests that Parties build on the work reported by the UNFCCC Secretariat in the Technical Paper on Terms of Transfer of Technology and Know-How (FCCC/TP/1998/1). Whereas the UNFCCC survey investigated a limited number of projects, the paper clearly delineated that barriers vary from country to country, and that a combination of policy instruments is likely to be needed to address the removal of these barriers.

The UNFCCC paper also noted that the key barriers, in order of decreasing importance, appear to be financial, economic, technological, institutional and cultural. Financing of technology development and diffusion in Annex I countries is mainly the domain of the private sector. When the financing impediment is considered alongside the economic barriers imposed by the often-substantial cost of new or upgraded technology and associated services, the need for individual governments to create favourable investment conditions for the private sector cannot be overlooked.

Technological and institutional barriers are, on the other hand, more amenable to addressing in a multilateral context, although circumstances will vary from country to country in respect of these barriers. At the technological level, UNFCCC can make a significant contribution to information dissemination, technology assessments (including financial analysis), and technology applications. Institutional impediments can be addressed through an integrated approach that provides for enhanced technical knowledge and capabilities at the country level through continuing education, training and skill development, research and development base, and other relevant capacity building.

Important work in respect of promoting the removal of barriers to technology transfer is being undertaken by the entity operating the convention's financial mechanism, the Global Environment Facility (GEF). The GEF has two operational programs specifically directed to barrier removal, namely "Removal of Barriers to energy efficiency and energy conservation" and "Promoting the adoption of renewable energy by removing barriers and reducing implementation costs". The experiences and lessons learned from the activities implemented under these programs are tracked and disseminated by the GEF's monitoring and evaluation

office. Parties may like to consider encouraging the GEF to enhance its outreach on these matters through mechanisms such as workshops in conjunction with meeting of the convention and its subsidiary bodies, enhanced information on the GEF's web page etc.

Initiate and promote the transfer of publicly owned technology and those in the public domain

In general, government science agencies and universities do not have the resources to commercialise their research outcomes by themselves. Commercialisation of publicly funded research and development is often carried out by the private sector, which has a more appropriate understanding of the market place and the requisite marketing and financial resources. Technology development and diffusion are subsequently managed by the private sector.

The identification of publicly owned technology in the climate change context could be part of the Secretariat's work program on technology transfer; in particular the first theme on assessing the experience of developed country Parties. It is important that any such work is restricted to technologies that have moved beyond the research and development phase and are firmly in the commercial domain.

Promote bilateral and multilateral technology cooperation to facilitate technology transfer

Australia is supportive of bilateral and multilateral technology cooperation activities to facilitate technology transfer. Australia has formal bilateral arrangements facilitating technology cooperation with several non-Annex I countries, especially in the Asia-Pacific region. Technology transfer is also facilitated through Australia's overseas aid program and the International Greenhouse Partnerships Office. Like most countries, Australia produces only a fraction of its total technological needs, and therefore also has bilateral arrangements to facilitation technology transfer from overseas.

At the multilateral level, technology cooperation is facilitated through Australian involvement in the activities of the International Energy Agency (IEA) and the Asia Pacific Economic Cooperation (APEC) arrangements. Australia is also active in the Climate Technology Initiative (CTI) which aims to foster international cooperation for accelerated development and diffusion of technologies.

Australia through AusAID supports bilateral, regional and multilateral projects that facilitate the transfer of "hard" and "soft" technology for climate change in sectors such as energy, forests, land resources and adaptation. In 1997-98 the total approved value of these activities was approximately $152 million and expenditure in that year was $20 million. Australia has committed approximately $116 million to the Global Environment Facility (GEF) since 1991. Approximately 40% of funds to GEF are allocated to climate change.

Australia considers that the identification of bilateral and multilateral opportunities to promote technology cooperation should be sought out by interested countries. The outcomes of the special IPCC report on methodological and technological issues relating to technology transfer that will be available in late 1999 and the Third Assessment Report of the IPCC to be completed in early 2001 may provide appropriate guidance in respect of future cooperative activities.

Consider appropriate mechanisms for technology transfer within the UNFCCC

Australia considers that the Kyoto mechanisms – Clean Development Mechanism and Joint Implementation – provide the foundation for far-reaching cooperative international action and have the potential to engage the energies of the marketplace, including in the technology transfer context. It is, however, crucial that the operational frameworks for these mechanisms are cost-effective if they are to realise their potential. The CDM will also be a crucial avenue for assisting non-Annex I countries in achieving sustainable development and in contributing to the ultimate objective of the Convention.

The Global Environmental Facility will continue to fund the incremental cost of activities that address specific guidance from the Convention, including that related to climate technologies.

Collaborate with relevant multilateral institutions to promote technology transfer

Australia considers that developing countries should avail themselves of assistance currently available through existing mechanisms for technology transfer such as the World Bank, regional development Banks, UN organisations, and the Global Environment Facility (GEF). Annex I Parties' overseas aid and other programs and the CDM will also facilitate the transfer of climate technology to developing countries.

Other multilateral organisations that have been facilitating technology transfer to non-Annex I countries include the IEA and APEC. Participating non-Annex I countries are also benefiting from the CTI.

Promote and facilitate, in collaboration with the interim financial mechanism, multilateral and bilateral institutions, the arrangement of financing of technology transfer

The GEF is the entity entrusted with the operation of the UNFCCC's financial mechanism. Australia continues to support the GEF as the primary funding vehicle for meeting Annex I obligations under the FCCC. We are particularly supportive of the GEF's incremental cost support for activities that seek to remove the barriers to energy efficiency and conservation and the adoption of renewable energy. The GEF's involvement in activities to reduce the long-term costs of low greenhouse gas emitting energy technologies is also crucial to facilitating the transfer of climate technologies. Ongoing work by the IPCC may suggest areas in which guidance to the GEF may be refined.

The World Bank and the regional development banks have also been active in arranging climate change financing, including through cofinancing operations with the GEF. For example, the World Bank has increased its share of lending for renewables and energy end-use efficiency over recent years. The Bank has also mobilised private capital and bilateral cofinancing for the GEF renewable energy and energy efficiency projects. Greater scope exists for leveraging of funds available through GEF, World Bank and the regional development banks.

Promote and assist developing country Parties to access technology information

Australia recognises that enhanced information on climate related technology is needed, as is capacity building to enable developing countries to take advantage of available technologies and to address the ultimate objectives of the Convention. Australia supports a comprehensive approach whereby all Parties have access to an enhanced technology information dissemination system.

At the Fourth Conference of Parties (COP4) in Buenos Aires, Australia proposed that Parties consider the possibility of establishing a "clearinghouse". This "clearinghouse" could coordinate activities with a number of international, regional, national and thematic focal points linked across the Internet. It could be located under the UNFCCC Secretariat or an existing information centre endorsed by the Parties. Users without access to the Internet could be provided with services in other formats such as diskette, print, etc.

Facilitate access to emerging technologies

Australia sees merit in the Secretariat's proposed work on the synthesis and assessment of information on emerging technologies which could build on current efforts of the Secretariat to prepare technical papers on coastal zone and other adaptation technologies. Australia supports the Secretariat recommendation that these activities would need to be implemented in cooperation with industry, specialised national institutes and other organisations.

Parties need to provide adequate guidance to the Secretariat on the scope of emerging technologies which would be the subject of synthesis and assessment.

Facilitate the appropriate role of the private sector

Australia sees the private sector playing an important role in technology development, diffusion and transfer, given that the bulk of environmentally sound technologies is privately owned. The transfer of such technology is most likely to occur on a commercial basis because the private sector would wish to recoup some of its investments in research, development and technology commercialisation.

Australia considers that developing countries could increase the already significant transfers of technology by the private sector by doing more to create the economic, legal and

social environments that would encourage the private sector (international and national) to invest in technologies, including climate technologies.

Support for the development and enhancement of endogenous capacities and technologies of developing country Parties

Provide technical advice on technology transfer to Parties, particularly developing country Parties

Australia considers that the SBSTA Roster of Experts is the appropriate mechanism to provide expertise to address issues related to technology transfer. Specific expertise can be drawn upon to address specific issues on technology transfer, be they financial, economic, technological or institutional.

Promote capacity building in developing country Parties through provision of concrete programmes

Australia notes the G77 views on capacity building focus on: (a) energy efficiency and utilisation of renewable energies; (b) sustainable management, conservation and enhancement of sinks and reservoirs; (c) adaptation to the adverse effects of climate change; and (d) research and observation.

Australia also notes that the third element of the Secretariat's work program addresses capacity building. Through a catalytic or facilitative role, the Secretariat proposes to address capacity building needs in developing countries to overcome institutional, financial and information barriers related to the transfer of technology. Australia believes that elements of the G77 decision could be actively pursued through the Secretariat's proposed work program. In addition, capacity building may be facilitated through bilateral, regional and multilateral development assistance organisations, as well as in the context of private sector sponsored projects to transfer technologies.

Assist developing country Parties, on request, to assess required technologies

As indicated previously, Australia considers that the Roster of Experts is the appropriate mechanism to provide expertise to assess required technologies. Developing country Parties should, in the first instance, identify the required technologies and make their request for assistance to the Secretariat. The proposed clearinghouse mechanism would also serve a valuable role in facilitating the exchange of information on assessments and experiences of various technologies.

Promote and enhance access to relevant technical, legal and economic information at national and regional centres

The second theme of the Secretariat's work program could be expanded to cover existing as well as emerging technologies. Information could be gathered on technologies of interest to non-Annex I countries and comprise:

- operational efficiencies, scale of operation, lead times, feedstock requirements, emissions control systems required, emissions reductions, overall pros and cons of the technology;

- costs, broken down into capital, operational and maintenance components;

- ownership of technology, patents and licensing information etc.

Such information could be put into the technology inventory and provided to national and regional information centres, or be eventually made available through the proposed "clearinghouse".

Develop a consensus on practical next steps to improve on existing technology centres and networks to accelerate the diffusion of clean technologies in non-Annex I Party markets

Australia considers that enhanced technology information dissemination needs to be considered. Such a mechanism should be open, transparent and cost-effective.

Australia has suggested previously that the Secretariat explore the role of a "clearinghouse" to assist the information needs of developing country Parties. (An appropriate example is the clearing-house being established under the Convention on Biological Diversity).

Promote an enabling environment for private sector participation

Private sector participation can be promoted through a range of policy measures, programmes and activities, viz

- establishing stable microeconomic and budgetary frameworks and adopting market-oriented policies

- reducing trade and investment barriers

- ensuring effective and accountable institutional frameworks, including intellectual property rights, banking and customs.

Assistance in facilitating the transfer of environmentally sound technologies and know-how

Oversee the exchange of information among Parties and other interested organisations on innovative technology cooperation approaches, and the assessment and synthesis of such information.

The Secretariat should have primary responsibility for overseeing climate change activities and assessing and synthesising relevant information. Both Annex I and non-Annex I Parties could be encouraged to report on information exchanges on innovative technology

cooperation approaches among themselves and other interested organisations. Ideally, this reporting should be through national communications.

Consider information on innovative technology cooperation approaches and develop recommendations to the Conference of the Parties which could be recognised more formally and widely implemented under the Convention

Innovative technology cooperation approaches that are considered to be "useful experiences" could be jointly brought (by the cooperating Annex I and non-Annex I Parties) to the attention of the Secretariat. The secretariat should prepare case studies for dissemination, with a view to encouraging wider implementation of the innovative approaches.

Identify projects and programmes on technology cooperation, which can serve as models for improving the diffusion and implementation of clean technologies internationally under the Convention, and provide information on these projects to the UNFCCC Secretariat

Through the climate change package announced in November 1997, the Government has provided $6 million over 3 years to the International Greenhouse Partnerships (IGP) Office to facilitate the establishment of commercial IGP projects. Assistance will cover additional transaction costs incurred by business in undertaking IGP projects, and reduce risks associated with entering new markets. The funding will enable Australia to experience from monitoring and reporting on emission savings, which will be of considerable value when emission credits become available via JI and CDM. Host countries will derive benefits from IGP, JI and CDM activities through:

- increased flows of foreign investment to meet their growing demand for emission abatement goods and services;

- increased access to state-of-the-art technology and know-how;

- fulfilling their obligations under the UNFCCC; and

- building appropriate capacity with regard to estimating and monitoring reductions in greenhouse gas emissions.

Following are examples of Australian aid projects or programs that promote, facilitate and/or finance transfer of technologies.

A. Project/program title: Henan/Yima Coal Gasification project
Purpose: To provide a cleaner and more greenhouse benign form of energy.
Recipient Country: People's Republic of China
Sector: Energy
Total funding: A$29,937,975
Years in operation: 1994-1996
Description:

The project provided the people of the Henan Province in China with a modern coal gasification plant. It replaced the existing form of domestic energy source, coal.

The gasification plant is only one part of the overall development, which will see a pipeline and municipal gas distribution network built to link the four major municipalities in the Henan province. The total cost of the joint venture concessional finance package is A$85.5 million.

The Australian involvement in the project included providing: the fuel oil recovery unit; the fluidised bed boilers; designing the processes providing skilled supervisors and advisers during the installation; commissioning and testing of the plant; training the operators; technical documentation and providing spare parts.

B. Project/program title: Huangshi Coal Gas Project Hebei Province
Purpose: To reduce the level of environmental pollution and thereby enhance health standards in the area, which are currently adversely affected by high levels of environmental pollution largely arising from coal burning activities.
Recipient Country: People's Republic of China
Sector: Energy
Total funding: A$29,937,975
Years in operation: 1994-1996
Description:
The proposed gasification plant will supply coal gas for domestic and industrial use, approximately in the ratio of 3:1. The domestic service will provide gas for 60,000 households.

The cost of the project is estimated to be US$13.5 million. AusAID provided US$2.2 million towards the gasification plant. The coal gasification process to be installed is a 2-stage Wellman cyclic water gas plant of modern design. Engineering, site engineers and training were also provided.

The project will greatly improve both outdoor and indoor air quality in Huangshi, where gas will replace the direct burning of coal for domestic and industrial purposes. The project is consistent with the national gasification policy and will contribute to national air quality improvement policy, particularly through the reduction in particulate and sulphur dioxide to the atmosphere.

C. Project/program title: ASEAN - Australia Economic Cooperation Program Energy Biomass Residue
Purpose: To reduce emissions through a benign form of fuel usage, as well as to preserve the carbon sink.
Recipient Country: ASEAN
Sector: Energy
Total funding: A$3,000,000
Years in operation: 1994-1998
Description:

The project will assist ASEAN countries in the commercial development of fluidised bed combustion (FBC) technologies for the production of combined heat and power which utilises biomass residue.

The project aims to achieve environmentally-sound disposal of biomass residues and wastes; improve the viability of rural industries and their working environments; enhance the capability in the ASEAN countries to design, construct, install, operate and service FBC technology; and develop an industry to manufacture reliable, high efficiency steam engines for small-scale FBC CHP plants.

The project consists of the following components: project management; technology awareness; steam engine development; FBC demonstration; and training and commercialisation.

D. Project/program title: Municipal Solar Infrastructure Project
Purpose: To supply electricity for health centres, water pumps, schools and community halls using greenhouse friendly solar technology.
Recipient Country: The Philippines
Sector: Energy
Total funding: A$13.2 million
Years in operation: 1997-99
Description:
One thousand photovoltaic (solar-powered) electricity generators will be installed at 387 barangays (local community areas) in the Philippines in this $37 million project. AusAID's contribution is $13.2 million. The target communities are located in some of the poorest provinces in the country.

The systems will be installed at health centres, municipal halls, schools and water supply facilities to provide electricity for basic services such as lighting, refrigeration (eg. for vaccines), communications, ceiling fans, small appliances and water pumping. They will reduce the communities' dependence on non-renewable energy services such as oil and fuel wood, as well as reducing deforestation.

The benefits of the project are expected to include: an improvement in the livelihood of the target communities; a reduction in local air and noise pollution; improved water supplies; better health and education facilities; and an improvement in the welfare of women and children by freeing time spent on food and water collection, and reduction of indoor pollution from the burning of biomass fuels.

By comparison, if diesel generators were used to provide the same levels of power, carbon dioxide emissions would increase by approximately 10,900 tonnes for the life of the project. Another long-term benefit of the project will come from demonstrating the substantial contribution that solar energy can make to social and economic development.

Other questions

Can specific technology transfer goals be set?

Specific technology transfer goals can be set as part of the national communications by non-Annex I Parties. These goals will vary from country to country.

Can we develop indicators and accounting systems to track progress on technology transfer?

The development of indicators should take into account and build on the work done already in this area through the work programme on indicators for sustainable development under the Commission for Sustainable Development (CSD). The CSD promotes the following indicators for tracking progress on transfer of environmentally sound technology:

– total value of capital goods import;

– foreign direct investment;

– share of environmentally sound capital goods imports in total capital goods import;

– value of technical cooperation grants.

Are particular institutional arrangements needed to monitor progress?

The Secretariat would appear to be the most appropriate body to monitor progress on technology transfer based on national communications.

PAPER NO. 2: CANADA

DEVELOPMENT AND TRANSFER OF TECHNOLOGIES

In response to Decision 4/CP.4 on the development and transfer of technologies, and as part of the consultative process on the same issue underway within the SBSTA, Canada presents the following views.

Technology development, diffusion and deployment are crucial elements in addressing the issue of global climate change mitigation and adaptation. Canada acknowledges the useful work in this regard that has been completed to date through the SBSTA, particularly in identifying the needs of developing countries and economies in transition.

In order to provide an overall perspective on the issues raised in Decision 4/CP.4, Canada has identified three overarching questions that serve as a useful backdrop for guiding our discussions on future actions at the local, national and global levels.

The local level - How can specific existing and emerging technologies, knowledge and know-how be employed in developing countries and economies in transition to reduce GHG emissions and/or adapt to climate change while also bolstering sustainable economic development?

The national level - How to ensure that national infrastructures in developing countries and economies in transition support effective and sustained use of the transferred technology?

The global level - How can the UNFCCC and other multilateral institutions contribute to the successful implementation of technology transfer in non-Annex 2 countries?

Establishing an enabling environment

In order to create an effective flow and interface for the development and transfer of technologies, it is necessary to establish an *enabling environment* that maximizes the opportunity for the full participation of key government and private sector players in both recipient and supplier countries. Without the full engagement of these players, technology transfer will fall short of its needed and desired levels.

It is important to underline that, in Canada's view, an "enabling environment" can only be achieved through the implementation of a broad range of legal, institutional and policy frameworks that first and foremost foster awareness and domestic innovation in recipient countries and second, stimulate capacity building and the effective engagement of the private sector in countries that supply technology and know-how. An enabling environment is a two-way information flow and partnership between the technology receptor

and the technology supplier based on knowledge transfer, training, infrastructure development and support, and an understanding of the needs and cultural aspects of the receptor country.

Facilitating the establishment of such an enabling environment for the transfer of technologies should be the principal objective for governments in developing countries and economies in transition as well as for developed countries. A number of important areas where governments could take action in this regard were identified in the Amsterdam Study (FCCC/TP/1998/1). Canada agrees that continued bilateral and multilateral work on the elimination of barriers and the creation of appropriate incentives and initiatives should be a priority at all levels of government-led action on climate change.

It should be recognized that the initiatives of the UNFCCC do not take place in a vacuum. Capacity building and other activities to support an enabling environment are already underway in many countries. UNFCCC and other multilateral efforts should build upon this work and avoid duplication.

Annex to Decision 4/CP.4: Issues and Questions

1.0) Practical steps to promote, facilitate and finance, as appropriate, transfer of, and access to, environmentally sound technologies and know-how

a) *The Removal of Barriers*

The Amsterdam Study listed eight types of barriers to the transfer of environmentally sound technologies: institutional, political, technological, economic, information, financial, cultural and general. These barriers, and potential solutions to eliminate them, run through the entire length of the Annex of the Decision document. Barriers also vary in nature and extent in different countries, work at different levels (i.e. local or national level), and can be technology-specific. Currently, significant barriers are found at many levels of the development and transfer of technologies and it is difficult to identify specific priorities in light of their specificity and their tight linkage. A single barrier can reduce the effectiveness of technology transfer and their elimination at all levels is crucial to creating an enabling environment.

b) *The Transfer of* publicly owned technology

In Canada, publicly owned technologies that would be available at no or low cost comprise a very small proportion of the total available technology base. Furthermore, in the majority of these cases, the ownership of such technologies is shared with private sector companies, with the associated intellectual property (IP) restrictions, or at such an early stage of development that they require private sector involvement to advance them to the commercialization stage. These facts highlight the need for central private sector involvement in the transfer process.

c) *Promote bilateral or multilateral cooperation to facilitate technology transfer;*

d) *Consider appropriate mechanisms for technology transfer within UNFCCC; and*

e) *Collaborate with relevant multilateral institutions to promote technology transfer.*

Bilaterally, Canada has developed, and continues to develop and expand on, a number of mechanisms and initiatives that facilitate technology cooperation and transfer. These include Canadian International Development Agency (CIDA) projects, the Clean Development Mechanism / Joint Implementation Office and WINExport (managed by the Department of Foreign Affairs and International Trade), the Virtual Office of the Environment (Industry Canada), the Canadian Technology Network (National Research Council Canada), Technology Early Action Measures (TEAM) and other Canadian Government initiatives run through individual departments and agencies such as Natural Resources Canada, Environment Canada, Transport Canada, Agriculture and Agri-Food Canada and the Export Development Corporation. Experience shows that these mechanisms have been quite effective where the right enabling environment exists. Canada continues to take steps to enhance the overall effectiveness of these bilateral mechanisms, in particular with respect to technologies that address climate change. In this regard, it is important to note that as part of the recently announced Climate Change Action Fund, the Canadian Federal Government has allocated increased resources to working with developing countries and the private sector to undertake technology transfer projects over the next three years.

Multilaterally, Canada supports and participates in a variety of initiatives carried out through the Global Environment Facility (GEF), Asia-Pacific Economic Cooperation (APEC) Energy Working Group, Hemispheric Energy Initiative (under the Summit of the Americas), the Climate Technology Initiative (CTI), the Organisation for Economic Co-operation and Development (OECD), International Energy Agency (IEA) and GREENTIE. Canada endorses continued work through these efforts, and encourages further analysis, possibly through the SBSTA, to identify gaps that are not being addressed as per the barriers identified in the Amsterdam Study. However, Canada strongly recommends that existing fora be used to promote technology transfer.

f) *Promote and facilitate, in collaboration with the interim financial mechanism, multilateral and bilateral institutions, the arrangement of financing of technology transfer*

Bilateral and multilateral efforts to reduce greenhouse gas emissions should utilize technology which maximizes both the local and global benefits and is most suited to meet local needs and capabilities. Priority should be given to the development and application of technology which, by reducing emissions, provides benefits such as reduced operating costs and improved air quality, and thus produces win-win results for both the recipient and investor.

The role of the GEF in this regard will be important particularly in the application of technologies that lack sufficient commercial interest at the moment. In addition, the GEF can

make a valuable contribution to capacity building, thereby assisting the establishment of a broader enabling environment.

g) *Promote and assist developing country Parties to access technology information and emerging technologies; and*

h) *Facilitate access to emerging technologies.*

As noted under barriers, basic improvements can be made here. Strengthening information exchange networks, access to information, and general capacity building are essential.

2.0) Support for the development and enhancement of endogenous capacities and technologies of developing country Parties

a) *Provide technical advice on technology transfer to Parties, particularly developing country Parties*

Existing technologies designed for national application by developed countries can be of general value in other countries, especially in the developing world. Techniques for monitoring and assessment technologies (e.g., modeling of ecosystems) can be of use in developing endogenous activities in a different national context. Such advice could be provided through, for example, exchanges between scientists and research institutes.

b) *Promote capacity building in developing countries through provision of concrete programmes; and*

c) *Assist developing country Parties, on request, to assess required technologies.*

Capacity building programs should be tailored around real technology projects, not be overly classroom-based, and involve local and national actors between the receptor and supplier countries. One of the principal objectives of such capacity building should be to create lasting "spin-off" relationships and networks between and across countries. Programs should be arranged through bolstering existing institutional arrangements at the bilateral and multilateral levels.

d) *Promote and enhance access to relevant technical, legal and economic information at national and regional centres; and*

e) *Develop a consensus on practical next steps to improve on existing technology centres and networks to accelerate the diffusion of clean technologies in non-Annex I Party markets.*

Diffusion will be most effective through a bottom-up approach where specific technologies are matched to particular challenges on a country-by-country basis.

Multilaterally, the International Energy Agency (IEA) is developing opportunities to improve energy efficiency (e.g., pilot projects in China). The Climate Technology Initiative (CTI), with membership from the UNFCCC Annex 2 Parties, has established multilateral working groups on capacity building, technology assessment, analysis and strategy, and research and development. In addition, the CTI continues to organize a number of technology diffusion seminars around the world, including a number of developing countries.

Networks should be strengthened based on existing institutions and initiatives.

f) *Promote an enabling environment for private sector participation*

In Canada's view, an "enabling environment" refers to the broad range of parameters that surround the development and transfer of technologies and should not be understood as narrowly limited to specific conditions for private sector involvement. Although effective private sector involvement is fundamental to success, we suggest that a broad view is preferable to that which suggests that an "enabling environment for private sector participation" can be separated from the larger processes of development and transfer.

3.0) Assistance in facilitating the transfer of environmentally sound technologies and know-how

a) *Oversee the exchange of information among Parties and other interested organizations on innovative technology cooperation approaches, and the assessment and synthesis of such information.;*

b) *Consider information on innovative technology cooperation approaches and develop recommendations to the Conference of the Parties which could be recognized more formally and widely implemented under the Convention; and*

c) *Identify projects and programmes on technology cooperation, which can serve as models for improving the diffusion and implementation of clean technologies internationally under the Convention, and to provide information on these projects to the UNFCCC secretariat.*

The current consultative process on the development and transfer of technologies and regular sessions of the Subsidiary Body on Scientific and Technological Advice (SBSTA) currently provides these functions. Work should continue to refine the process and corresponding guidelines for Parties.

4.0) Other questions

a) *Can specific technology transfer goals be set?*

b) *Can we develop indicators and accounting systems to track progress on technology transfer?*

c) *Are particular institutional arrangements needed to monitor progress?*

Canada does not feel that the establishment of meaningful and measurable goals for the transfer of technologies is feasible. It is, however, important to track and report on progress made in the transfer and uptake of environmentally sound technologies by

developing countries and economies in transition. While further discussion is required on the most effective means of monitoring such progress, maintenance of a register, possibly under the auspices of the UNFCCC, might be a viable option.

PAPER NO. 3: EGYPT

DEVELOPMENT AND TRANSFER OF TECHNOLOGY

Submission responding to the questions identified in the Annex to the COP4 Decision on Development and Transfer of Technology

Questions

How should Parties promote the removal of barriers to technology transfer?

Which barriers are a priority and what practical steps should be taken?

* Building capacities and capabilities of the appropriate institutions to be able to adopt and implement clean technologies in their fields.

* Developed countries must take practical steps to promote , facilitate, and finance the transfer of environmentally sound technologies and know-how to developing countries.

* Encouraging all relevant international organizations to promote technology cooperation and facilitate its transfer to developing countries.

* Strengthening the capacities and capabilities of developing countries should take place to remove barriers to technology transfer by offering a simple labor intensive technologies.

The main barriers in priority order are:

1* Lack of investments and financing mechanisms.
2* Lack of capable institutions.
3* Lack of trained human resources.
4* Lack of effective public-private partnerships
5* Lack of public awareness.
6* Lack of public acceptance and social biases.

What additional bilateral and multilateral efforts to promote technology cooperation to facilitate technology transfer should be initiated? What should be the priority?

The CDM would be a potential mechanism to promote technology transfer.

Are existing multilateral mechanisms sufficient?

No, as none of the existing mechanisms do monitor the actual transfer of technology or finance specifically technological advances related to climate change.

Are new mechanisms needed for technology transfer?

If so, what are appropriate mechanisms for the transfer of technologies among parties in pursuance of Article 4.5 of the convention?

Certainly, Yes and the mechanism should be of inter-governmental nature which would be specifically meant for the support of technological advances and for the monitoring of the transfer of technology, i.e. to decide on projects to be financed from the financial mechanism supporting the convention and establish a roster of the activities that had been carried in this respect and their results.

What should be the objective of collaboration with relevant multilateral institutions to promote technology transfer and what practical steps should be taken?

Collaboration between multilateral institutions to support capacity building and strengthening of appropriate institutions in developing countries to enable the transfer of environmentally sound technologies which will be appropriate for each developing country given its relevant national circumstances.

What sort of information is needed and how can this best be done?

Technical and financial information are needed.

This can best done be improving information networks and clearinghouses and demonstration centers that disseminate information and provide advice and training.

1. The publicly owned technologies, which have already been proposed by Korea in a meeting held in Seoul in 1997 and apparently there is not follow up of this. This should be a first area of concentration to insure availability to the developing countries of all the technologies related to climate change which are available in the public domain, with a clear indication of how to reach these technologies, the costs, the types, the availability, the requirements for getting these.

2. The technologies which are still under patent, and these require very clear indication of how to achieve these is it though buying the patent and the know how which is very rare or is it through joint venture or what is it, and how do you reach that exercise.

What role is the private sector playing in technology transfer? What additional role can the private sector play? What barriers prevent their great participation?

Private sector can develops, manufactures, markets, promotes and operates technologies.

The main barriers prevent their participation are high investment, intellectual property rights and market distortions in developing countries.

Support for the development and enhancement of endogenous capacities and technologies of developing country parties

What technical advice on technology transfer is needed?

How should such advice be provided?

Training, technical assistance, demonstration projects technology information centers ….etc.

What area should be the focus of capacity-building and how should it be undertaken, e.g. what kinds of activities, programs and institutional arrangements?

Create awareness of the need of Environmentally Sound Technologies and developing the capacity for the adoption, implementation and operation these technologies.

Training of human resources.

Increasing awareness of public to increase their acceptance of the new technologies.

Increasing management skills on technology transfer.

Institutional capacity building at the national level.

PAPER NO. 4: GEORGIA

1) How should Parties promote the removal of barriers to technology transfer?

Which barriers are a priority and what practical steps should be taken?

1. Lack of Capacity and Institutions in host country
   Step: recommendations to the host countries' Governments by International Institutions to establish effectively acting indigenous institutions and capacities.

2. Weak legislative basis. Lack of Laws supporting the development and implementation of clean technologies.
   Step: Requests to the International Organizations and Funds (ICF), which in return for their financial support to the developing countries and the countries in transition strongly request them to implement the severe taxation policy, allow such countries to use more flexible taxation policy for the projects with transfer of environmentally sound technologies.

3. For non-Annex I parties with economy in transition lack of indigenous capital (private and public sector)
   Step: establishment of international funds for guarantee loans

What additional bilateral and multilateral efforts to promote technology cooperation to facilitate technology transfer should be initiated? What should be the priority?

1. Regional coordination of technology transfer process

2. The establishment of institute for regional coordination (coordinator)

3. The establishment of regional and national centers for technology transfer which will be responsible for gathering and dissemination of information on climate friendly technologies (like GREENTIE), provision of transferring the state-of-the-art technology

Are existing multilateral mechanisms sufficient? Are new mechanisms needed for technology transfer?

If so, What are appropriate mechanisms for the transfer of technologies among Parties in pursuance of Article 4.5 of the UNFCCC?

The existing multilateral mechanisms under Kyoto Protocol will be sufficient if they will work fully and help host countries with the processes of Capacity Building, Education and Public Awareness.

What should be the objective of collaboration with relevant multilateral institutions to promote technology transfer and what practical steps should be taken?
Objectives:

- dissemination of information on environmentally friendly technologies
- soft loans from multilateral financial institutions
- to meet the agreed incremental costs
- provision with the guarantee loan

What additional guidance should be given to the interim financial mechanism?

- support the process of Capacity Building in host countries
- clear and simple definition of incremental costs during technology transfer
- provision for the financing of pilot/demonstration projects

What sort of information is needed and how can this best be done?

- current information on generation and power of technological equipment, price, lifetime, efficient conditions for use the technology, data from pilot/demonstration project
- UNFCCC Secretariat or other international organization for technology transfer provide regional structures or directly non-Annex I Parties to Convention with information listed above on the state-of-the-art technologies

What role is the private sector playing in technology transfer?

What additional role can the private sector play? What barriers prevent their greater participation?

- The most important role in technology transfer may play the private sector of Annex II countries. The primary role of host country in most of the cases is to reduce the risk for foreign partners.

Barriers

1. High prices of the modern technologies and long term period for payback and benefits for the most of clean technologies.
2. Lack of incentives for private sector. The main incentive- the access to the market of developing countries and countries in transition is not enough.

3. Lack of free capital in private sector of host countries. As it is known GEF and other funds give grants only for financial support of incremental costs. Drawing the investments for rehabilitation of old ones or construction of new technologies is very difficult and long term process for the countries with the economy in transition (absence of development plans even for 3-4 years, non supportive legislative and regulatory framework, high risk, low collection of tariffs).

4. Lack of concrete demonstration projects showing not only the technical, but also the economic, environmental and financial feasibility of projects with environmentally friendly technologies.

5. Delay of processes or incorrect direction for privatization in countries with transition which increase the risk for foreign partners. (The mechanisms for collection of tariffs is not always clear).

6. Energy produced from renewables in most cases requires to be included in the grid (wind) or the costs are high.

7. The most of the grants are for feasibility study. We recognize the necessity of feasibility studies for investors and in the process of technology transfer but it would be waste of time, finance and labour if it is not in progress. Most of these feasibility studies have no continuation in pilot and demonstration projects. Only after this full cycle is over, it will be possible to draw the private sector to the technology transfer process.

What technical advice on technology transfer is needed? How should such advice be provided?

Technical advice could be done during technical workshops, consultations with the experts and with representatives of private sector. Facilitation of high quality (with the experts with rich experience on this field) technical workshops will promote the process of advice on technology transfer.

What areas should be the focus of capacity-building and how should it be undertaken, e.g. what kinds of activities, programmes and institutional arrangements?

Focused areas:

- institutions in host country
- hardware and information networks
- public awareness
- training of indigenous staff

Programmes and institutional arrangements:

- international and regional workshops
- international training programmes
- workshops for high level officials
- regional and national information centers for technology transfer
- national and/or regional agency serving the technology transfer process

How, to whom and in what format should developing country Parties make their request for assistance to assess required technologies?

We think that it will be more efficient if developing countries submit their needs for technologies to the centralized body which has gathered all information. At the same time developing countries have to try themselves to get needed technologies on the bilateral basis.

What technical, legal and economic information is needed? What practical steps should be taken to promote and enhance access to such information by national and regional centres?

Information needed is listed above.

Capacity Building, training of local staff, creation of the information networks and international and regional workshops will facilitate to promote and enhance access to information on technologies

What type of process is needed to develop a consensus on practical next steps to improve on existing technology centres and networks in non-Annex I Party markets. What type of arrangement is needed to monitor progress?

Non-Annex I countries must participate in the monitoring of process for technology transfer.

What measures, programmes and activities can best help to create an appropriate enabling environment for private sector investment?

Requests to the Governments (the Legislative Bodies) of Annex II countries to make suitable changes and amendments to their legislation and regulatory acts for taxation facilitating the Technology Transfer and encouraging the participation of their own private sector in this process.

How should the Convention oversee the exchange of information among Parties and other interested organizations on innovative technology cooperation approaches, and the assessment and synthesis of such information?

How should information be compiled and synthesized on innovation technology cooperation approaches? When should recommendation on such approaches be forwarded to the Conference of the Parties?

How and when should information on projects and programmes of technology cooperation which Parties believe can serve as models for improving the diffusion and implementation of clean technologies internationally under the Convention be provided to the secretariat? How could information on such model programmes be evaluated?

PAPER NO. 5: NORWAY

Development and Transfer of Technologies

I. Introduction

This two-part submission sets out some preliminary views by Norway on the issue of the development and transfer of technology. The first part focuses on projects and programmes that the Government of Norway has funded which could serve as models for the diffusion and implementation of clean technologies under the Convention. The second part of this submission focus on the issues and questions contained in the Annex to Decision 4/CP.4.

II. Co-operative approaches to technology transfer

The aim of the report is to propose strategies and instruments which may contribute to increased transfer of environmentally sound technologies to developing countries taking into account issues and questions addressed in the annex to Decision 4/CP 4.

The report is mainly based on experiences gained from capacity building approaches for transferring cleaner production strategy and technologies over the last 10 years by UNEP IE (United Nations Environment Programme, Industry and Environment Office, Paris), and a number of Norwegian supported Cleaner Production programmes in CEE/NIS and developing countries.

Relevant experiences on technology transfer from the 15 UNIDO-UNEP Cleaner Production Centres are also reviewed in the report.

UNEP summarised at its 4th High Level Seminar on Cleaner Production in September 1996, Oxford, UK that the challenge is to move from supply driven to demand driven approaches for Cleaner Production. With funding from the Norwegian Government, UNEP recently initiated a project specifically designed to address this issue, using strategies and Mechanisms for promoting investments in environmentally sound technologies. The main elements of this project are included in this document.

Cleaner production includes by definition increased energy efficiency although traditionally the focus has been on environmental improvements (reduced emissions to water, air and reduced waste production). Environmentally friendly or sound technologies and cleaner production/cleaner technologies are closely related. Experiences from the UNEP Cleaner Production Programme are therefore highly relevant to the issues covered in Decision 4/CP 4.

1. Technologies and Techniques

The implementations of technologies at the plant level normally have two dimensions.

· The technology, or the equipment designed for a special purpose (the hardware).

· During the lifetime (the use of) the specific technology, there is a tendency toward reduced efficiency. The management of the technology then becomes more and more important until the decommissioning of technology. The EU has introduced the term "techniques" in order to add a management element to technology. According to the EU "techniques" "shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned".

Without ensuring appropriate training (i.e., in operating, implementing regular maintaining procedures, managing the equipment), technologies will experience reduced efficiency – reduced capacity, poorer products, reduced energy efficiency and increased emissions to air, water and waste.

On the other hand, normally well operated technologies can increase efficiency and reduce environmental impact by 20-30 % by utilising housekeeping measures – improving existing management routines and introducing new management routines.

2. Capacity Building. National Cleaner Production Centres as a model

The UNEP has defined Cleaner Production as "the continuous application of an integrated preventive environmental strategy applied to processes, products, and services to increase eco-efficiency and reduce risks to humans and the environment".

The Cleaner Production strategy applied for production processes implies "conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes".

This Cleaner Production strategy might be implemented at the plant level (production facilities) by applying Cleaner Production Assessments. This tool is used to examine an industry's production processes, evaluate the changes that could be made and estimate their cost. The outcomes from such assessments are a number of improvements from housekeeping measures to economically viable investments.

Experiences from a number of countries (OECD countries, economies in transition as well as developing countries) show that many improvements including energy efficiency, can be made in the production processes at no or very little cost, improving both profitability and environmental performance.

The UNEP International Cleaner Production Information Clearinghouse (ICPIC) contains more than 600 case studies on implementation of cleaner production strategy at the plant level.

The ultimate goal of the UNEP-UNIDP NCPC Programme "is to facilitate an increase in the application of the concept of Cleaner Production in industry and incorporation of the concept in the national environmental policy of developing countries and economies in transition".

To realise this goal, in 1995 UNEP and UNIDO co-operatively established eight National Cleaner Production Centres to facilitate the transfer of cleaner production information and cleaner production technology to industrial enterprises and environmental management agencies. As of 1999 there are 15 centres in the following countries:

Brazil	Zimbabwe	China
Mexico	Tanzania	India
El Salvador	Tunisia	Vietnam
Guatemala	Czech Republic	
Nicaragua	Slovak Republic	
Costa Rica	Hungary	

The centres undertake four types of activities: (3)

- **In plant demonstrations** can show how the Cleaner Production strategy works in a given country and is a showcase of cleaner production success stories. They are a platform for hands on training for plant personnel and national consultant.

- **Training** is linked to the in-plant demonstrations (learning by doing, in-plant training and training the trainers). Training is also conducted outside plants through workshops, seminars and in-depth technical training. These training activities are conducted to raise the Cleaner Production capacity and awareness of branch organizations, government agencies, educational and research institutes, and consultants.

- **Information dissemination** is crucial in creating a cleaner production network within a country and among countries. Within the country, the NCPC aims to be the provider of technical information such as available technologies for solving environmental problems, sharing experiences with relevant stakeholders through submission of case studies and promoting the centre's activities.

- **Policy assessment and advice** is an important activity component to evaluate the sustainability of the cleaner production strategy in a country. In order for Cleaner Production activities to be sustainable, there is a need for effective policy frameworks that accommodate preventive environmental management. This not only involves administrative measures like licensing, but also economic instruments such as duty and fee systems for waste disposal and prizing of raw materials and energy. The NCPCs assess the existing policies and provide recommendations on how to better incorporate Cleaner Production considerations. The centres have access to policy studies conducted in various countries, and are supported by international institutions, which have experiences in conducting policy reviews.

These four activities are key elements in building national capacity for cleaner production. One activity is not more important than the other, what is important is the mix of activities. In some way in-plant demonstrations, training and dissemination form the platform

– the supply side – and policy assessment and advice should make the future direction and develop the demand for cleaner production.

In the period 1993-1996, a co-operative project between the World Bank, National Environmental Protection Agency for China and UNEP IE (Industry and Environment Office) implemented a project to demonstrate how to develop and to test a systematic approach to cleaner production. (4)

According to the lessons learned from this project, there are 8 components of success (not prioritised):

· Training

· Generic manual (in the local language, in this case in Chinese) on how to implement Cleaner Production at plant level

· Sectoral manuals

· Policy studies

· Dissemination of results

· A network of centres of expertise and experts

· Demonstration projects

· A national centre

Again, one component is not more important than the other, it is the mix of activities that is important.

3. Instruments for Promoting Cleaner Production

While it is industry that ultimately must implement environmentally friendly and energy efficient measures, the role of the government is to develop, design and implement an appropriate mix of instruments that will accelerate the process and encourage the industry to initiate its own improvement programmes.

In industrialised countries, instruments may be divided in three categories:

· Legislation

Regulations
Guidelines
Permit systems

Voluntary agreements
Enforcement schemes

· Financial instruments

Tax, duties and fees
(to discourage unwanted practises)
(water pricing, energy pricing, landfill taxes)

Grants and subsidies
Soft loans, funds
(to promote improvements)

· Information and education

Demonstration projects
Consultant support
Centres of expertise
Newsletters
General manuals
Databases
Videos
Conferences and seminars
Research and development programmes

Although legislation has traditionally focussed on end of pipe solutions, there has been a gradual change in focus, especially in the nineties, constituting a pressure on companies for environmentally improvements. Environmental impacts (externalities) have to be internalised using a mix of "sticks" and "carrots". Another approach using a mix of the three types of instruments need to be developed:

· the companies have to be **able** to identify improvements

· the companies need to have the **will** to identify improvements

· the **pressure** towards the companies needs to be increased

Case studies, training and dissemination are all activities for improving a companies abilities and willingness to undertake necessary measures for improvements. Pressure has to be increased by developing a well-designed mix of policy measures. Together, all elements constitute capacity building.

Key elements for efficient technology transfer are development of a regulatory framework, institutional development, training and awareness raising. Experience shows that there is room for increasing efficiency by instituting housekeeping measures and low cost investments for **existing facilities.**

For **new facilities** the challenge is to develop mechanisms that ensure the efficient installation of equipment. It may be equally important, however, to ensure continuous improvements are taking place by implementing the best available management systems (implementing the best available techniques).

Development of a legal infrastructure, institutional arrangements followed up by a mix of appropriate instruments is a governmental responsibility, as is the design of economic instruments for discouraging unwanted activities. The establishment of financing facilities, dissemination of case studies, training and awareness raising are partly governmental and private sector responsibilities.

4. Strategies and Mechanisms for Promoting Cleaner Production Investments

Agenda 21 commits the international community to direct industrial investment in developing countries to support the transition towards sustainable development with specific recommendations towards UN organisations, governments and industry (Chapter 30, paragraphs 28, 20 and 12).

Still, existing industries in developing countries have encountered difficulties in financing cleaner production activities, although financing is generally available for other types of industrial activities. At the same time evidence is growing that new industrial establishments do not as yet sufficiently capitalise on available Cleaner Production opportunities.

The issue of financing cleaner production in developing countries has not yet been systematically assessed, and therefore remains complex and at times intangible.

Present efforts to promote cleaner production in developing countries are largely constrained to the transfer and dissemination of technical information and technology. Transfer of financial knowledge and instruments, and strengthening of financial institutions and industrial authorities are also required to make available the necessary financing for those Cleaner Production investments available.

Environmental policies in developing countries lean heavily on environmental regulations without sufficient enforcement systems in place. Incentives (including investment promotion) which generally have more direct and longer lasting impacts on industry decision-making, are not widely used.

Given this, UNEP IE designed the project “Strategies and Mechanisms for Promoting Cleaner Production Investments in Developing Countries”. The project will be undertaken in five countries (Vietnam, Zimbabwe, Tanzania, Guatemala and Nicaragua) will run for three years and is funded by the Government of Norway. (5)

The **objectives** for the project are to:

- Demonstrate how to initiate and facilitate the financing of cleaner production activities– both in existing and new industrial establishments – through the case of 5 countries mentioned above.

- Develop financing instruments for effectively promoting Cleaner Production investments in developing countries and designing enabling strategies for supporting public and private financial institutions and the industrial community to adopt these financing instruments.

- Motivate key decision-makers in the international community (in particular international organisations and development banks, international credit providers and vendors, and donor agencies) to pursue cleaner production investments in developing countries.

In short, the main **activities** are:

- An analysis of the past investments practises to identify "lost" opportunities and to develop a platform for reorientation of investments towards cleaner production. The analysis will also be used for priority setting of awareness raising and capacity enhancement activities with both the financial sector and technical assistance providers.

- Awareness building and capacity enhancement in the technical assistance sector (case studies, training of future investment promoters, developing a pipeline for creditworthy proposals).

- Awareness building and capacity enhancement in the financial sector (development of cleaner production criteria and guidelines for priority industrial sectors, preparation of lending schemes customised to cleaner production investments, and training of loan evaluators).

- Assessment of the potential and need for cleaner production adapted equipment and engineering services.

- Analysis of the opportunities for, costs and savings of, cleaner production investments in priority industrial sectors.

In order to develop a platform for the project, a preliminary survey took place to identify hypothetical strategies that could be adopted to promote cleaner production investments in developing countries. The following eight potential strategies, were identified largely based on experiences with financing industrial energy improvements. They can be divided into two groups:

- Financing strategies

· Supportive strategies (organisational, institutional, economic policy, industry and technology policy)

1. Aggregate Types of Cleaner Production Investments and Locate Financing (financing strategy)

Aggregating the market by hardware (energy efficient industrial boilers) or by groups of end-users with similar equipment needs.

2. Increase the Participation of Commercial Credit Providers (financing strategy)

Local financial institution may be in a good position by playing a role as financial intermediaries, facilitators, fund administrators, etc. They may also play a role in facilitating leasing schemes.

3. Increase the Amount of Vendor Financing Available (financing strategy)

Accessing export credit financing and pursuing vendor-supported financing programmes appears to be another under-utilised source of finances for cleaner production.

4. Establish Country-, Region- and Sector Specific Cleaner Production Funds (financing strategy)

Special purpose funds can be a good strategy provided they are well structured, their uses fairly well planned and they are targeted to where demand is known. An example is the Cleaner Production revolving fund established in 1998 by the Nordic Environment Finance Corporation (NEFCO) (6), designed for cleaner production investments in Russia and the Baltic Countries. The first loan applications have been approved for projects in Russia and Lithuania. Most of the approved projects have an energy efficiency component.

5. Obtaining Funding for Cleaner Production Service Companies (supportive strategy; organisational)

The model is a number of established Energy Service Companies (ESCOs) which have proven to be an effective mechanism for pursuing industrial energy efficiency.

6. Build Management, Technical and Institutional Capacity (supportive strategy; institutional).

While building these capacities (project development, enhancing engineering capacities, training financial institution in project evaluation and strengthening

organisational capabilities for key stakeholders) is not directly a strategy for investments, but is a strategy for building bridges between the financial and technical sector. It is often a critical prerequisite in countries where cleaner production expertise is not yet well developed.

7. Continue Market (and Energy Sector) Reforms (supportive strategy; economic policy)

Specific reforms in the energy and other public utilities sectors, and direct financial incentives for energy and water conservation, as well as for reduction of discharges into the environment can have a direct impact and constitutes pressure towards companies for environmental improvements. Examples: water pricing, discharge fees and landfill taxes.

8. Increase Market Penetration of Cleaner production Goods and Services (supportive strategy; industry and technology policy)

Local availability of cleaner production equipment, technology and services through local manufacturing and services.

5. References

1) Official Journal of the European Communities. No L 257/40, 10.10.96.

2) UNEP IE leaflet on Cleaner Production.

3) UNIDO-UNEP National Cleaner Production Centres. Programme. NCPCs Activities, June 1997.

4) Cleaner Production in China: A Story of Successful Cooperation. UNEP 1996.

5) Government Strategies and Policies for Cleaner Production. UNEP IE 1994.

6) Strategies and Mechanisms for Promoting Cleaner production Investments in Developing Countries. UNEP IE Project Document. Final version 24 February 1998.

7) Nordic Environment Finance Corporation. NEFCO Revolving Facility for Cleaner Production Investments.

III ISSUES AND QUESTIONS FROM THE ANNEX TO DECISION 4/CP.4

The recommendations below are based on experiences and approaches referred to above as they pertain to the Issues and Questions listed in the Annex, Decision 4/CP.4.

Promote the removal of barriers to technology transfer.

There are probably 2 main barriers to technology transfer; lack of institutional capacity in order to put in place the relevant instruments (legal, economic and information/training) and lack of a well designed mix of instruments in order to develop a demand for environmentally sound technologies.

Barriers may be removed by transferring experiences (institutional co-operation), strengthening government institutions, establishing a regulatory framework and implementing training programmes (capacity building).

Promote bilateral and multilateral technology co-operation to facilitate technology transfer.

In order to develop an enabling framework for the transfer of technology, one approach might be to support centres of expertise focusing on case studies, training, dissemination activities and policy development. The UNIDO-UNEP National Cleaner Production Centres could be a model, both for bilaterally and multilaterally supported centres.

Collaborate with relevant multilateral institutions to promote technology transfer.

The objective of collaboration should be to ensure access to relevant information (case studies, experiences on technologies/techniques implementation and to share information on experiences on implementation of instruments and policy design--a clearinghouse function).

Promote and assist developing country Parties to access technology information.

In order to be of the greatest assistance, information has to be specific and linked to actual and solving real problems. This could be done by using case studies with cleaner production/energy efficiency assessments as an identification tool, i.e., clarifying the nature of the problems and what type of technology might be needed for solving the problems (increasing energy efficiency). This strategy could be focussed on selected industrial sectors.

Facilitate access to emerging technologies.

R&D institutions are normally involved in developing new technologies and techniques. They also have a good overview of running programmes and a good national, regional and global network.

By organising institutional co-operation programmes between R&D institutions in OECD countries and developing countries, access to emerging technologies could be facilitated through joint R&D projects and training programmes.

Facilitate the appropriate role of the private sector.

Business opportunities are the driving force for the private sector (technology providers and financial institutions). It is necessary to develop an enabling framework for commercial based co-operation.

Insufficient regulatory infrastructure, lack of investment projects and lack of financing facilities and complicated banking procedures may be the main barriers preventing private sector participation.

A programme utilising cleaner production assessments as a project identification tool, transforming technical improvement options into bankable project applications for special purpose financing facilities, could catalyse co-operation projects within the private sector.

Provide technical advice on technology transfer to Parties, particularly developing country Parties.

The basic platform for technical advice on technology transfer is likely to be a programme that develops case studies (training by doing, in plant training and training the trainers). The case studies would develop practical information on existing problems linked to the technologies needed and the achievements made by improving management of the existing technologies.

Lessons learned from a number of case studies could serve as the basis for technical advice (enabling institutional framework, techniques needed and potential improvements) on technology transfer.

Promote capacity building in developing country Parties through provision of concrete programmes.

Focus areas for capacity building might include:

- Institutional strengthening
- Developing instruments for promoting environmentally sound technologies.
- Support the establishment of centres of expertise
- Demonstration projects
- Training programmes

Assist developing country Parties, on request, to assess required technologies.

This issue should be divided into two parts;

- Required technologies for existing plants have to go through a normal feasibility study.

- New/emerging technologies for new plants or a comprehensive modernisation of existing plants may be assessed by an Environmental Impact Assessment combined with a Life Cycle Analysis/Technology Assessment.

The requests for training might be linked to cases and directed to the countries providing the technology and/or multilateral organisations.

Promote and enhance access to relevant technical, legal and economic information at national and regional centres.

Basic information needed includes:

- experiences on utilisation of instruments to promote environmentally friendly technologies environmentally management –division of responsibilities of authorities at the central, provincial, and local levels

Information on economics should include an overview on financing facilities for investment funding and lists of projects funded.

Technical information should be focussed on the most important industrial sectors, the most typical problems experienced, the technologies available and what can be achieved through increased energy efficiency. A system for establishing benchmarks for the relevant industrial sectors might be preferable.

The information should be collected at national centres of expertise independent of the Government and industry connected to an international network – regional as well as global.

Develop a consensus on practical next steps to improve on existing technology centres and networks to accelerate the diffusion of cleaner technologies in non-Annex 1 Party markets.

The first step in analysing existing technology centres should be to clarify their roles through a stakeholder analysis--what are strengths and weaknesses, who are the stakeholders and clients (nationally as well as internationally), and how can the centres meet their needs and requirements. The aim should be to ensure national ownership and economically viable centres.

Promote an enabling environment for private sector participation.

The following elements constitute a platform for private sector participation:

- a clear division of responsibilities between governmental agencies at different levels (central, provincial and local), horizontally as well as vertical.

- a mix of instruments (legal, financial and information) to promote sound technologies

- an appropriate mix of financial facilities to promote investments and sufficient information to industry associations on available facilities

– a systematic implementation of cleaner production (energy efficiency) assessments as a project identification tool – both for investments as well as for identifying business partners.

Oversee the exchange of information among Parties and other interested organisations on innovative technology co-operation approaches, and the assessment and synthesis of such information.

Consider information on innovative technology co-operation approaches and develop recommendations to the Conference of the Parties which could be recognised more formally and widely implemented under the Convention.

Identify projects and programmes on technology co-operation, which can serve as models for improving the diffusions and implementation of clean(er) technologies internationally under the Convention, and to provide information on these projects to the UNFCCC secretariat.

Compilation and synthesis of information should be linked to technology types (example; industrial boilers) and the utilisation of technologies/techniques for industrial sectors – both for existing industrial activities and technologies and techniques for new facilities.

In addition technology performance standards (benchmarks) for different sectors should be compiled to informing governmental agencies and industry associations. Governmental agencies may use the information in order to analyse degree of improvements, and industry associations may use the benchmarks for advising members on potential improvements.

PAPER NO. 6: SOUTH AFRICA

TECHNOLOGY TRANSFER

Issues Questions

Practical steps to promote, facilitate and finance, as appropriate, transfer of, and access to, environmentally sound technologies and know-how

Promote the removal of barriers to technology transfer.

How should Parties promote the removal of barriers to technology transfer?

Which barriers are a priority and what practical steps should be taken?

The following are common barriers to Technology transfer:

Limited local skills to adapt to new technologies
Limited support infrastructures to cater for new technologies
Availability of resources, eg primary energy sources
Lack of mechanisms for preferential pricing of new and appropriate technologies coupled with perceptions of unreliability and high operating costs for new technologies
Low foreign investment rates coupled with reduced levels of ODA and other support
Need to assess performance in a local environment
Private sector ownership of technology and capacity of local private sector to participate

The slow rate of economic development in developing nations compromising the availability of funds with which to purchase technology

Excess capacity in some economies – for example in the industrial sector Age of the capital base - young assets still need to be fully depreciated before new ones can be built to avoid problems with "stranded assets"

National security concerns
Competition from other current technologies
"Locking into" a particular country's technology
Non-sustainability due to lack of after-sales-service
"Culture Transfer" is often a component of technology transfer and as such the technology is often resisted.

Lack of public awareness and appreciation of climate change and environmental matters in general

The barriers of skills, technology need and resources are considered primary barriers to the transfer, adaptation and main stream application of technologies which will support the objectives of the UNFCCC. As such the following strategy is proposed to facilitate the overcoming of barriers:

1. CAPACITY BUILDING IN DEVELOPING NATIONS

The fundamental capacity of developing nations to assimilate, apply and sustain a variety of technologies needs to be developed. This capacity needs to include a critical mass of adequate core skills. This implies that training programmes need to be established in every developing nation to develop these skills.

The development of capacity includes the development of an appropriate support infrastructure for relevant technologies. It should be stressed that capacity building is a long-term issue which should be initiated now, even if the technology is only required if a nation's economy develops adequately to justify it.

Capacity building may be facilitated via the establishment of centres and networks. International centres for the dissemination of technology information, capacity building and the facilitation of technology transfer should be established via the identification and strengthening of relevant existing institutions in developing nations – locally or on a regional basis. The strengthening of the technological infrastructure in Africa in particular is essential for the sustainability of technology transfer initiatives. In establishing such centres an equitable spread of centres regionally and amongst developing nations must be ensured.

Ideally every developing country should have a centre, but this is not necessarily cost effective and existing centres and networks should be developed wherever possible. These centres should play a role in the implementation of the strategy detailed below in cooperation with the secretariat and with a focus on the development of indigenous technological capacity and infrastructure. It is important that this include consideration of unique local cultural issues which could be impacted by imported technologies. As such the human dimension of technology transfer is an important capacity consideration. Indigenous capacity should be used to operate and develop the centres, with specialist support as required.

Centres should be financed on the basis of long-term grants from the financial mechanism under the Convention. It is proposed that developing countries be encouraged to prepare detailed proposals for the establishment of such centres in developing countries to be presented to the GEF for funding. It should be stressed that a centre can be a virtual centre comprising a network of relevant centres in a variety of nations in a region. For example the Power Institute of East and Southern Africa hopes to establish regional centres of expertise in Southern Africa to support the power sector. These could also act as centres for power sector related technology transfer under the UNFCCC.

2. FORMULATION OF NATIONAL STRATEGIES FOR THE DEVELOPMENT AND TRANSFER OF TECHNOLOGIES.

A process needs to be established to address the direct information and technology transfer needs of individual developing nations. Particular attention should be given to matching specific local needs with technologies and relevant mechanisms to effect transfer and full diffusion into the mainstream of recipient nations.

It should be noted in all activities that technology transfer includes a component of culture transfer and due sensitivity to the impact of such influence must be shown. In particular respect for the indigenous skills and technology base must be maintained.

To further the transfer of technology in achieving the objectives of the Convention, the development of specific national strategies is proposed. Funding for developing countries to develop these strategies should be supplied under the financial mechanism to the Convention. The individual national strategies should be developed as follows:

A. Generic Identification of technologies

The information collected by the secretariat to date should be consolidated into a single database which identifies generic technologies and transfer mechanisms which enable vulnerability assessments, adaptation activities, monitoring, evaluation and impact modelling and emission mitigation The information collected to date could be supplemented by the secretariat inviting the business sector to submit technologies for inclusion in the database. It is further proposed that the previously proposed specialist task teams or technology transfer panels, assess these technologies under common efficacy criteria. It should be stressed that technologies assessed would include those in developing nations. This database should identify all relevant technologies, along with a quantification of their economic, environmental and social impacts, costs, ownership, skills and infrastructural requirements and intellectual property issues.

B. National specific technology matching

Based upon the studies in support of national communications currently underway in most developing countries (and completed in some cases), it will be possible for these countries, if adequately resourced, to identify gaps between their current technology base and the technologies required for optimal performance in terms of vulnerability assessment, adaptation and mitigation of GHG emissions. This will enable each nation to develop a sector specific package of technologies which it requires.

C. Test against national priorities and prioritise

The desirability of transferring the technologies identified above into specific countries needs to be established by testing them against specific national priorities. This will enable those technologies which address both national priorities and the Convention objectives to be identified.

D. Develop a nation specific technology transfer strategy

A technology transfer, adaptation, application, assimilation, monitoring and evaluation strategy should then be defined by each developing nation. In particular country specific strategies for the transfer of the highest priority technologies should be developed on a technology-by-technology and sector-by-sector basis. In this regard African nations attach critical importance to technologies which will enable them to adapt to the negative impacts of climate change. A sound business approach to any strategy will ensure the sustainable utilisation of any technology transferred. Funding for the development of these strategies should be sourced from the GEF and technical expertise should be made available should it be required. This expertise must be drawn from developing nations to ensure relevancy of the strategies developed. These strategies should include, inter ail: - Feasibility studies and pilot plants required to develop local capacity Skills, capacity building and technological infrastructure requirements Time frames for implementation Full costs an support infrastructure for the entire life cycle of the technology Financing mechanisms, including intellectual property considerations

E. Allocation of tasks

The establishment of the database should be undertaken by the secretariat assisted by the previously proposed sector specific specialist task teams, consisting of experts from developing and developed nations. The technology matching, national priority matching and prioritisation should be undertaken by the relevant agencies in developing nations. The GEF should make funding available for this activity. The country specific technology transfer strategy should be developed by the receiving nation, with GEF funding and, if necessary, with specialist assistance.

Initiate and promote the transfer of publicly owned technology and those in the public domain.

What publicly owned technologies are available?

It is difficult to define "publicly owned" technologies. Even public domain technologies – eg solar water heating, requires a commercial vehicle to develop, market and implement it. As such the focus should not be on public or private ownership, but rather on identification of technologies, identifying areas of application and then defining means of overcoming hurdles.

How could Annex II Parties report upon them?

There are several options open to the identification of technological resources. These include: An internet based database which public and private sector organisations, including NGOs, may enter information on environmentally sustainable technologies. Such information could include: Description of technology and reason for its definition as environmentally sustainable; Cost and ownership issues; Greenhouse gas mitigation potential and related costs per unit reduction; Adaptation potential; Availability and potential mechanisms for transfer, including adaptation, demonstration and assimilation strategies; Capacity and support

infrastructure required Inclusion of available technologies in the national communications, including the same level of detail as above.

How should Annex II Parties promote the transfer of publicly owned technologies?
For specific technologies to become fully integrated into the mainstream of a nation's economy and culture, a holistic strategy needs to be established – specific to a particular nation and often to a particular technology. This strategy should be developed as detailed above.

Promote bilateral and multilateral technology cooperation to facilitate technology transfer.

What additional bilateral and multilateral efforts to promote technology cooperation to facilitate technology transfer should be initiated? What should be the priority?
The priority should be on developing capacity in developing nations as well as preparing and implementing specific national technology transfer strategies as detailed above.

Consider appropriate mechanisms for technology transfer within the UNFCCC.

Are existing multilateral mechanisms sufficient?

It is considered that existing multilateral mechanisms are not adequate to facilitate technology transfer. Clearly institutional entities at a macro level are adequate, however even these are inadequate at a local level – especially with respect to poorer nations. Functions and modalities also require modification if Technology Transfer is to succeed in a sustainable manner.

Are new mechanisms needed for technology transfer? If so, what are appropriate mechanisms for the transfer of technologies among Parties in pursuance of Article 4.5 of the UNFCCC?

The mechanism proposed above is considered appropriate for effective technology transfer.

Collaborate with relevant multilateral institutions to promote technology transfer.
What should be the objective of collaboration with relevant multilateral institutions to promote technology transfer and what practical steps should be taken?
The primary objective should be capacity building, establishment of technology transfer partnerships and the leverage of skills, resources, institutional capacity and finances to both transfer technology whilst enabling the sustainable utilisation of such technology through sound business principles.

Promote and facilitate, in collaboration with the interim financial mechanism, multilateral and bilateral institutions, the arrangement of financing of technology transfer.

What additional guidance should be given to the interim financial mechanism?

The strategy detailed above can be used as the basis for the guidance given to the interim financial mechanism. In particular the GEF should be instructed to fund the initial studies, the development of strategies and seed funds for the development of local capacity and initial technology transfer projects. It could be argued that all GEF projects should include a technology transfer strategy – however this is regarded as too restrictive. Instead it is proposed that the GEF use technology transfer as one of the project evaluation criteria. This should definitely be a prerequisite for any technology based GEF project.

Promote and assist developing country Parties to access technology information.

What sort of information is needed and how can this best be done?

See strategy detailed above. Technology information may be collected on an international Internet network of databases, however access to information is not considered to be the major constraint to technology transfer. At the same time such a database can be useful in identifying technological opportunities. Information which would be useful would include:

Description of technology and reason for its definition as environmentally sustainable
Cost and ownership issues
Greenhouse gas mitigation potential and related costs per unit reduction Adaptation potential
Availability and potential mechanisms for transfer, including adaptation, demonstration and assimilation strategies
Capacity and support infrastructure required In particular technologies which facilitate adaptation to negative impacts whilst promoting sustainability would be useful.

Such technologies could relate to: Infrastructure development – energy, water, roads, rail etc; Food security; Water provision; Disaster response; Risk management; Pest and disease control; Mechanisms to improve the robustness of infrastructure; Clean technologies eg clean coal technology, waste management technologies etc

Facilitate access to emerging technologies.

How could access to emerging technologies be facilitated?

Whilst the process described above can play an enabling role, it is suggested that emerging technologies typically exist in the R&D domain – as such it is difficult to include them in the strategy. It is however proposed that mechanisms to promote joint R&D programmes with public and private sector institutions in developing nations can provide this access most cost effectively. Not only can R&D and demonstration programmes be undertaken at low cost in many developing nations, but also the local capacity development will ensure that this process becomes sustainable. As such some mechanism to encourage the execution of R&D in developing nations – especially in the form of pilot demonstrations

should be established. The cost efficiency of R&D execution in developing nations should also be promoted.

Facilitate the appropriate role of the private sector.

What role is the private sector playing in technology transfer?

Currently the private sector is playing the major role in technology transfer through normal market mechanisms. Through private sector initiatives the uptake of efficient and low emitting technologies have been effectively applied throughout the world.

What additional role can the private sector play?

The private sector can operate as the mechanism for the transfer of technologies via enabling mechanisms such as those detailed above. It should be noted that the Kyoto mechanisms can play an important role in enabling technology transfer via activities such as CDM and JI projects

What barriers prevent their greater participation?

Limited support infrastructures to cater for new technologies; Availability of resources, eg primary energy sources; Lack of mechanisms for preferential pricing of new and appropriate technologies coupled with perceptions of unreliability and high operating costs for new technologies; The slow rate of economic development in developing nations compromising the availability of funds with which to purchase technology; Excess capacity in some economies – for example in the industrial sector; Age of the capital base - young assets still need to be fully depreciated before new ones can be built to avoid problems with "stranded assets"; Cultural resistance; The local and global policy environment

Support for the development and enhancement of endogenous capacities and technologies of developing country Parties

Provide technical advice on technology transfer to Parties, particularly developing country Parties.

What technical advice on technology transfer is needed? How should such advice be provided?

The technical advice required is as detailed above – namely how to develop a country specific technology transfer strategy. This clearly needs to be linked to information about the availability, cost and efficacy of relevant technologies. It is proposed that a programme to develop this capacity at a local or regional level be established – individual nations will then be able to source this advice locally. The technology transfer centres can also play a role in this regard.

Issues Questions

Promote capacity building in developing country Parties through provision of concrete programmes. What areas should be the focus of capacity building and how should it be undertaken, e.g. what kinds of activities, programmes and institutional arrangements? In the short term capacity in the area of technology management is required. This should result in the country specific strategies and then technology specific capacity is required. This would initially be required in areas focussed on technologies to adapt to the negative impacts of climate change, followed by technologies to maximise the efficacy of mechanisms such as the CDM in promoting sustainability, followed by emission reduction technologies for local application.

Proven mechanisms for capacity building include: Formal training programmes; the execution of local R&D programmes undertaking pilot and demonstration programmes using local skills local infrastructural development – including academic and R&D capacity FDI.

Assist developing country Parties, on request, to assess required technologies. How, to whom and in what format should developing country Parties make their request for assistance to assess required technologies? The procedure detailed in the first section of this submission is proposed

Promote and enhance access to relevant technical, legal and economic information at national and regional centres.

What technical, legal and economic information is needed ?

What practical steps should be taken to promote and enhance access to such information by national and regional centres? As per proposal in first section of this submission

Develop a consensus on practical next steps to improve on existing technology centres and networks to accelerate the diffusion of clean technologies in non-Annex I Party markets.

What type of process is needed to develop a consensus on practical next steps to improve on existing technology centres and networks to accelerate the diffusion of clean technologies in non-Annex I Party markets. What type of arrangement is needed to monitor progress? It is proposed that a negotiating text be compiled for finalisation by SBSTA as a matter of urgency. The basis of the negotiating text should be all information submitted to date, with a focus on a mechanism to enable technology transfer. In order to avoid creating additional mechanisms, it is proposed that additional enabling funds be made available for developing nations to include reporting on technology transfer in their national communications. Developed nations should also report on progress in this regard.

Promote an enabling environment for private sector participation. What measures, programmes and activities can best help to create an appropriate enabling environment for private sector investment ? Whilst the mechanism detailed above will define a strategic direction for specific countries, it will not enable private sector investment. It is therefore proposed that mechanisms such as the CDM could strongly promote private sector

investment as well as technology transfer. Clearly this should be factored into the guidelines for CDM operation and modalities.

Assistance in facilitating the transfer of environmentally sound technologies and know-how

Oversee the exchange of information among Parties and other interested organizations on innovative technology cooperation approaches, and the assessment and synthesis of such information. How should the Convention oversee the exchange of information among Parties and other interested organizations on innovative technology cooperation approaches, and the assessment and synthesis of such information? As per proposal detailed in the first section of this submission

Consider information on innovative technology cooperation approaches and develop recommendations to the Conference of the Parties which could be recognized more formally and widely implemented under the Convention. How should information be compiled and synthesized on innovative technology cooperation approaches? When should recommendations on such approaches be forwarded to the Conference of the Parties? As per proposal detailed in the first section of this submission.

Identify projects and programmes on technology cooperation, which can serve as models for improving the diffusion and implementation of clean technologies internationally under the Convention, and to provide information on these projects to the UNFCCC secretariat. How and when should information on projects and programmes of technology cooperation which Parties believe can serve as models for improving the diffusion and implementation of clean technologies internationally under the Convention be provided to the secretariat? How could information on such model programmes be evaluated? Pilot projects established under the AIJ programme, as well as a proposed CDM pilot phase, could be useful case studies – however more focus is required on African nations. Critical success factors would include emission reduction efficacy, adaptation efficacy, capacity built and investment sustained.

Other questions

Can specific technology transfer goals be set? Ideally goals should be set, however these are extremely difficult -unless specific to the degree of uptake of a specific technology- in which case long term skewing of technological priorities can occur with an attendant reduction in innovation.

Can we develop indicators and accounting systems to track progress on technology transfer? It is difficult to envisage specific indicators at this stage. Indicators such as technological capacity, technology base of the economy etc can be adopted, however these are at best indirect indicators. As such it is proposed that reporting be qualitative and against progress in implementing the process described in the first section of this submission.

Are particular institutional arrangements needed to monitor progress? Use existing institutional and reporting structures (as for national submissions)

PAPER NO. 7: UNITED STATES OF AMERICA

Programs for Technology Transfer

I. *Introduction*

The U.S. offers the following submission for consideration by SBSTA in response to the COP-4 decision inviting Parties to "identify projects and programmes on cooperative approaches to technology transfer . . . [that] can serve as models for improving the diffusion and implementation of clean technologies under the Convention." As the consultative process moves forward, SBSTA should recognize that existing bilateral and multilateral technology transfer activities, along with their documented successes and failures, can provide useful guidance for establishing even more effective technology transfer programs.

In the view of the U.S., country-specific, market-based technology transfer programs will be most effective in achieving the goals of the UNFCCC. The public sector, however, can play a pivotal role in promoting market-based technology transfer by assisting in the removal of market barriers and building human capacity. In recognition of this, the U.S. Government has been implementing a range of programs for the diffusion of environmental technology. This submission will discuss bilateral and multilateral programs that demonstrate key aspects of technology transfer.

After first introducing other programs that serve as important models for the transfer of climate-friendly technologies, this submission will discuss the Technology Cooperation Agreement Pilot Program (TCAPP), the principle model developed by the U.S. to achieve the goals of the UNFCCC. Specifically, the submission will describe TCAPP principles, methodology and specific program results. In the view of the U.S., programs such as TCAPP provide important opportunities for developing expanded and improved models for technology cooperation.

II. *Technology Cooperation Programs*

Existing bilateral and multilateral technology transfer efforts developed to address national, regional and global environmental problems can serve as important models for designing effective technology diffusion programs under the UNFCCC. In considering these models, it is important to recognize that the definition of technology transfer under the UNFCCC includes both "soft" and "hard" elements of technology transfer.[1]

A. *Climate Technology Initiative*

[1] The term "transfer of technology" . . . encompasses practices and processes such as "soft" technologies, for example, capacity building, information networks, training and research, as well as "hard" technologies, for example, equipment to control, reduce or prevent anthropogenic emissions of greenhouse gases in energy, transport, forestry, agriculture, and industry sectors, to enhance removal by sinks, and to facilitate adaptation.

To date, the most significant multilateral technology transfer activity under the UNFCCC process is the Climate Technology Initiative (CTI). Launched at COP-1 in Berlin in 1995 by 23 IEA/OECD countries, the CTI mission is to promote the objectives of the Convention by fostering international cooperation for accelerated development and diffusion of climate-friendly technologies and practices for all activities and greenhouse gases.

CTI's primary focus areas are on: (1) capacity building; (2) technology assessment, analysis and strategy; and (3) research and development. Specific activities stressing near-term results include: technology training courses; joint seminars with industry on technology diffusion; and the development of Cooperation Technology Implementation Plans (CTIPs).

Regional Training Courses

A very successful technology training course was held in October 1998 in Japan to assist developing countries in Asia with climate change mitigation options. The one week course focused on energy efficiency in various industrial sectors and included participants from China, Indonesia, Malaysia, Thailand and the Philippines. The next training course is scheduled for March 1999 in the U.S. for representatives from Mexico, Central America and the Caribbean. All of these courses are intended to provide hands-on training in environmentally sound technologies including the ability to assess how these technologies can be applied to suit country-specific circumstances.

Regional Technology Diffusion Seminars

These regional seminars are intended to broaden developing country understanding of the information and tools necessary to increase penetration of climate-friendly technologies. Engaging a broad range of public and private sector participants provides the opportunity to share perspectives and identify concrete next steps.

Two seminars were held in 1998, one in Beijing, China and one in Pretoria, South Africa. Another seminar is planned for Victoria Falls, Zimbabwe in March 1999 in cooperation with the Southern African Development Community (SADC). Ministers from most SADC countries are scheduled to participate along with a wide range of regional industry and NGO representatives, including the UNFCCC Secretariat. Outcomes of these seminars will be communicated to the SBSTA and Secretariat to contribute to the exchange of relevant information under the consultative process.

Technology Cooperation Implementation Plans

The objective of the TCIP is to assist countries to establish a collaborative process for determining sector-specific technologies and practices that are consistent with a particular country's development goals. This "bottom-up" process involves a range of stakeholders from both developing and developed countries, including the private sector.

Note: Additional information on on-going and planned CTI activities will be provided to the Secretariat under separate cover.

B. Selected USG Activities

In the view of the U.S., public-private sector programs should be viewed as important vehicles for expanding technology transfer in the area of climate change. The U.S. Government has a strong track record in the design and implementation of environmental technology transfer activities worldwide. Among the lessons learned from these programs are the importance of, inter alia, engaging in-country stakeholders, developing public-private partnerships, and ensuring sustainable programs through capacity building.

What follows are descriptions of selected US Government programs that illustrate specific market development aspects of technology transfer. These programs represent only a small sample of U.S. programs, many of which were briefly described in a document distributed at COP-4.[2]

1. Energy Partnership Program (EPP)

Managed by the U.S. Energy Association (USEA), the Energy Partnership Program (EPP) is a USAID program that matches U.S. and overseas utilities and regulatory agencies with counterparts in developing countries. Once selected for the program, the participating organizations execute partnership agreements and commit to cooperate for a minimum of two years. For example, USEA orchestrated a cooperative agreement between Pennsylvania Power and Light (PPL) and Andhra Pradesh State Electricity Board (APSEB) in India. As a result of this partnership, APSEB is replacing inefficient irrigation pumps with more reliable single-phase pumps. The new pumps will reduce technical distribution losses by 14% per unit. In addition, discussions with PP&L executives on behalf of privatization in Andhra Pradesh led APSEB staff and union members to reconsider their position on the controversial issue of restructuring. As a result, APSEB is negotiating a $1 billion loan package with the World Bank for the restructuring of the transmission and distribution sector in Andhra Pradesh.

2. Environmental Enterprises Assistance Fund

In cooperation with USAID, the Environmental Enterprises Assistance Fund (EEAF) finances innovative environmentally sound enterprises in the developing world. EEAF has taken the know-how from the U.S. venture capital and "angel fund" experience and transferred it to nascent venture organizations in developing countries. EEAF also helps organizations raise funds to participate in debt or equity investment in projects. EEAF has raised over $13 million for investments in businesses in the developing world that have a clear environmental focus. EEAF has also continued to expand its funds under management and has been successful at attracting investment. In 1997, EEAF was named one of the three fund managers by the IFC for the Renewable Energy and Energy Efficiency Fund (REEF). The REEF will make investments in RE&EE enterprises in the countries of the developing

[2] United States Government Support for Climate Technology Cooperation, Projects and Activities 1998, distributed at COP-4.

world. EEAF and their partners are currently raising capital for the fund and expect to raise $50 million by mid-1999 and reach the target level of $150 million by 2000.

3. National Thermal Power Corporation

SAID is working with local utilities in India to demonstrate energy efficiency strategies. One demonstration program with the National Thermal Power Corporation (NTPC), whose plants generate more than 25 percent of India's electric power, was so successful that NTPC is investing $2.5 million in energy efficiency improvements this year. According to NTPC, the firm's investment in energy efficiency technology at NTPC's Dadri plant will save millions annually in coal purchase while generating a significant reduction in emissions.

4. Bagasse Cogeneration in India

USAID is implementing a $19 million Greenhouse Gas Conversion Pollution Prevention Initiative in India in collaboration with several Indian and U.S. public and private sector partners. A principal component of this initiative is the Advanced Bagasse Cogeneration (ABC) Program. Until recently, most sugar mill bagasse combustion systems in India were designed to meet the electricity and thermal needs of the mill. The ABC Program is helping Indian sugar mills design bagasse-based cogeneration systems that maximize combustion and electrical output, operate throughout the year, and have the potential to supply electricity to the grid. USAID has also sponsored a series of policy studies designed to open the markets for cogenerated power. These studies have led to breakthroughs in power purchase pricing in all India’s key sugar producing states, providing direct incentives to investments in cane cogeneration. Almost 300 MW of installed capacity can be attributed to USAID’s work in promoting bagasse cogeneration in India.

5. Winrock REPSO

Developed in cooperation with USAID, the Renewable Energy Project Support Offices (REPSOs) are part of Winrock International's strategy to help local people find appropriate and environmentally sustainable solutions to their energy and income needs. Staffed with in-country professionals, REPSOs are an effective vehicle for matching the global interests of the RE industry with the needs of rural populations without electric services in the developing world. REPSOs provide technical and financial support services to small businesses, NGOs, communities, and others to promote development of renewable energy programs, equipment, and services. The network functions as a conduit between local project developers and commercially proven technologies and services. It serves industry by identifying new markets and development opportunities, sharing information, and promoting local expertise. REPSOs operate in Brazil, Guatemala, India, Indonesia, and the Philippines, and are being developed in China, Mexico, the Dominican Republic, Nepal, and South Africa.

6. Energy & Environment Training Program

USAID's Office of Energy, Environment, & Technology has operated energy training programs for over fifteen years, training close to 9,000 people in USAID-assisted countries. In FY 1998, USAID launched the Energy and Environment Training Program (EETP), which increases the capacity for individuals within host country development partners to effectively and efficiently use available material, technological, and financial resources and apply them within local contexts. In FY 1999, the EETP is offering 12 training programs that are open to host country development partners in USAID-assisted countries. As a product of the courses, the EETP will also be developing a series of best practices guides in these courses areas. Courses are offered in:

- Energy Efficiency Entrepreneurship Program
- Economic and Financial Evaluation of Energy Efficiency Projects
- Applying ISO 14000 Environmental Management Systems to Municipalities
- Rural Renewable Energy Entrepreneurship Program
- Economic and Financial Evaluation of Renewable Energy Projects
- Integrated Resource Planning (IRP)
- Implementation of Power Sector Reform
- Carbon Emissions Trading
- Macro-Economic Modeling for Climate Planning
- Economics of Climate Change
- Monitoring and Verification of Carbon Emissions Reductions
- Climate Change and Development

The guides will be made available for downloading from the internet as they are published. For courses taking place in the U.S., funding covers participants' tuition fees and per diem while in training. Participants' employers are expected to fund the round-trip international travel of the participant to the course site in the U.S., and the participant's salaries while in training. For regional or in-country courses, funding covers participants' tuition fees, and liaison with a local partner or host. Participants' employers are expected to fund round-trip travel of the participant to the course site, as well as the participants' per diem costs and salaries while in training.

7. US-Asia Environmental Partnership (US-AEP)

The United States-Asia Environmental Partnership (US-AEP) is an interagency program led by USAID. US-AEP was established in 1992 to assist in addressing environmental degradation and sustainable development issues in Asia and the Pacific by mobilizing U.S. environmental experience, technology, and services.

With the participation of a wide spectrum partners -- Asian and American individuals, nonprofit organizations, professional associations, private businesses, and government agencies -- US-AEP stimulates direct technology transfer; develops networks and long-term relationships; disseminates information; identifies financial assistance vehicles; provides grants and fellowships; and organizes business and technology exchanges. In addition, US-AEP Environmental Technology Representatives, our local market experts, are located in eleven Asian economies to facilitate program activities.

Much of US-AEP's work towards sustainable industrialization and urbanization promotes GCC mitigation by addressing energy and resource efficiencies. Just a few examples of such activities are: promotion of environmental management systems addressing energy efficiency, conversion of waste to energy, material recovery and re-use, and municipal solid waste management (with landfill methane gas recovery). Through USAEP, the National Association of State Development Agencies, awarded ten grants to private sector groups promoting technology transfer relating to energy audits, waste recovery, recycling and reuse, waste to product technologies, medical waste incineration, and waste minimization. The Environmental Exchange Program sponsored ten programs with Asian business professionals and officials relating to topics such as recovery and recycling in the printed circuit board industry, recycling of oil and lubricants, waste-derived fuels, and livestock management. The Policy Group supported a meeting of Asian climate change specialists in conjunction with the launch of the Greening of Industry Network at Chulalongkorn University in Thailand. The Clean Technology and Environmental Management team continued a broad range of activities to improve energy and resource efficiencies in industry.

C. Technology Cooperation Agreement Pilot Project

Designed specifically as a model technology transfer program under UNFCCC, the Technology Cooperation Agreement Pilot Project (TCAPP) is aimed at assisting developing countries in attracting investment in clean energy technologies that will meet development needs and reduce greenhouse gas emissions.

There are four primary attributes that make TCAPP an effective model for technology transfer under the FCCC:

- TCAPP provides a country-driven approach for technology cooperation between developed and developing countries that will meet development needs while reducing greenhouse gas emissions. One of the hallmarks of TCAPP's success has been that it provides a vehicle for developing countries to articulate their climate change technology needs and engage the U.S. Government, other OECD countries and multilateral donors, and the international private sector in responding to these needs.

- TCAPP focuses on actions that will facilitate private investment in clean energy technologies and actively engages international businesses. Through the Business Council for Sustainable Energy, TCAPP has established a network of over 150 international energy companies that are participating in the TCAPP activities to help support the development and implementation of investment initiatives in each country.

- TCAPP provides a mechanism for coordinating donor responses to country needs. Over 30 bilateral and multilateral donor representatives have expressed interest in responding to the country priorities defined through the TCAPP process. TCAPP is also coordinating its activities with the Climate Technology Initiative (CTI) to promote multilateral participation in TCAPP and related CTI programs.

- Senior climate and energy officials from key developing countries are engaged in TCAPP and endorsing it as an effective model for technology transfer under the FCCC. For instance, TCAPP was highlighted by the Philippines delegation at COP-4 as an effective technology transfer model.

Following is discussion of the program's background, goals and methodology as well as an annex providing details on implementation status.

1. Background

The U.S. government initiated the Technology Cooperation Agreement Pilot Project (TCAPP) in August 1997 in recognition of the need to establish a mechanism for implementing technology transfer (Article 4.5) under the United Nations Framework Convention on Climate Change (UNFCCC). The TCAPP program is currently assisting Brazil, China, Kazakhstan, Korea, Mexico, and the Philippines in attracting private investment in priority clean energy technologies that will meet development needs and reduce greenhouse gas emissions. The U.S. Agency for International Development (USAID), the Environmental Protection Agency (USEPA), and the Department of Energy (USDOE) are supporting the program.

The National Renewable Energy Laboratory (NREL) leads the implementation of TCAPP for the U.S. government, and is assisting these countries in carrying out activities in two phases. In the first phase, which the five participating countries have carried out over the past year, TCAPP country teams develop technology cooperation frameworks that define the priority clean energy technologies that will meet development goals and reduce greenhouse gas emissions. These frameworks describe barriers to private investment in these technologies and propose actions by government agencies, donors, and the private sector to overcome these barriers and to attract investment. In the second phase, TCAPP program staff assist the country teams in implementing these actions through close collaboration between in-country government agencies, businesses, and non-governmental organizations (NGOs); the international donor community; and international businesses and investors. A key element of TCAPP is the coordination of private sector participation to ensure that industry views are incorporated into TCAPP's strategy, structure, and implementation.

2. Goals and Principles

The primary goal of TCAPP is to establish a mechanism for implementing Article 4.5 of UNFCCC by assisting developing country teams in designing and implementing technology cooperation frameworks, and in engaging private sector organizations and international donor agencies. By design, TCAPP is market-based, country-driven and broad-based.

- TCAPP is market based. TCAPP focuses on opportunities to attract private investment in country technology needs. TCAPP encourages the country teams to solicit feedback from in-country businesses and investors on the best opportunities for clean energy investment and most critical country and donor actions to support this investment. Through the Business Council for Sustainable Energy (BSCE), TCAPP

has also established and is continuing to expand a network of international energy companies and investment organizations to provide similar feedback on investment opportunities and country and donor actions to promote investment. These actions include directly facilitating private investment and removal of legal, policy, or institutional barriers.

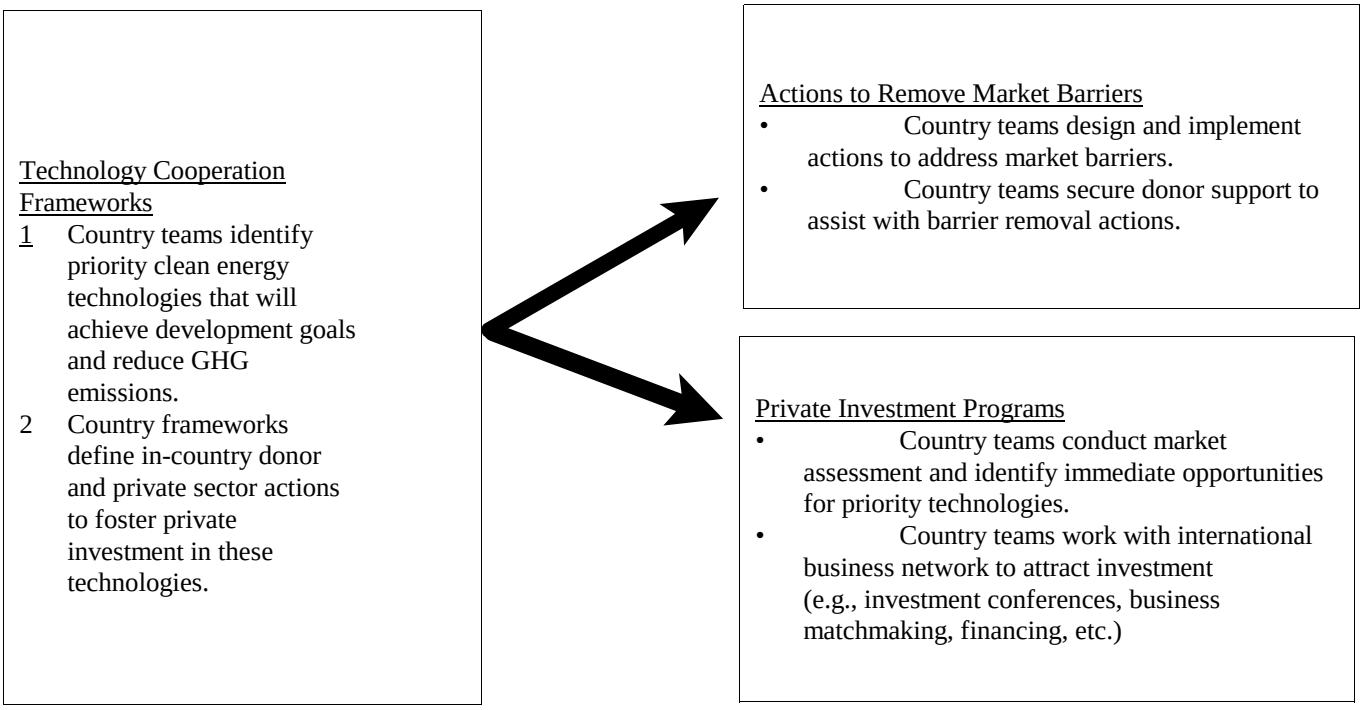
- TCAPP is country-driven. In-country teams led by senior government officials and with active participation of all key government, private sector, and non-government stakeholders establish a country's technology priorities. TCAPP provides small amounts of funding for in-country coordination and technical guidance and review, but is only a minor source of financial support. Country teams select priority technologies based on the contribution of these technologies to national development goals and their potential for greenhouse gas reduction. Each country team has established its own set of criteria for selecting priority technologies. These criteria generally include consideration of social and economic development goals, local environmental benefits, potential attractiveness of the technology to private investors, and potential contribution to greenhouse gas reduction. Countries build on their previous work in programs such as the Global Environment Facility Enabling Activities and the U.S. Country Studies Program and Support for National Action Plans as well as their own national processes. By employing priorities that are already well established and supported by government institutions, country teams can avoid using time and resources needlessly reassessing direction.

- TCAPP is broad-based. The program is designed to encourage actions by a broad range of in-country stakeholders by the host country while it promotes active participation and collaboration between the international donor community in response to the country technology cooperation needs. The U.S. Government has worked with the OECD, IEA, GEF, World Bank, UNEP, UNDP, and various other OECD countries and other multilateral donor organizations to design TCAPP. As a result, TCAPP will be a useful mechanism for donors to respond in a coordinated way to country technology needs. TCAPP aims to attract donor support for both the work of the country teams in designing actions to attract clean energy investment and for implementation of actions to address market barriers and directly facilitate investment deals.

3. Methodology

TCAPP is designed as a two-phase process. In the first phase, which the five participating countries have carried out over the past year, TCAPP country teams have developed technology cooperation frameworks that define their technology cooperation priorities and actions to attract investment in these technologies. In the second phase, TCAPP assists the country teams in attracting in-country, donor, and private investment support for implementing these actions, which address market barriers and promote direct private investment. All of these activities require close collaboration between in-country government agencies, businesses, and NGOs, the international donor community, and international businesses and investors. This process is depicted in the figure below.

The TCAPP Process



Annex -- Status of TCAPP

Activities were carried out in four major areas in the first year of TCAPP: (1) program design; (2) development of country technology cooperation frameworks; (3) private sector participation; and (4) international donor participation.

A. *Program Design*

The National Renewable Energy Laboratory and the U.S. Government agencies supporting TCAPP worked closely with developing and transition country officials, donor representatives, and international energy businesses and associations to develop an effective design for TCAPP. Program design occurred through individual consultations with these different groups, as well as a workshop held at NREL in November 1997.

NREL initiated work with Brazil, Indonesia, India, Kazakhstan, Mexico, and the Philippines prior to this workshop. Officials from these countries presented preliminary frameworks to international donor and private sector representatives at this workshop. This provided a foundation for discussions between the country and donor officials and private sector representatives on how the program design could be improved. A total of 40 country, donor, and private sector representatives participated in this workshop.

The workshop was a unique opportunity for country team representatives and the international donor and private sector communities to share ideas about attracting private investment. The attendees expressed strong support for the TCAPP concept. The participants commented on the need for a rigorous and consultative process for selecting country technology priorities, on the value of focusing on opportunities to attract private investment and thus the need for active business involvement in the TCAPP process, and on the key role of TCAPP in facilitating broad donor participation and coordination.

B. *Preparation of Technology Cooperation Frameworks*

The Technology Cooperation Framework is the foundation for TCAPP. It documents the process the country used to select priorities and the priority technologies resulting from this process. The frameworks describe the barriers to private investment for these technologies and identify opportunities for coupling actions by domestic agencies, international donors, and private sector investors to achieve sustained investment in the technologies. The frameworks are designed to contain the information most crucial to attract interest from international donors and the private sector. To date, five countries have completed the following steps in their efforts to produce frameworks.

1. In-country teams were established to guide the preparation of the technology cooperation frameworks. Teams were usually led by the country's energy ministry, since this is often the agency most responsible for policy implementation in the energy sector. Other ministries and stakeholders also participated in the teams. TCAPP has been fortunate to have had motivated and influential individuals act as the lead for the team. In Brazil, for example, the Director of Energy Development at the Ministry of Mines and Energy, who oversees the government's activities in energy

efficiency and renewable energy, led the team. In most cases, the team lead is assisted by others who have influence and are interested in pursuing the goals of TCAPP. In the Philippines, the team lead from the Department of Energy has been receiving support from the Presidential Assistant on Poverty Alleviation.

2. In-country teams developed a short list of possible technology priorities. Countries were encouraged to utilize established priorities if these priorities were strongly supported. Most countries have previously undertaken priority setting exercises, either for the purpose of energy planning, for economic development, or for climate change assessments. This approach has already demonstrated that enabling developing countries to consider the full range of options and allowing them to apply criteria that are most meaningful to them has two important benefits. First, countries are more serious about pursuing their own priorities. And second, because a country is likely to already be making efforts to pursue these priorities, they often have resources and capacity in place. For each priority, teams identified key market barriers and identified possible actions that can be taken by in-country or donor agencies to eliminate these barriers. Barriers can range from complex legal issues having to do with ownership, enforcement of contracts, or measurement of performance, to simpler problems such as a lack of awareness.

3. Teams refined the list of priorities, proposed in-country, donor, and private sector actions and prepared a comprehensive technology cooperation framework. This refinement occurred through consultations with technical experts, private companies, and international donors. More important were the in-country consultations with experts, stakeholders and other government agencies. When conducted correctly, in-country consultations help attract the support of key decisionmakers who may be involved in program implementation. The validation process in Brazil, for example, involved conducting a series of meetings to address the different priority areas. The meeting on direct use of fossil fuels and transportation required a different group of people than the meeting on rural renewable energy technologies. The review process for the technology cooperation framework included senior government officials once a complete draft document was prepared.

C. *Private Sector Involvement*

An important goal of TCAPP is to foster sustainable commercial markets in clean energy technologies. As a result, TCAPP is engaging the private sector in each step of the process. Representatives of the different types of energy efficiency and renewable energy businesses attended a workshop in Golden, Colorado in November 1997. Their contribution helped the country representatives and the other attendees maintain a market focus.

In March 1998, BCSE, an international association of energy efficiency and renewable energy businesses, joined TCAPP to facilitate a high degree of private sector engagement in TCAPP. BCSE's activities have included identifying companies interested in TCAPP countries and their priorities, soliciting feedback from the businesses on the barriers

and the proposed activities reported by the TCAPP countries, and attracting the interest of these companies in making investments of their resources in the TCAPP countries.

BCSE has now established a network of over 100 companies and investment organizations interested in participating in TCAPP. In September 1997, representatives from 24 companies and four trade associations attended a meeting on TCAPP hosted by USAID. Many companies expressed interest in meeting with the TCAPP country teams, and scheduled one-on-one meetings with country teams in Washington just 2 weeks later.

D. *International Donor Agency Participation*

Another key TCAPP goal is to actively engage international donors in supporting actions by countries that will build sustainable markets for their clean energy technology priorities. Donor involvement in the program began in the design stage, when discussions with donors in the first half of 1997 inspired the birth of TCAPP. Donor involvement has continued in a number of ways. For example, TCAPP has held individual consultations with headquarters and field donor representatives. Several international donor agencies sent representatives to the November 1997 TCAPP workshop in Golden, Colorado. International donors also attended the TCAPP side event at COP3 in Kyoto, when representatives from the Brazil and Philippines TCAPP teams made short presentations along with USAID, NREL, and the International Energy Agency.

Through these interactions, donor organizations identified three attributes of TCAPP of particular interest:

- TCAPP provides a common set of country-specific clean energy investment priorities reflecting input from key agencies and stakeholders in the country that can help focus donor activities.

- TCAPP provides donor organizations with a valuable mechanism for participation by private sector businesses and investors in clean energy initiatives.

- TCAPP can serve as a mechanism to help focus donor activities on country clean energy and climate change technology needs.

In an effort to bring TCAPP countries and international donors together in the most productive way possible, NREL organized a meeting in Washington on October 9, 1998, where TCAPP countries could present their Technology Cooperation Frameworks to international donors. The five TCAPP countries each sent one or two senior country team representative. More than 30 representatives of international donor agencies attended this meeting. A number of other international donor representatives who did not attend sent in requests for more information on TCAPP.

The October 9th meeting enabled each of the TCAPP countries to present a summary of its Technology Cooperation Frameworks. Each country also met individually with donor representatives to discuss opportunities for collaboration in responding to the country

technology needs. The meeting participants identified six next steps that could be pursued to broaden donor participation in TCAPP and further enhance the value of TCAPP to the donor community.

- The country teams should work with donor organizations to better define how their specific needs for support relate to and build on current donor programs.

- TCAPP should explore opportunities to become more of a multilateral program and to secure support from other donors (beyond the United States) for the overall work of the country teams under TCAPP, including designing actions to address market barriers and developing investment programs

- The U.S. institutions supporting TCAPP should pursue joint development of projects with the international donor organizations where there is a match of donor interests and country needs identified in the frameworks.

- TCAPP should continue its efforts to promote donor coordination and should work with the donor community to develop appropriate mechanisms for ongoing donor coordination in responding to climate change technology cooperation needs.

- The experiences of TCAPP should be shared more widely to promote further consideration of TCAPP as one model for implementing Article 4.5 of the UNFCCC.

- TCAPP should continue its efforts to expand participation by international business and finance organization in efforts to foster private investment in priority technologies.

- TCAPP efforts should be expanded to include new developing country participants.

E. *Country Implementation Progress*

TCAPP in-country teams are at various stages of development in the TCAPP process. Following is a status summary for each team, highlighting specific activities in the TCAPP process, including progress to date in facilitating the transfer of priority technologies.

1. *Brazil*

The country team in Brazil has begun to make substantial progress on the TCAPP priorities they identified in the fall of 1998. A series of meetings in early December resulted in actions being proposed in each priority area, including the following:

<u>Energy Efficiency in Truck and Bus Transportation</u>

Brazil already has two strong national programs in this area, and is planning to convene an international conference in an attempt to attract private sector participation. This idea, which was born at a TCAPP meeting, is beginning to gather momentum. Several key

Brazilian agencies are supportive of the conference, including Petrobras, the National Transportation Confederation (CNT), and the National Agency for Petroleum (ANP). TCAPP will help by attracting participation and sponsorship from international companies working in the field of energy efficient transport technology and urban planning.

Direct Use of Natural Gas

In Brazil electric water heaters are common for residential use. The introduction of natural gas to the Brazilian energy matrix offers the opportunity to replace the use of electric appliances, including showers, with gas appliances. TCAPP will assist the National Program for Fuel and Natural Gas Conservation (CONPET) in attracting support for a feasibility study that could demonstrate the benefits of direct use of natural gas in several types of applications.

Industrial Energy Efficiency

The National Program for Electrical Energy Efficiency (PROCEL) is beginning an industrial energy efficiency auditing program, which will focus on industrial processes. TCAPP will assist PROCEL in identifying and securing the services of the best industrial energy efficiency auditing companies for several specific industries. TCAPP will also work with PROCEL to secure financing for their energy efficiency projects.

Rural Renewable Energy Technology

The Program for Energy Development of States and Municipalities (PRODEEM) has an ambitious plan for implementing renewables-based rural electrification. TCAPP will assist by helping to design and attract partners for the demonstration projects that must be undertaken before new technologies or applications can be fully incorporated into the effort. The Ministry of Mines and Energy, working with TCAPP, will focus its efforts on obtaining short- term results to demonstrate the efficiency of systems for use in isolated areas, including biomass, small hydro, solar energy for ice making, and hybrid system technologies. TCAPP will work with PRODEEM staff to inform the international business community of PRODEEM's investment solicitations for these technologies. As a first step, TCAPP helped publicize a photovoltaic solicitation that PRODEEM issued in January 1999. Please notify us if you would like to receive more information on PRODEEM's PV solicitation.

Fuel Cells

Fuel cell technology is moving rapidly from the R&D stage to the marketplace. Fuel cells can be powered by a variety of fuels, though ethanol would be an ideal fuel for Brazil. Competitively priced, ethanol based fuel cells have the potential of dramatically changing the way renewable energy could be delivered in rural Brazil. TCAPP will draft a proposal for a Brazil/NREL partnership to develop ethanol-powered fuel cells.

2. China

Representatives from China presented their climate change technology cooperation framework at the TCAPP donor meeting held in October 1998. This framework was prepared by an interagency team, including experts from the Ministry of Science and Technology, the State Development Planning Commission, the State Economics and Trade Commission, the State Power Corporation, Tsinghua University, China's Energy Conservation Investment Corporation, the Energy Research Institute, and various other agencies and institutions. Due to government restructuring, the leadership for TCAPP in China has recently been moved from the Ministry of Science and Technology to the State Development Planning Commission.

The framework identifies five technologies as the highest priorities for accelerated investment and deployment, all of which reduce greenhouse gas emissions while supporting economic development. These five technologies are higher efficiency power generation, high efficiency electric motors, advanced industrial boilers, wind power generation, and coal bed methane capture and recovery technologies.

China's TCAPP team is currently in the process of finalizing their work plan for the next phase of TCAPP activities. This work plan includes development of investment programs (e.g., investment solicitations, investment conferences, business matchmaking, and financing) for each priority technology. The team is identifying the actions they would like to pursue, with domestic and donor support, for removing market barriers to these technologies. The team is also starting to develop implementation plans and donor proposals for actions to remove these barriers. Decisions on the scope of China's investment program and actions to remove market barriers will likely be made by April 1999.

3. Kazakhstan

Kazakhstan completed a final draft of their technology cooperation framework and presented this framework to the assembled representatives at the TCAPP donor meeting in October 1998. Of the four priority technology areas identified, the greatest interest was in the development of small hydropower facilities and the improvement of energy efficiency (and reduced carbon emissions) at coal-fired power plants.

Kazakhstan is about to enter the next phase of its TCAPP activities, which will focus on the development of solicitations for immediate investments in one or more of the priority technology areas. The government of Kazakhstan is, however, undergoing a physical and political transition due to recent elections and the fact that the official capital is being moved from Almaty to Akmola. While the economic, development, and environmental ministries have very strong interest in technology cooperation, TCAPP activities are currently on hold until the governmental transition is complete. It is anticipated that a new Kazakh country team will be formed in early February. That team's first task will be to develop the strategy and work plan for the next phase of TCAPP activities.

4. Mexico

For the past two years, the National Commission for Energy Conservation (CONAE) has been developing an important effort to promote and facilitate the application of energy efficiency and renewable energy technologies. This initiative has focused on the development of capabilities that will be of use in the implementation of technology-specific programs. Examples include the development of specific methodologies using computer software tools and an interactive web page that contains on-line technical assistance, links to various resources, and a large set of training courses and seminars.

Using a set of technological priorities that CONAE identified, TCAPP has been facilitating the development of a technology cooperation framework. At the October 1998 donor meeting, a CONAE representative presented the draft framework for three priority technologies that builds on pilot projects and studies that CONAE has already initiated, thus facilitating multi-agency buy-in.

Nation-wide Expansion of Efficient Lighting in Public Buildings

The goal of this proposed effort is to reduce, by at least 20%, the energy use of lighting systems in 1000 public buildings, resulting in energy savings estimated at 150 GWh. The program is based on the One Hundred Public Buildings program, through which CONAE, in partnership with other public agencies, identified potential energy savings of 19 GWh. In 1999, TCAPP will participate in the development of policy and technical needs, and in strengthening the private supply infrastructure needed to achieve this goal.

One very important component of this activity is an effort to develop a decree which, if approved, will make mandatory the application of an energy efficiency project that would apply CONAE's methodologies to all public buildings that have more than 5,000 square meters of floor area. This activity would be performed in conjunction with the Ministry of Environment (SEMARNAP). Additionally, CONAE is beginning the design of a large-scale investment program to be proposed to the Global Environment Facility (GEF) through the World Bank.

Nation-wide Expansion of Steam Generation and Distribution Systems

Under this program, CONAE hopes to work with private organizations to increase, by 20%, the energy efficiency of 300 steam generation and distribution systems in privately owned installations. This proposal is based on a pilot activity through which 37 industrial sites, both large and small, were analyzed to determine needed efficiency improvements. TCAPP will work with Mexican partners to organize the effort within the industry, and to define a national program that will include policy, technical, and educational outreach activities.

Solar Water Heating Program

This program will aim to double the total surface area of installed solar water heating systems in Mexico. Quality will be assured through the development and implementation of

standards and certification procedures for solar water heating components and systems. Increased use of this equipment can reduce dependence on liquid petroleum (LP) gas in urban areas, thus helping to mitigate air-pollution problems related to combustion and leaking gas tanks. Although Mexico has a well-established solar water heating industry, analyses performed by CONAE show great potential for growth in this market. Together with several public and private partner organizations, CONAE and TCAPP will work to develop standards, certification procedures, and other incentives to significantly increase private investment in solar water heating technologies.

In November 1998, CONAE made an informal presentation of the TCAPP framework to the Inter-institutional Committee on Systems for Environmental Management and Sustainable Government, comprising seven federal institutions focused on promoting efficiency in the use of electricity, water, petroleum, and the production of waste within these organizations. This committee is likely to be the basis of a broader interagency working group on TCAPP activities, coordinated by CONAE. Near-term plans include the designation of an in-country contractor to coordinate TCAPP activities, and finalization and execution of a work plan for 1999 that will include a focus on building interest in private sector investment.

5. Philippines

The Philippine country team has made significant progress on the TCAPP priorities they identified in the fall of 1998. During meetings in December, actions were identified to advance efforts of the Philippine Department of Energy to make near-term policy and regulatory changes to catalyze the growth of renewable energy and energy efficiency markets.

The Philippine TCAPP team has agreed to a series of actions to implement these policy changes and attract private investment. First, NREL and Preferred Energy Incorporated will work with stakeholders to identify near-term, high-priority policy changes that the Philippine Department of Energy could make. Among the recommended policy changes are streamlining the process for approving tax incentives and tax credits for renewable energy projects and redirecting a locally targeted Philippines fund towards rural renewable energy electrification. The Philippines Department of Energy is currently considering these recommendations. The Philippine Department of Energy has a significant opportunity to advance these implementation actions rapidly, because its efforts are integrated with the highest priority of the presidential administration: rural poverty alleviation.

The TCAPP team will continue its efforts to coordinate donor and private-sector actions to support identified technology cooperation goals. The Philippine Department of Energy actions and the government's initiatives for rural poverty alleviation will enhance the opportunities for donors and the private sector to advance successful projects. The TCAPP team will build momentum towards increased investment in priority technologies by attracting participation in investment programs. TCAPP's efforts in the Philippines will be closely coordinated with the newly implemented Philippines Renewable Energy Project, an agreement between USAID-Manila and NREL.

6. Republic of Korea

In September 1998, the Republic of Korea expressed interest in participating in TCAPP and identified the Ministry of Commerce, Industry, and Energy (MOCIE) to lead the Korean government's participation in the TCAPP program. Follow-up meetings were held in January 1999 with MOCIE and several key research institutions to initiate TCAPP work in Korea. TCAPP activities in Korea will be supported by USEPA and the Asian Environmental Partnership / USAID. Officials from these organizations joined NREL representatives on this visit to Korea.

MOCIE has established a Korean research team to carry out TCAPP activities in Korea. This team will be lead by the Research and Development Management Center for Energy and Resources (RaCER) which is part of the Korea Energy Management Corporation (KEMCO). The team will consist of representatives and experts from a broad spectrum of Korean institutions, including energy research institutions, energy companies, and industry associations.

The Korean TCAPP team met on January 27, 1999 to discuss the scope of project activities in Korea and define the next steps required for project implementation. At the meeting, the participants agreed to hold a scoping workshop in March to finalize the project work plan and begin the process of selecting priority clean energy technologies. In the meantime, the team will be conducting background research on the development benefits, greenhouse gas mitigation potential, and market potential of a range of clean energy technologies for consideration and discussion at this workshop. The Korean team also decided to aim for development of actions to facilitate investment in the priority technologies by August 1999, with the development and preparation of a draft technology cooperation framework shortly thereafter. A second phase of work to support implementation of investment actions would begin after this framework is completed.

Suggestions on the Consultative Process

The U.S. offers the following submission for consideration by SBSTA in response to Decision 4/CP.4 inviting Parties to respond to annex issues and questions related to the consultative process. Through the attached responses, the U.S. hopes to contribute toward both advancing substantive issues related to technology cooperation as well as furthering the consultative process. In moving ahead, it will be important to bear in mind the key aspects of technology transfer that the U.S. believes should guide future actions.

Under Article 4.5 of the UNFCCC, developed country Parties are obligated to "take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties". To begin this process, at COP-2 in Geneva the Parties defined technology transfer as follows:

> The term "transfer of technology" . . . encompasses practices and processes such as "soft" technologies, for example, capacity building, information networks, training and research, as well as "hard" technologies, for example, equipment to control, reduce or prevent anthropogenic emissions of greenhouse gases in energy, transport,

forestry, agriculture, and industry sectors, to enhance removal by sinks, and to facilitate adaptation.

The U.S. believes that any technology cooperation activities occurring under the auspices of the UNFCCC should be guided by the following principles:

1. Technology cooperation is most successful when it occurs through a holistic approach that integrates a country-driven definition of priorities with proven delivery mechanisms for joint action by government agencies, the private sector, and international donors in responding to these priorities. It will be necessary to establish efficient mechanisms for feeding country priorities into the design of implementation programs and for ensuring that such implementation programs actively engage all key domestic and international stakeholders.

2. Technology cooperation must go beyond the simple sale or transfer of hardware. Successfully establishing a program of sustained technology transfer requires the development of in-country enabling conditions and capabilities.

3. Private sector participation will be critical to any technology transfer program under UNFCCC. From a practical standpoint, the private sector supplies most climate-friendly technologies around the world and can provide much of the human and financial capital for effective deployment. As a result, any government sponsored technology transfer programs should engage the private sector and focus on creating the conditions that will accelerate development of markets for climate-friendly technologies. Government sponsored activities and government-to-government cooperation should focus on removing barriers to investment, and facilitating the commercial deployment of technologies.

4. In the U.S. view, technology cooperation is most successful if it is driven by country priorities and is sector specific. Technology transfer programs should assist individual developing countries in defining country-specific technology priorities that conform to existing development objectives. To ensure hands-on, in-country involvement, and therefore rapid technology diffusion, technology priorities should focus on specific sectors where countries already have a strong interest.

5. Mechanisms need to be established to coordinate the responses of the bilateral and international donor community to address the climate technology needs of developing and transition countries. This requires a clear delineation of country priorities, as well as effective procedures for coordinating donor programs and facilitating international business participation.

The consultative process should become a platform for expanded dialogue on technology cooperation, enabling Parties to present new models and programs that can be implemented, tested and adapted. It can provide an opportunity for technical experts, private industry, negotiators and policy officials from both developed and developed countries to share experiences and views in detail. This is essential to the development of a common

understanding of technology cooperation models as a basis for next steps under the Convention. The U.S. views the consultative process as an important opportunity to establish effective programs that meet UNFCCC goals.

Annex Issues & Questions

Practical steps to promote, facilitate and finance, as appropriate, transfer of, and access to, environmentally sound technologies and know-how

A-1 *Issue*: Promote the removal of barriers to technology transfer
Question: How should Parties promote the removal of barriers to technology transfer? Which barriers are a priority and what practical steps should be taken?

As detailed in a technical paper prepared by the Secretariat, technology diffusion is limited by a range of barriers, including institutional, legal, political, technological, economic, informational, financial and cultural barriers (FCCC/TP/1998/1). Citing Agenda 21, the Secretariat identifies specific strategies for removing barriers. These include a range of possible activities that focus on policy reform, institutional strengthening, capacity building, information dissemination, technology assessment, technology demonstration and research.

The U.S. is actively involved in designing and implementing programs to remove barriers to technology diffusion in developing countries. In the U.S. view, the private sector is the main vehicle for technology transfer, and as a result U.S. technology cooperation programs focus on creating conditions for expanding markets for clean technology. Technology markets and institutional conditions, however, are enormously complex and variable from country to country. There is no generic strategy for removing barriers. Rather, barrier removal measures and activities must be customized to suit the needs and constraints of each country and in many cases the specific technology market within a country.

To promote the removal of barriers, Parties first need to clearly identify technology objectives consistent with sustainable development goals. It is then possible to identify barriers and develop strategies for overcoming these barriers that are country-specific and applicable to the technologies of interest. It is essential that such barrier removal efforts focus on a few priority technology areas that hold the most promise for effective implementation and that in-country and donor actions are concentrated on and coordinated by a common set of priorities. The U.S. Technology Cooperation Agreement Pilot Program (TCAPP) is a good example of how such country and donor efforts can be concentrated on priority technology areas and sustained to achieve significant results.

To ensure success, programs should include broad participation from in-country and developed country stakeholders. From a practical standpoint, countries should focus on priority areas that match existing development objectives and represent important market opportunities. Developing institutional capabilities to achieve the successful transfer of priority technologies should be a key objective of any program.

A-2. *Issue*: Initiate and promote the transfer of publicly owned technology and those in the public domain

Question: What publicly owned technologies are available? How could Annex II Parties report upon them? How should Annex II Parties promote the transfer of publicly owned technologies?

There is no single worldwide legal and regulatory system controling the transfer and commercialization of technologies developed with publicly funded research. Each government establishes its own legal and institutional requirements according to national R&D policy objectives. As a result, it is difficult to know the availability of publicly owned technologies without each country undertaking a careful inventory.

In the U.S. it is an explicit goal of public policy to ensure that the private sector is responsible for commercialization and market delivery of technology. Thus, even where government supports research and development that lead to new technologies, these technologies are quickly transferred to private companies for marketing. It is an explicit objective of the U.S. Government not to directly compete with the private sector in this area. Thus, in the U.S., publicly-owned technology is unlikely to be a major source for international transfer.

A-3. *Issue*: Promote bilateral and multilateral technology cooperation to facilitate technology transfer

Question: What additional bilateral and multilateral efforts to promote technology cooperation to facilitate technology transfer should be initiated? What should be the priority?

The technology transfer consultative process should be targeted largely to answering this question. Systematically reporting the successes, failures and lessons learned from a range of recent and ongoing programs within the consultative process will provide a basis for establishing improved technology transfer methodologies and mechanisms. Programs such as the Climate Technology Initiative (CTI) and the Technology Cooperation Agreement Pilot Program (TCAPP) provide important opportunities for developing more effective methods of technology cooperation under the UNFCCC. It is important that all bilateral and multilateral organizations working on climate friendly technology cooperation communicate their models and approaches into the process. The objective should be initially to improve communication and to learn from a wide variety of experiences as a basis for recommending incremental steps to improve and expand these programs.

An important priority for promoting technology cooperation should be to strengthen efforts to assist countries in identifying their technology needs and priorities and in focusing in-country and donor resources on the actions necessary to address these needs. This priority can be best achieved by helping developing countries establish one set of technology cooperation priorities, linking donor support for these needs with in-country action, and targeting resources more efficiently through enhanced donor coordination.

A-4. *Issue*: Consider appropriate mechanisms for technology transfer within the UNFCCC

Question: Are existing multilateral mechanisms sufficient? Are new mechanisms needed for technology transfer? If so, what are appropriate mechanisms for the transfer of technologies among Parties in pursuance of Article 4.5 of the UNFCCC?

There is consensus that the existing financial mechanism under the Convention already provides for financing of technology transfer. Operating the financial mechanism for the Convention in accordance COP guidance, the Global Environment Facility (GEF) has established three operational programs that support technology transfer among Parties. Specifically, GEF programs focus on establishing enabling conditions for technology transfer: (1) removing barriers to energy conservation and energy efficiency technologies; (2) promoting adoption of renewable energy technologies by removing barriers and reducing implementation costs; and (3) reducing long-term costs of low greenhouse gas emitting energy technologies.

The remaining question is whether a new mechanism is needed to provide services other than financing to facilitate technology transfer under the Convention. In the view of the U.S., more work remains for the development of additional country-driven, bottom-up approaches such as TCAPP that work toward identifying technology priorities, removing barriers to technology diffusion and establishing in-country capacity for sustaining market-based technology transfer. It is useful to facilitate detailed exchange of information, experiences and views on such approaches, and this should be a major focus of the consultative process. It is premature, however, to consider establishing new formal mechanisms or institutions for technology transfer. It is hoped that the technology transfer consultative process will identify what needs, services and functions are currently unmet and which, if any, could be best addressed through a new institution or mechanism under the Convention.

A-5. *Issue*: Collaborate with relevant multilateral institutions to promote technology transfer

Question: What should be the objective of collaboration with relevant multilateral institutions to promote technology transfer and what practical steps should be taken?

In the context of technology transfer under UNFCCC, existing multilateral institutions can generally provide some support for country-driven technology transfer activities. This support, however, should be offered in parallel with separate, broader trade and investment reform initiatives that create enabling conditions for the transfer of all technologies.

A-6. *Issue*: Promote and facilitate, in collaboration with the interim financial mechanism, multilateral and bilateral institutions, the arrangement of financing of technology transfer.

Question: What additional guidance should be given to the interim financial mechanism?

In the U.S. view, the most efficient means for Parties to address such operational issues as technology transfer is through the GEF Council, and not through COP guidance.

A-7. *Issue*: Promote and assist developing country Parties to access technology information

Question: What sort of information is needed and how can this best be done?

Commercial, technical and regulatory information is critical to the effective diffusion of technology. Policy makers, project developers, financiers, consultants, and vendors require very specific information to engage in the complex chain of events leading to the transnational transfer of technology.

Access to information, however, can be a significant barrier to technology transfer. To overcome this barrier, many international organizations and government agencies have established excellent environmental technology information centers and networks worldwide.

Despite this existing information infrastructure, there remains a need for better coordination among suppliers of this information, and for continued improvements in the ability of developing country users to easily access needed information from the enormous volume of technology information that already exists through such information channels and resources as the internet.

This issue should be an important priority for discussion within the consultative process. Suggestions of a clearinghouse or "one-stop shop" for technology information have been made repeatedly in technology transfer discussions under the Convention. It may be useful for the secretariat to consider providing a pilot service of this type (with support from Parties and international institutions) to assist the consultative process in evaluating options and recommending next steps on this issue.

A-8. *Issue*: Facilitate access to emerging technologies.

Question: How could access to emerging technologies be facilitated?

In the view of the U.S., the most effective strategy for increasing access to all climate-friendly technologies is to design and implement specific market-based policy measures that reduce regulatory, legal, financial, technical or informational barriers to technology diffusion. The process of identifying and addressing these barriers should occur on a country-specific basis, depending on each country's development priorities and needs. The outcome of this analysis will determine whether emerging or more conventional technologies will be adopted. In fact, in some cases, the process of identifying a country's needs may stimulate further research and investment in emerging technologies.

In addition to actions aimed at removal of market barriers, access to emerging technologies could also be enhanced through programs designed to provide training for in-country businesses and investors on advanced technologies. However, since resources are limited for such training activities, it will be necessary for countries to focus such training activities on the emerging technologies that hold the most promise for near-term commercial deployment. Such training and business capacity building activities, therefore, should be linked to climate change technology cooperation priorities established by developing countries.

A-9. *Issue*: Facilitate the appropriate role of the private sector.

Question: What role is the private sector playing in technology transfer? What additional role can the private sector play ? What barriers prevent their greater participation?

The primary agent of technology transfer is the private sector. Through its technical capabilities, financial resources and commercial networks, the private sector has established a worldwide mechanism for technology transfer. The effectiveness of this mechanism, however, is limited by economic, institutional, legal, technical and other barriers to technology diffusion.

As a result, the public sector has an important role to play in technology transfer by implementing policies that reduce these barriers. One means of reducing barriers is for governments to work in partnership with the private sector to identify strategies for strengthening both the supply of and demand for technology. Public-private partnerships can be important platforms for governments to experiment with various measures and mechanisms for increasing technology transfer. In addition to removal of policy barriers, governments can help promote private sector technology transfer by sharing information on new investment opportunities that can lead to technology transfer.

Support for the development and enhancement of endogenous capacities and technologies of developing country Parties

B-1. *Issue*: Provide technical advice on technology transfer to Parties, particularly developing country Parties.

Question: What technical advice on technology transfer is needed? How should such advice be provided?

Developing country Parties need advice on technological, legal, regulatory, economic, scientific, commercial and financial issues. Technical advice should be provided on a country-by-country basis through bilateral and multilateral programs that establish specific technology cooperation frameworks. These frameworks should facilitate participation by a range of actors, including government agencies, non-governmental organizations, universities, research centers, financial institutions and private sector firms. The consultative

process can provide a channel for communication of results, experience, and lessons learned for country specific programs among all parties, so that effective models are available for replication or adaptation by other Parties as appropriate.

B-2. *Issue*: Promote capacity building in developing country Parties through provision of concrete programmes.

Question: What areas should be the focus of capacity building and how should it be undertaken, e.g. what kinds of activities, programmes and institutional arrangements?

Capacity building programs and activities should be country specific, depending on the priorities and needs of a particular country. Nevertheless, in general, capacity building should focus on strengthening both human and institutional capacity through training and technical assistance. Participants should include members of the regulatory, non-governmental, financial, technical, business and NGO communities. Training and assistance activities should be linked to technology priorities that have been developed by in-country stakeholders and show commercial promise.

B-3. *Issue*: Assist developing country Parties, on request, to assess required technologies.

Question: How, to whom and in what format should developing country Parties make their request for assistance to assess required technologies?

Technology assessment is an important component of the technology transfer process. Assessment considerations typically involve a range of actors, including governments, financial organizations, non-governmental organizations and private sector firms. Recognizing the complexities of the assessment process, developed country Parties and international organizations have offered assistance to developing country Parties to strengthen in-country assessment capabilities.

In particular, several countries have worked with developing countries on a bilateral basis to assess sector growth plans and the technologies being considered with the goal of facilitating the adoption of more environmentally-sound options. For example, in August 1997 the U.S. established the Technology Cooperation Agreement Pilot Project (TCAPP) under which a given country's technology needs and priorities are assessed in a collaborative process, including in-country and external technical, business and financial expertise with the intent of identifying viable projects capable of near-term implementation through private sector sources.

In addition to bilateral efforts being pursued, one of the activities under the multilateral Climate Technology Initiative (CTI) (comprised of 23 IEA/OECD countries and the European Commision) is designed to work with developing countries, and countries with economies in transition, to establish a cooperative technology implementaion plan, known as the Cooperative Technology Implementation Plan (CTIP). Once a country has been selected, the CTIP process includes a collaborative technology needs assessment on a sectoral basis.

The goal of this assessment is to identify climate-friendly technology options that will be capable of attracting private sector financing and may be implemented on a near-term basis.

Countries willing to participate in CTI's Cooperative Technology Implementation Plan activities should contact the CTI Secretariat located at IEA in Paris (331-4057-6522). Selection of countries will be based upon a combination of factors including: (1) level of interest and commitment to the process; (2) availability and quality of current and historical greenhouse gas emissions; and (3) degree of financial support made available by CTI member countries and organizations.

Building on these models, the consultative process should consider options for facilitating access by developing country Parties to support for technology needs assessment. This should include programs by multilateral development banks, UN organizations, and bilateral initiatives such as TCAPP, and should be integrated with other efforts to improve access to technology information and services under the Convention.

B-4. *Issue*: Promote and enhance access to relevant technical, legal and economic information at national and regional centres.

Question: What technical, legal and economic information is needed? What practical steps should be taken to promote and enhance access to such information by national and regional centres?

Ready access to accurate technical, commercial and legal information is critical to the technology transfer process. Specific information needs, however, depends on the requirements and priorities of each country, and national or regional information centers can play an important role in identifying and meeting these needs.

Although many excellent information systems are currently in place, more work is required to establish a more comprehensive and effective system for organizing and coordinating the flow of technology transfer information. The consultative process should give priority to this issue, establishing a well-defined process for establishing information system requirements and capabilities.

B-5. *Issue*: Develop a consensus on practical next steps to improve on existing technology centres and networks to accelerate the diffusion of clean technologies in non-Annex I Party markets.

Question: What type of process is needed to develop a consensus on practical next steps to improve on existing technology centres and networks to accelerate the diffusion of clean technologies in non-Annex I Party markets. What type of arrangement is needed to monitor progress?

The consultative process should provide a platform for establishing consensus on practical steps for developing the systems necessary for disseminating information on specific

technologies and opportunities. As part of the process, working groups of public and private sector actors from developing and developed countries should work to identify innovative approaches for meeting information needs. The consultative process should establish a program of concrete measures and systems that would enable progress to be monitored.

B-6. *Issue*: Promote an enabling environment for private sector participation.

Question: What measures, programmes and activities can best help to create an appropriate enabling environment for private sector investment?

The primary agent of technology transfer is the private sector. Through its technical capabilities, financial resources and commercial networks, the private sector has established a world-wide mechanism for technology transfer. The effectiveness of this mechanism for transferring technologies to developing countries, however, is limited by economic, institutional, legal, informational, technical and other barriers. In addition, an appropriate regulatory structure in the host country can be instrumental in providing positive incentives for cleaner, more efficient technology as opposed to less desirable "business-as-usual" options. Overcoming these barriers and establishing the proper enabling environment requires the co-ordinated response of developing and developed country policy makers.

In the view of the U.S., the most effective means for establishing enabling conditions is to engage in-country teams in a "bottom-up" process that identifies sector-specific technology priorities and barriers to diffusion. Once priority technologies and barriers have been identified, teams can establish develop policies for barrier removal and facilitate specific investment opportunities. Exemplified by the Technology Cooperation Agreement Pilot Project (TCAPP), an U.S. initiative, this country-driven approach provides a practical model for establishing institutional, regulatory and investment enabling conditions on a national basis.

Assistance in facilitating the transfer of environmentally sound technologies and know-how

C-1. *Issue*: Oversee the exchange of information among Parties and other interested organizations on innovative technology cooperation approaches, and the assessment and synthesis of such information.

Question: How should the Convention oversee the exchange of information among Parties and other interested organizations on innovative technology cooperation approaches, and the assessment and synthesis of such information?

The role of entities established by the Convention process should be to facilitate rather than oversee the exchange of information on technology cooperation. Through the consultative process, Parties should work to develop approaches for sharing information among Parties, organizations and private sector actors with a view to strengthening the role of business and industry in technology cooperation.

C-2. *Issue*: Consider information on innovative technology cooperation approaches and develop recommendations to the Conference of the Parties which could be recognized more formally and widely implemented under the Convention.

Question: How should information be compiled and synthesized on innovative technology cooperation approaches? When should recommendations on such approaches be forwarded to the Conference of the Parties?

How and when information on technology cooperation approaches should be compiled and forwarded to Parties to the Convention should be determined through the consultative process.

C-3. *Issue*: Identify projects and programmes on technology cooperation, which can serve as models for improving the diffusion and implementation of clean technologies internationally under the Convention, and to provide information on these projects to the UNFCCC secretariat.

Question: How and when should information on projects and programmes of technology cooperation which Parties believe can serve as models for improving the diffusion and implementation of clean technologies internationally under the Convention be provided to the secretariat? How could information on such model programmes be evaluated?

The 4th Conference of the Parties invited Parties to "identify projects and programmes on cooperative approaches to technology transfer...[that] can serve as models for improving the diffusion and implementation of clean technologies under the Convention." These submissions provided concurrently with responses to specific questions should provide an initial basis for discussions of models and approaches. How and when additional information on technology cooperation programs should be provided to the Secretariat should be determined through the consultative process. Likewise, how this information should be evaluated can be best determined through the consultative process.

Other questions

1. *Can specific technology transfer goals be set?*

   Specific technology transfer goals may only be set at the national level according to country-driven technology cooperation frameworks that incorporate country-specific needs and priorities.

2. *Can we develop indicators and accounting systems to track progress on technology transfer?*

   Indicators tracking the progress of technology transfer programs may be set at the national level according to country-driven technology cooperation frameworks that incorporate country-specific needs and priorities.

3. *Are particular institutional arrangements needed to monitor progress?*

Institutional arrangements for monitoring progress should be established at the national level as part of country-driven technology cooperation frameworks that incorporate country-specific needs and priorities.

PAPER NO. 8: UZBEKISTAN

COMMENTS ON THE ESTABLISHMENT OF THE CONSULTING PROCESS FOR THE PROMOTION OF THE ARTICLE 4.5 IMPLEMENTATION AND QUESTIONNAIRE PRESENTED IN THE ANNEX TO 4/CP.4 DECISION

From the very beginning the consulting process on the issues of technology transfer established by 4/CP.4 resolution should be more comprehensive and open. We think that alongside with the issues identified in the Annex to 4/CP.4 Resolution and in FCCC/CP/1998/6 Document it is also required to include the elaboration of the agreed criteria of the assessment of the fulfilment of obligations on Article 4.5 by Annex II Parties, the development of the successive approaches, guidelines and supplementary aspects of the working program of the secretariat, corresponding to the present status of the problem of technology transfer. One of the objectives of this process can be the preparing of the memorandum of the mutual understanding presenting the agreed position of Parties on the key concepts in the field of technology transfer.

As the Secretariat's activities on technology transfer are not integral and concentrated it is recommended to elaborate the acceptable strategy in this area, which integrates the priorities, approaches and methods of practical realization. The concept of assistance aimed at capacity building in the developing countries for the overcoming the institutional, financial and information barriers can be one of the main concepts in this strategy. The elements identified in the Annex to 4/CP.4 Resolution can be put into its basis. Our comments to this matters are as follows:

1. To promote the removal of the barrier in the technology transfer.

    - With the concrete programs and operational GEF strategies the Parties can sustain the establishment of the national processes in the organization of the regular assessment of the demands for technologies and the areas of their most effective application, transfer and improvement and the strengthening of the national institutional and technological potential.

2. To initiate and promote the transfer of publicly owned technology and those in the public domain.

    - The Annex II Parties should identify the environmentally friendly technologies, which are the state properly and can be transferred. The given list of the national technologies can be distributed by the appointed or the specially established centers of technological information.

    - Assistance of Annex II Parties can be the creation of the national stated technology funds open for other countries, the development and realization of transferred technologies accompaniments system, which includes the maintenance infrastructure and national personnel training.

3. To promote the bi- and multilateral technology cooperation to facilitate technology transfer.

   - The extension of the multilateral co-operation of Parties can be carried out thought the creation of the common information bank of technological proposals of Annex II Parties, classification of sectoral effects of the new technologies and elaboration of recommendations on their application, agreeing of the simplified conditions of transfer and types of the technologies to be transferred.

4. To consider appropriate mechanisms for technology transfer under the Convention.

   - The existing multilateral mechanisms of the technology transfer should the be substantially functionally ans structurally developed. For the improvement of the effectiveness of the transfer mechanisms the chain of the executory bodies is required: from the national information and technology centers analysing the country demands up to the specialized agencies responsible for the technology introduction, personnel training and technical maintenance.

5. To collaborate with relevant multilateral institutions to promote technology transfer.

   - Co-operation with such multilateral mechanisms as international science and technical programs can facilitate the improvement of education, ability for understanding and creation of the inner potential in the research area and the import of the most effective technologies. The enlargement of the list of science and technical programs, firstly, in developed countries, and inclusion of the science and technical potential of the developing countries can actively influence the correction of the national strategies, policies and measures.

6. To promote and facilitate, in collaboration with the financial mechanisms and multi- and bilateral institutions, the arrangement of financing of technology transfer.

   - Financing of technology import/export through the different projects should take into account the realization of the long-term strategies and be transparent at all stages of the project implementation.

7. To promote and assist developing country Parties to access technology information.

   - Technological information should be concentrated in the special science and technical centers with the proper informational network. This information should present the clear and comprehensive idea about the technology and infrastructural cost characteristics, ecological parameters, intellectual property, experience of its application.

8. To facilitate access to emerging technologies.

- To charge the special centers of technological information with the collection and dissemination of the information on the new technologies including the sates of research, development and testing the analysis of ecological effectiveness and division by sectors.

9. To facilitate the appropriate role of the private sector.

   - In the process of technology transfer the private sector can participate, as well as with crediting of target oriented programs, in the independent assessment of technological needs, market transparency of the legislation basis sufficiency and effectiveness of the financial procedures.

10. Provide technical advice on technology transfer to the Parties, particularly developing country Parties.

    - Technical consulting is required for the whole period of preparation and implementation of the projects on the technologies import. They can also be required for the formation of the large-scale national programs on the distribution/use of technologies. In particular, in relation to the introducing of the new mechanisms of Kyoto protocol it is necessary to plan the series of the regional training workshops on the specific features of realization of the projects on clean development mechanism or providing for the relevant consultations.

11. To promote capacity building in the developing countries providing for the concrete programs.

    - For many developing countries the creation of the national institutional bodies designed for the education, training and collection and discrimination of technological information such as the national committees and centers of technological information, is a very important and timely measure. The planning of co-operation with the international agencies should include the assistance of Convention Secretariat in search for financing.

12. To assist the developing countries, on request, to assess required technologies.

    - This function can be executed by the intergovernmental technical consulting groups with the experts in the field of the economical, financing and technical issues.

13. To promote and enhance access to the relevant technical, legal and economic information at national and regional centers.

    - For the propaganda and study of the successful projects it is also important to have the information on the carried out normative and legislative reform, innovational stimulating governmental activities informing the establishment

of the tax regime beneficial for the new technologies introduction, to specific features of the interaction between the state and private sectors in the support of the process of technology transfer/use, credit policy.

14. To develop a consensus on practical next 1 steps to improve existing technology centers and network in order to accelerate the diffusion of the clean technologies in Non-Annex I Parties markets.

- Approaches for the improvement of the existing technological centres can be elaborated in the process of informal consultations and round table with participation of the parties concerned.

15. To promote an enabling environment for private sector participation.

- The obligatory conditions of the involving of additional investments from the private sector should include the risk-mitigation for the agencies and investors involved, the stability of macroeconomical situation, the character of innovation stimulating activities of recipient governments.

16. To oversee the exchange of information among Parties and other interested organizations on innovative technology cooperation approaches, and the assessment and synthesis of such information.

- The special review on implementation presenting the assessment of experience and efficiency of the co-operative approaches in the area of innovation technologies can be made.

17. To consider information on innovative technology cooperation approaches and develop recommendations to the Conference of Parties which could be recognized more formally and widely implemented under the Convention.

- The presentation of recommendations on the co-operative approach in the area of innovatory technologies to the Conference of Parties will be possible only after the accumulation of the relevant experience and its assessment.

18. To identify projects and programs on technology co-operation which can serve as a models for improving the diffusion and implementation of clean technologies internationally under the Convention and to provide information on these projects to the Convention Secretariat.

- The experience of IVAM on the collection and analysis of information on technologies transfer developed at Amsterdam University can be used for selecting of the improvement of the distribution and implementation of the environmentally friendly technologies and to prepare the similar review.

PAPER NO. 9: INTERNATIONAL ATOMIC ENERGY AGENCY

CHALLENGES OF TECHNOLOGY TRANSFER

1. INTRODUCTION

The International Atomic Energy Agency (IAEA) conducts an extensive range of activities for the transfer of technology to its 128 Member States. Activities funded and implemented each year include 800 technical co-operation projects, 400 scientific meetings, over 1,000 research contracts, the addition of 80,000 records to a comprehensive information database, the operation of two research laboratories for scientific support and training, and the fielding of 3,000 experts and training courses for 2,500 scientists from developing countries.

The IAEA's funding of these activities amounts to US $130 million per year. But the overall financial investment is far higher. Each Agency dollar is matched by recipient countries at an average ratio of 1:3 through direct funding or other participation. In practical terms, this means that IAEA-supported technology transfer activities amount to an effort equivalent to US $400 million each year.

Augmenting this picture is strong collaboration with UN and other international organisations. Co-operative work extends to a wide range of scientific and technical challenges that must be met to help promote development and environmental goals. These partnerships are in areas of human health, food security, control of pollution, managing and protecting water resources, and sustainable energy production.

The co-operative network for technology transfer has evolved since the IAEA's founding in 1957, and strongly builds upon the Agency's scientific and technical expertise. Over the years, the IAEA has become a catalyst for technology transfer in keeping with its statutory mandate and the shared interests of its Member States in fields of development.

As we move into the next century, science and technology will play key roles in meeting the challenges ahead. The world is seeing a greater diversity and complexity of technologies available to address specific problems. We are also witnessing growing needs in developing countries for more sophisticated tools to support their development. This changing environment has raised a number of questions at the IAEA: How well is the IAEA helping countries to address their needs and problems? What new opportunities are opening for greater global co-operation and effectiveness of technology transfer activities? Is the traditional approach for technology transfer adequate to meet these challenges or are different ones required? If so, which directions and approaches are best to follow, in view of experience acquired so far?

The need for changes in the traditional approaches to technology transfer is clear. As

noted by UN Secretary-General Kofi Annan in his 1998 report[1] to the Administrative Committee on Co-ordination (ACC), "The manner in which technical assistance is provided also needs to be critically re-examined. Technical assistance as it was originally conceived was designed to close the technical capacity gap between industrial and developing countries by accelerating the transfer of knowledge, skills and expertise, thereby building national capacity. In some cases this has been done but, in many others, technical assistance has had precisely the opposite effect, reining in rather than unleashing national capacity. It has been observed that today, after more than 40 years of technical assistance programmes, 90 per cent of the $12 billion a year spent on technical assistance is still spent on foreign expertise - despite the fact that national experts are now available in many fields."

The Secretary-General's observations reflect the IAEA's experience from its long-standing efforts to build up capacity and expertise in its Member States. Over the years, physical infrastructures were developed, tens of thousands of the best technical staff received specialised training, and co-operation between research institutions and among Governments was strengthened through an extensive TCDC (Technical Co-operation among Developing Countries) programme. As national capabilities developed, the Agency started using these newly established facilities in the developing world for training scientists from less-developed countries, and it began using national and local experts to service projects in countries throughout a region.

These years of capacity building were successful and indeed helped to decrease the technological gap in the use of nuclear techniques by developing countries. A good indicator of this achievement is the number of institutions, research centres and experts now available and participating in the respective country's scientific activities. For example, in 1998 out of the 3,360 expert missions funded by the IAEA's Technical Co-operation Fund (TCF), 2,300 or about 69% were hired in developing countries.

Efforts are now being directed towards instituting a second step, namely moving from "capacity building" towards "partnership for development." For this transition, new initiatives are being developed such as the concept of Model Projects, Country Programme Frameworks, and Thematic Planning to make the technology transfer more efficient and heighten its impact at the national level. These concepts are described in the following sections of this report.

This report describes the IAEA's experience in fields of technology transfer, the lessons learned and applied, and the new initiatives being pursued to build stronger partnerships for development. It is intended to contribute to the co-operative global efforts of the Subsidiary Body for Scientific and Technology Advice of the United Nations Framework Convention on Climate Change (UNFCC-SSTA).

[1] As communicated to IAEA Member States in GOV/INF/1999/2.

2. THE CHALLENGES

New challenges confronting the IAEA Technical Co-operation Programme arise from the need to give greater priority to environmental and sustainable development issues. Additionally being faced are rising demands of newly independent countries, which lack sufficient infrastructure or human resources, and the growing diversity of technologies that countries require to address and solve problems.

The IAEA has taken two courses of action in response to the challenges. The first was to review and redirect technical co-operation to ensure that technology transfer is achieved under these changing conditions. The second was to ensure that financial resources are used to address real needs and national priorities in Member States and that projects are designed to achieve the highest *impact* on a country's development.

2.1 The Environment and Sustainable Development

A number of problems fall within the IAEA's mandate that were identified by the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992 and summarised as "Agenda 21" under the broad concept of "sustainable development". The Agency's on-going activities directly support "Agenda 21" objectives in several areas, and in others, new initiatives could be undertaken if additional resources could be found.

For example, the IAEA supports activities for the production of food using environmentally sustainable methods. Food production is effectively assisted through the application of nuclear techniques in a number of ways. For example, crops can be developed that are more resistant to common diseases or more tolerant to harsh environments. Adverse environmental impacts can be reduced by optimising the use of fertiliser through the investigation of nutrient uptake in crops. Insect pests affecting crops and livestock can be eradicated using techniques that do not pollute the environment.

In other fields, the IAEA has been promoting nuclear-related techniques that minimise or even eliminate the environmental impact of certain industrial activities: Radiation sterilisation of medical products, for instance, has replaced earlier processes that used highly toxic gases which were released to the atmosphere; Another application, called electron-beam processing technology, is being developed and applied to flue gases of fossil fuel-burning plants to reduce emissions of SO_2 and NO_x, both gases associated with 'acid-rain.'

To achieve the maximum effectiveness of activities supporting the objectives of "Agenda 21", the IAEA works closely with other international organisations that have sectoral responsibilities. Substantial efforts are co-ordinated with the UN and other agencies through the Interagency Committee on Sustainable Development established by the Administrative Committee on Co-ordination (ACC).

2.2 New Member States and their Needs

Following the political and economic changes in Central and Eastern Europe and the former Soviet Union, several newly independent countries have joined the IAEA and others are taking the necessary steps to do so. The Agency's membership increased from 102 in 1990 to 128 today. Many new members face major environmental problems resulting from their long isolation from technological developments in the west. These include problems arising from past programmes in utilisation of nuclear power and from the application of nuclear techniques in general.

In many areas, technical assistance and technology is needed to rebuild infrastructures, establish regulatory bodies, train staff, and support implementation of remedial measures to upgrade research facilities. Affecting all these challenges is the need to bring environmental problems under control. The countries concerned need to establish internationally proven regulatory practices relating to the licensing, control and inspection of their nuclear facilities. They also need to prepare for the decommissioning of a number of these facilities in the future.

2.3 Increasing the Impact of Technical Co-operation

A major aim of the IAEA Technical Co-operation Programme is to maximise the beneficial impact of individual projects at the country level. Impact can be reasonably assessed only in terms of some measurable indicator of achievement, such as a higher yield of food crops, better product quality using non-destructive testing techniques, or better public health because of improvements in the use of modern techniques for medical diagnosis and treatment.

All these indicators depend on the sustained use of the technology or techniques by a country after the IAEA's support has been delivered. Sustainability is created at the national level through, for example, the absorptive capacity for a technique, a stable staffing situation and stable financial support. However, the prime indicator is the perception, at the government level, of the importance of the technology in terms of the country's own national development goals and priorities. Without government support for the continuity of activities, it is not possible to achieve sustainable development.

Another requirement for achieving greater impact is the *orientation of activities to the end user*. Training and equipment for specific technologies are now increasingly delivered to the government sectors concerned, rather than to specialist groups at research centres of national atomic energy commissions. For example, the end users of medical diagnostic techniques are hospital staff; the end users of food and agriculture projects are farmers' co-operatives and the food industry; the end users of isotopes in hydrology are the water management institutions. Reaching the end users in such high technological areas, however, has proved to be a considerable challenge.

In 1995 the IAEA moved to gradually broaden governmental awareness of the relative values of nuclear technologies, and their potential impact for achieving national development goals. Such assurance is essential to avoid supporting activities that are of limited or no

importance in the overall national or sectoral priorities as outlined by the government, and which would therefore cease if IAEA support were withdrawn.

2.4 Strengthening Technical Co-operation

Several initiatives and mechanisms are being developed to strengthen technology transfer:

a) Increased interaction with governments should help the Agency's technology transfer activities be more in line with national development plans;

b) Establishing and strengthening national nuclear safety, radiation protection and waste management systems are a prerequisite for the development of nuclear energy programmes. This will be achieved mainly through the provision of training and advice;

c) More priority will be given to those areas for co-operation which address basic human needs, such as water resources, health, and energy supply and to the transfer of techniques contributing to environmental protection and sustainable development;

d) Increased co-operation with other international organisations will be pursued, including greater co-ordination and exchange of information.

2.5 Greater Inter-country Co-operation

Two major forms of inter-country technical co-operation activities are followed:

a) *Regional Co-operative Agreements*, with the principal aim of promoting and co-ordinating co-operative work in a wide range of nuclear applications and techniques; and

b) *Regional projects*, which deal with one specific technology or nuclear energy related activity.

Regional technical co-operation activities have proven to be an effective mechanism. It enables focusing combined efforts on problems common to several countries, and addressing them with an intensity of support that could not be provided to each country individually. Of no less importance is the fact that it promotes and facilitates Technical Co-operation among Developing Countries (TCDC). TCDC encourages regional self-reliance and the sharing of common experience and as such can contribute to increasing the effectiveness and efficiency of technology transfer activities.

At present there are three regional co-operative agreements for research, development and training in nuclear science and technology: in Africa (AFRA), Latin America (ARCAL), and East Asia and the Pacific Region (RCA). These agreements are concluded under the

auspices of the IAEA, which also acts as secretariat and provides assistance in the formulation of projects, financing, administration and scientific support. Regional membership has grown steadily and today 60 IAEA Member States participate in such regional agreements.

In addition to the above approaches, more than 30 multi-year regional projects are in operation, and about 140 regional training activities are carried out annually. The subjects covered reflect the priorities of the different regions. About one-fifth of the total resources available for the IAEA Technical Co-operation programme are allocated to regional activities.

The contribution of developing Member States to regional technical co-operation activities is increasing. These countries host the training events and provide most of the experts for the implementation of these agreements. Almost half of all assignments in 1998 used experts from developing countries and three-quarters of the training activities were hosted by developing countries.

3. FROM CAPACITY BUILDING TO PARTNERSHIP FOR DEVELOPMENT

Over the past four decades the IAEA has assisted developing Member States in capacity building and establishing infrastructures in nuclear science and technology. In the areas of its core competence, the IAEA often plays an indispensable role. In countries where nuclear power is not a priority, the IAEA has transferred isotope and nuclear technologies that have applications in industry, human health, agriculture, environment, water management and other sectors. These efforts for the most part had technical objectives and their cumulative effect on technical capacity has been and continues to be significant. It is precisely the IAEA's success in capacity building efforts, combined with the desire of Member States to strengthen the efficiency and effectiveness of technology transfer activities that created the opportunity to re-orient the IAEA's technical co-operation programme towards projects that will bring significant socio-economic benefits.

To move in this direction, it was necessary to focus the scarce resources available for technology transfer on activities which are both cost effective and contribute to national development. This has led to a series of initiatives which, taken together, represent a gradual shift in emphasis in the IAEA's technical co-operation programme. The shift has been from project activities directed at building capacity in research institutions, towards collaboration with counterpart organisations which could employ this capacity for productive and sustainable human development.

As a first step, a new strategy was defined. It can be stated as follows:

Technical co-operation with the Member States shall increasingly promote tangible socio-economic impact by contributing directly in a cost-effective manner to the achievement of the major sustainable development priorities of each country.

This goal is conveyed by the term Partners in Development - the idea being that the IAEA has become a partner with each Member State, co-operating in the process of achieving

sustainable development. To achieve this goal three new instruments for programming were developed: namely, Model Projects (MPs); Country Programme Frameworks (CPFs); and Thematic Plans (TPs). Respectively, they address setting and maintaining standards of quality in project design; achieving country programmes focused on a few priority development needs; and targeting those nuclear and isotopic techniques that offer clear cost-benefit advantages in achieving sustainable development. In simple terms these tools can help answer: *How* best to undertake the co-operation, *what* to co-operate on, *where*, and with *whom*?

3.1 Model Projects

Producing sustainable socio-economic impact in technical co-operation activities requires high standards for project design and management. The Model Project is essential to the Partners in Development concept because it represents the programme's highest standard of project quality. The established criteria for Model Projects are that they must: respond to a real need of the country; produce significant economic or social impact through the end user; reflect the distinct advantages of nuclear technology over other approaches; and attract strong government commitment. Such ideas also involve detailed workplans and objective performance indicators. Model Projects established thus far have indicated that this criteria does improve the quality of technology transfer.

The concept involves looking beyond the immediate recipient of a technology and reach the end user. It requires substantive, ongoing dialogue with the counterparts in Member States; a strong government commitment and the local infrastructure sufficient to ensure sustainability. Government commitment provides hard evidence of the usefulness and priority of the project to the country. It is being increasingly demonstrated by cost-sharing for national projects. The need for such a government commitment also implies the involvement from the start of national authorities, often extending beyond the recipient institute to the end user. The net effect is more direct contact with the sector involved, a strengthened role for counterpart organisations, and a wider interest in the outcome and sustainability of an activity beyond the lifetime of its IAEA project.

3.2 Country Programme Frameworks

In designing and managing co-operation projects to meet Model Project standards, programme preparation assumes crucial importance. The goal of the CPF process is to achieve agreement between the IAEA and a government on a few priority areas for technical co-operation and hence transfer of technology that can produce significant impact. This leads to the identification of opportunities for Model Projects and the systematic application of their standards. To be effective, the CPF must become an integral part, and eventually the principal means, of a country's process of formulating and appraising projects.

3.3 Thematic Planning

While CPFs result from interaction primarily involving the IAEA and governments, thematic plans initially derive from an assessment of the potential benefits of various nuclear

techniques to solve specific problems and the record of past technical co-operation experience. The need to identify services and technologies with special value has emerged in connection with efforts to expand the IAEA's comparative advantage. In simplest terms the special value of a service or technology relates to the priority of the problems it can solve. In effect thematic planning is a management tool for identifying special value services and technologies amongst those that the IAEA is currently transferring to Member States.

In addition to undertaking the three initiatives discussed above, the IAEA continues to emphasise and expand its experience with the UN concept of TCDC - Technical Co-operation among Developing Countries. TCDC strengthens the sustainability of project activities by building self-reliance and mutual interest between the countries involved. Here again the IAEA has unique experience among the UN organisations as it has established successful mechanisms for TCDC in Africa (AFRA)[1] in Latin America (ARCAL)[2] and Asia (RCA)[3]. The IAEA has strengthened these regional endeavours by encouraging Member States participating in the programmes to take responsibility for project formulation and by encouraging more advanced national institutes within each region to contribute in kind and in cash to solving common problems. In 1998, projects under these regional agreements received allocations of over US $12 million from the IAEA alone.

As countries develop, their growing capability and experience become important resources for others attempting to follow a similar path. Some of the more advanced developing countries have know-how and nuclear scientific establishments that in certain areas equal those of developed countries. The IAEA plans an important role in fostering partnerships among such countries and between them and the least developed countries (LDCs).

As a consequence of the above initiatives, and on recommendation of its Board of Governors, the IAEA started making intensive contacts with sister organisations in the UN system such as FAO, WHO, UNEP and UNIDO. With concrete end user oriented projects in hand, these contacts were much more meaningful. Although it is realised that all UN organisations are strapped for funds, the objective of these contacts is to identify common

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[1] **AFRA**: African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology: Participating Member States: Algeria, Cameroon, Democratic Republic of the Congo, Egypt, Ethiopia, Ghana, Kenya, Libyan Arab Jamahiriya, Madagascar, Mali, Mauritius, Morocco, Namibia, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Sudan, Tanzania, Tunisia, Uganda, Zambia, and Zimbabwe

[2] **ARCAL**: Regional Co-operative Arrangements for the Promotion of Nuclear Science and Technology in Latin America: Participating Member States: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela

[3] **RCA**: Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (for Asia and the Pacific): Participating Member States: Australia, Bangladesh, China, India, Indonesia, Japan, Republic of Korea, Malaysia, Mongolia, Myanmar, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, and Vietnam

goals whereby inputs by individual agencies would complement one another and resources could be pooled. Additionally, the IAEA initiated intensive activities to approach bilateral and multilateral funding organisations, again with concrete proposals in hand, laying a foundation of contacts with organisations such as the World Bank, the International Fund for Agricultural Development (IFAD), the African Development Bank, the Islamic Development Bank, CIDA of Canada, ODA of UK, USAID and the European Union as well as continuing our links with UNDP and its Global Environmental Facility.

These activities were essential to gradually shift the perception most donor institutions have on the IAEA's role in technical co-operation. Generally the IAEA was seen as mainly providing technical assistance, rather than being a *partner in development*. Examples of such a change of attitude are projects in Jamaica and participation in a World Bank project on water management in Mexico.

4. LESSONS LEARNED

Technology transfer is a dynamic process, hence its management approach and modalities of operation must be reviewed and adjusted from time to time as recipient countries progress towards development. Also, there is not always progress as setbacks can occur due to the erosion of social, economic or political conditions. Adjustments are also necessary here too. Organisations involved in technology transfer must be alert to such events and feed back the lessons learned into new programming activities.

Such adjustment by the IAEA can be exemplified by the results of a comprehensive survey carried out in 1993 on the internal and external factors hindering technology transfer and contributing to the observed low implementation rate. The first step was to look at the status of the TC programme implementation as of mid-year 1993, and then at the historical implementation problems to see to what extent the experiences in 1993 could be compared with that of previous years. It was found that annual deliveries (including manpower development) were quite uniform, fluctuating between 55 and 65% of the programmed activities. These figures were independent of the size of individual projects or the size of the entire TC programme in a given year. Could these percentages represent the upper limit of the capacity by Member States to absorb co-operation and technologies being transferred?

Programme delivery and technology transfer problems for those projects were discussed with the respective programme and implementation officers. It was found that many different factors were responsible for affecting the implementation of the projects and causing deviation from the proposed workplans. These factors were related to developments:

- in the Member States (counterparts)
- within the IAEA's Secretariat
- external to Member States and the IAEA.

They were grouped into five major categories (A to E) as below.

A. Factors Related to Recipient Countries and Counterparts

- Civil war or serious disturbance
- Lack of decision by government/counterpart on construction of a necessary facility
- Request by government to change objectives to include additional activities
- Lack of local staff and/or appropriate premises
- Lack of clarification from the counterpart on needs under the project in relation to the approved activities
- Loss of local staff from the project
- Pending reorganisation of the local institutions, including assignment of counterparts
- Delays in submitting fellowship applications for the proposed training
- Lack of radiation protection legislation or infrastructure
- UN embargo
- Government/counterpart requests for delay/postponement of expert missions or of all project activities
- Counterpart delays in installing equipment

B. *Late receipt of funds from donors (extrabudgetary contributions)*

C. *Factors related to IAEA internal management*

- Difficulties in identifying suitable and available international expertise
- Delays due to internal management's limited resources, structural problems and/or conflicting priorities
- Inadequate appraisal of the local conditions required for project implementation
- Difficulties in finding host countries for fellowship training
- Delays in equipment purchase or repair

D. *Delays connected with legal matters related to supply/transfer of equipment.*

E. *Cost beyond project resources*

- Cost of equipment requested was beyond the IAEA's input, waiting for government/counterpart to provide the balance as government cash contributions to complete purchase.

It was found that the non-fulfilment of financial obligations by the project counterparts as committed when requesting the project was a major obstacle to implementation. Projects with weak government support were the ones that suffered the most.

The survey also identified that manpower development which is the key element for absorbing the technology transferred is the most difficult component of a project to be

implemented. Many factors influence the implementation of this component of which two are prominent: Firstly there is a lack of sufficient number of fellowship applications to meet the programmed funds and objectives. The ability of countries and counterparts to recruit personnel to work on the agreed projects are in many cases limited by regulations or budgets. In addition, most of the fellowship applications are not submitted in a timely manner; usually less than 20% of the expected applications are received within the established deadlines. Secondly, delays occur in accepting a fellow by some host countries: while the current average review/placement time by the host countries is approximately four months, some countries can take up to ten or more months.

To attenuate these negative factors, it was concluded that more attention should be given to the design of the projects both by the requesting country and the IAEA (programming stage). Not only the right technology and technical aspects should be considered at the design stage, but also the adequacy of personnel with appropriate skills and the existence of economical, technological and political constraints both nationally and internationally on its implementation. Pre-project activities are recommended to decrease these risks.

Another lesson learned refers to the implementation of development oriented projects, where the technology component is subordinate to the overall objective. However, the successful technology transfer remains a *sine qua non* condition for the success of the overall development programme. In these cases there is little time for adaptation of technologies through additional R&D activities and the approach is to transfer only well tested and mature technologies which can readily be put into use.

Similarly, much attention should be given, during the design of the project, to the related elements which are necessary for sustainability. For example, projects in the area of agriculture such as in soil sciences may need the training of a few individuals and the establishment of modest infrastructure for analytical services, follow-up and extension services to farmers. On the other hand, projects in human health such as radiotherapy require training, not only of medical staff but also health physicists, and the establishment of legislation conferring authority to regulatory bodies and regulations for inspections and enforcement. Without such associated activities, all the technology transfer in terms of enhanced diagnostic and treatment capabilities will not be sustainable and therefore lost in a few years.

5. CONCLUSION

a) The IAEA undertakes a multitude of activities which have substantially contributed to the promotion of nuclear energy and its applications in developing countries. In fact, for most of these countries, IAEA-supported projects provide key input to establish national infrastructures required for the introduction of nuclear techniques for such basic human needs as food production and supply, public health, industry and environment, as well as electricity generation and issues related to nuclear and radiation safety.

b) The IAEA is not a major player on the global stage of development projects but a key one because of the scientific and technical expertise it can bring to such undertakings. Hence, efforts are being made to work in partnership with development organisations rather than in isolation. This experience of pooling efforts has been very rewarding.

c) Lessons learned through decades of work in technology transfer point out the dynamic nature of such undertakings. Changes in the political, social and (lately) economic situation in many developing countries are decisive factors affecting technology transfer activities which require multi-year implementation. In such cases contingency plans must be made at the project design stage to ensure that the parts already transferred are not lost, but sustained throughout difficult times. The most sensitive component is the preservation of trained human resources. Technology transfer outside a clear objective or framework for its application mostly results in loss of time and resources, leading to established infrastructure and trained personnel vanishing rapidly as soon as international assistance terminates. The lack of institutional support and the more attractive salaries offered by other government organisations or the private sector are the causes of this internal *brain drain*, which ultimately results in the loss of an investment in human resource development. On the other hand, if the technology transferred is an integral part of a national rather than institutional development programme, the likelihood of sustainability of the activities once the international assistance terminates is much larger.

There is considerable scope for the expansion of technology transfer activities. Much can be done in spreading the benefits of nuclear energy for sustainable development, environmental protection, and human health, and for generally improving the quality of life. Opportunities exist. It is a challenge to the IAEA, and to the international community that supports it, to continue meeting those demands for global and equitable growth, economic and social development in the 21st century.

APPENDIX 1

IAEA's Mechanisms For Technology Transfer

The IAEA has two mechanisms for technology transfer. The first consists of activities which are carried out under its regular programme and financed from its Regular Budget; the second, and most substantive, is a dedicated Technical Co-operation Programme funded mainly from voluntary contributions by Member States.

Activities under the Regular Programme include information exchange through symposia, seminars, conferences and technical committee meetings, co-ordinated research projects, publications, and support services. Many meetings, projects and programmes of the technical departments result in publications and technical documents which are widely disseminated to Member States. In 1997 developing countries received over 170,000 copies of IAEA publications, including cost free proceedings, technical documents, and bulletins.

An International Nuclear Information System (INIS) has been in operation since 1970. INIS continues to be one of the IAEA's principal channels for disseminating scientific and technical information. At present, 80 developing and 23 industrialised Member States, and 19 international organisations participate in INIS. The full INIS database is available online via the Internet or on CD-ROM.

Uniquely among the UN organisations, the IAEA operates its own research and service laboratories, which contribute significantly to the transfer of nuclear technology. The laboratories at its headquarters in Vienna and nearby at the village of *Seibersdorf* provide Member States with a diversity of technical services for programmes in physics, chemistry, hydrology, instrumentation, environment, industry and agriculture, to assist developing countries to solve a variety of problems. For example, services provided in agriculture cover soil fertility, irrigation and crop production; plant breeding and genetics; animal production and health; insect and pest control and agrochemicals. The laboratory at Seibersdorf transfers selected techniques and technologies to national research institutions through training courses, on-the-job training and laboratory services.

The IAEA *Marine Environment Laboratory* at Monaco**,** studies conventional pollution and radioactivity in the marine environment, collaborating with oceanographic institutes world-wide and undertaking projects in co-operation with other international environmental programmes and institutions. At present there are projects on the Black Sea, the Caspian Sea, the Sea of Japan and the Atlantic, Pacific and Indian Oceans.

The *International Centre for Theoretical Physics (ICTP),* financed jointly by the Italian Government, UNESCO and the IAEA, with some additional funding from other donors, is an important mechanism for the exchange and transfer of advanced scientific knowledge and skills. Over 3,000 scientists of whom over half are from developing countries participate in research and training activities at the Centre every year. The Centre has 441 Associate Members and 376 federated institutes in developing countries.

Through the Research Contracts programme, the IAEA unites researchers in developing and industrialised countries to progress towards common research goals. These contracts offer guidance to scientists from the developing world and provide opportunities for scientists in all Member States to communicate freely and exchange information on research activities. Contracts and agreements are made with research centres, laboratories, universities and other institutions in Member States to conduct research projects in relation to their scientific programmes. In the last ten years the IAEA has financed research activities totalling $58.1 million in this way.

Some illustrative examples of the results of such research with a large component of technology are given below:

a) In food and agriculture, the use of isotopic tracers in Co-ordinated Research Programmes (CRPs) has led to increased efficiency of phosphorus uptake by crops and in studying the rate of soil erosion; the use of neutron moisture gauges has led to improved water use efficiency in irrigation systems. A research study on the radiation induction of mutation in breeding rape-seed for oil has led to the release to farmers of three mutant varieties in Bangladesh and China. Similarly, 19 mutant varieties of sesame have been released in Egypt and the Republic of Korea. Significant progress has also been made using radiation-induced mutations in improving plant architecture and in modifying seed oil quality and content.

b) A CRP for Asia, Africa and the Middle East on the application of isotope and geochemical techniques in exploration for geothermal energy was completed in 1993. Institutes from 11 countries carried out investigations in low temperature geothermal areas on the Southeast Asian coast (China and Viet Nam) and on the Korean peninsula, in medium temperature areas in the Himalayas (India and Pakistan), and in high temperature fields in Iceland, Indonesia, Italy, New Zealand, the Philippines and Turkey. Isotope techniques have helped understand the hydrology of geothermal areas in order to identify the location of the resources and in particular to identify the most suitable sites for drilling production wells.

c) In the application of nuclear tracer techniques in human health, progress has been made through a CRP on optimising radionuclide based molecular techniques for the diagnosis of tuberculosis and blood borne diseases such as hepatitis, Chagas disease, AIDS and malaria. Also, successful completion of previous CRPs on the indigenous production of reagents for radioimmunoassay (RIA) has allowed the start of regional and national programmes for the detection of neonatal hypothyroidism, a major cause of mental and physical deficiency in the world. Similarly, ongoing CRPs on the indigenous production of radioimmunoanalytic reagents for the detection of hepatitis B will provide the springboard for future programmes dealing with this disease of increasing prevalence in the developing world and closely linked to the aetiology of cancer of the liver.

A CRP on immunoscintigraphy of colonic cancer, completed in 1994, pioneered the use of monoclonal antibodies labelled with Tc-99m. Other CRPs were designed as randomised multicentre clinical trials for monomodal and multimodal therapeutic approaches, using either

open (nuclear medicine) or sealed (radiation therapy) radioactive sources in the treatment of diseases, including hyper-thyroidism and different types of cancer.

There are many more examples of effective transfer of technology to the developing world. All of them have a potential for contributing to socio-economic development, depending on the use and scale of integration into national development activities.

The Technical Co-operation Programme

This is the main and most comprehensive mechanism of the IAEA's technology transfer to Member States. The TC Programme, consists of projects requested by Member States and approved by the IAEA Board of Governors, and covers all geographic regions and all aspects of nuclear technology for power and non-power applications. In 1998 alone the programme comprised 854 projects in about 90 developing countries for an amount of US $85 million.

The TC Programme comprises projects with individual Member States (national projects), and regional projects. Many of the regional projects fall within the framework of regional co-operative agreements to which Member States of the region may choose to be a party. Regional activities support common interests between countries, and permit better use of resources while supporting inter-country co-operation, in particular Technical Co-operation among Developing Countries (TCDC). The IAEA is very keen on TCDC and throughout the years has promoted this concept. Probably it has the most advanced and effective TCDC programme among the UN agencies.

Figure 1 shows the proportion of the total annual disbursements in each major programme area from 1990 onwards and illustrates the trends and changing directions of the TC Programme. Member States gave priority to nuclear techniques in food and agriculture, the physical and chemical sciences, health safety and industry. These particular programme areas cover a wide range of development sectors and represent 70% of the total programme while disbursements in nuclear power safety and radioactive waste amounts to only 30%.

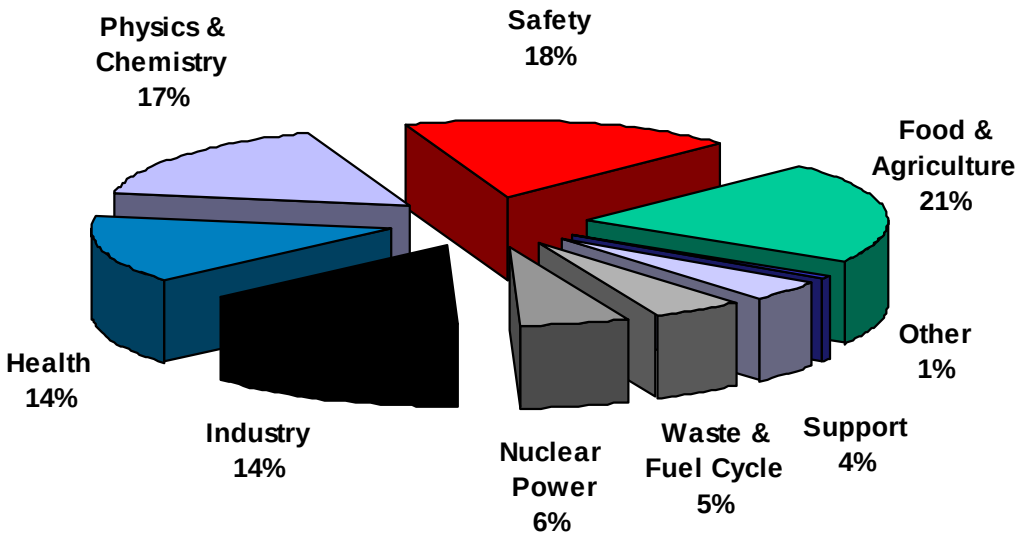

Figure 1 Disbursements by programme area through technical co-operation for the period 1980-98

Disbursements in physical and chemical sciences ranged throughout the years from 15% to 30%, while industry and earth sciences maintained an average share of about 15%. This distribution reflects the principal development aims of the TC programme, which is to seek to improve the health, welfare and the quality of life of the populations of IAEA Member States, particularly those of Least Developed Countries (LDCs), as well as to promote economic, scientific and technical development.

Another programme area which shows continued increase since 1990 is human health. The number of requests for assistance in the utilisation of nuclear techniques for the diagnosis of many diseases, such as leishmaniasis, Chagas disease, iodine deficiency diseases, sickle cell disease and thalassaemia and treatment by radiation therapy reflects this high degree of interest and demand.

In the last 25 years, about 20,000 scientists and specialists from developing Member States have been awarded fellowships or scientific visits and about the same number of participants have attended training courses. About 30,000 qualified experts have been assigned to assist development in Member States in areas where nuclear technology is involved and over $400 million worth of equipment and materials have been delivered.

Technical co-operation projects are financed from four separate resources: *the Technical Assistance and Co-operation Fund* (TACF) accounts for over three quarters of the total resources and is derived from voluntary contributions by Member States towards an agreed target. This target was set at $65 million for 1999. Member States are encouraged to pledge their respective share of the target, which is calculated according to the rates used in the United Nations system

for assessed contributions; *Extrabudgetary* cash contributions are made from donor countries to finance specific approved projects; *In-kind contributions* are made by Member States which provide expert services, donate equipment, or arrange fellowships, free of charge *UNDP funded activities are less than 1%.*

APPENDIX 2

Examples of IAEA's Technology Transfer
with Significant Impact

Environment Protection

1. In 1995 a preparatory study was started to address the consequences of the **rise of water level** of the Caspian Sea for the riparian countries. The complexity and magnitude of the problem requires a collective effort by several UN agencies. A workshop was organised with the co-sponsorship of the Intergovernmental Oceanographic Commission (UNESCO) in Paris, including participants from all the affected countries. The IAEA organised a three-week course on the Caspian Sea that provided training on sampling techniques, measurement of various hydrological and chemical parameters and interpretation of data. A large, multi-year, multi-funding project will be designed based on the accumulated experience.

2. One major activity related to environmental assessment started under a regional project in Europe - **Marine Environmental Assessment** of the Black Sea Region - where harmonised methodologies, co-ordinated monitoring and good quality data produced, created a reliable basis for Black Sea environmental management decisions on a regional scale. The second phase of the project in 1998 regionally co-ordinated marine pollution monitoring and assessment. Some US $700,000 worth of sampling and radiometric equipment and laboratory supplies were provided. Over 20 scientists were trained in marine sampling, radio-analytical and tracer techniques. A cruise was organised on the Black Sea to continue the assessment programme initiated in 1997. Analytical work on samples collected during the 1998 cruise was initiated. The autonomy of the existing task group structure was enhanced in order to provide a technical basis for the sustainability of the project output after its completion. As a result during the March 1998 annual co-ordination and planning meeting of the project in Vienna, a group of experts from the region suggested bringing the Black Sea environmental ministers together to agree on a declaration on the status of the Black Sea and remedial steps their governments are taking to tackle the serious pollution of the Black Sea.

Success of this project will bring direct economic and development benefits to the region. The application of nuclear techniques is demonstrably the most effective and appropriate technology to address the pollution problems in the Black Sea. Technology transfer is not only building local scientific and technical expertise and capacity, but is also building co-operation between many different States, international organisations, regional bodies and institutions.

In October 1998 during a three-day Ministerial Meeting, where nine environmental ministers and deputy ministers from Bulgaria, Georgia, Romania, the Russian Federation, Turkey and Ukraine were present, a **Black Sea Declaration** was signed in the presence of the IAEA Director General. The Declaration refers to the commitments of the participating Member States and the role they expect the IAEA to play in co-ordinating their efforts. This document not only defines the future of the Black Sea countries, but also recognises of the IAEA's role in bringing the countries together and in assisting them to upgrade their marine environmental assessment capabilities.

3. Burning poor quality coal in conventional power plants releases millions of tons of SO_2 and NO_x into the atmosphere each year, causing major pollution. Several advantages are offered by electron beam (EB) technology to clean flue gases. The IAEA is therefore promoting this technique in several developing countries by assisting in feasibility studies. Poland is being assisted under a project constructing an industrial demonstration EB plant at the Pomorzany power station which emits 5,800 tons of SO_2 and 2,900 tons of NO_x annually in Szczecin, a city with a population of 500,000. The project requires a total investment of some $16 million, with about $5 million from the IAEA and extrabudgetary contributions from Japan and others. High power electron accelerators are to be supplied and the plant should be operational by the end of 1998. Bulgaria, Turkey, Ukraine and Brazil now have active programmes for EB technology, and Ukraine has started the construction of an industrial plant with assistance from the IAEA.

Water Management

4. Under a regional project on **water resources** for Africa, field investigations and sampling were carried out in Egypt, Ethiopia, Morocco and Senegal. Initial results have proved highly relevant to water resource management in the region. For example, isotope data from Morocco indicate prevalence of paleo-water, disproving previous assumptions of recent replenishment of the groundwater system. In the Moyale aquifer system (in the south of Ethiopia), preliminary data of the isotope tritium revealed two types of groundwater resources with different rates of replenishment and different potentials for meeting water requirements in the area. Steps are now underway to include more countries in a planned second phase of the project.

5. The water supply deficit in Caracas, Venezuela is expected to worsen due to adverse climatic conditions, dependency on reservoir water and the rapid increase in population. Restricted distribution of water to several districts is now a common measure taken by the authorities each year to save water for the long dry season. The exploitation of the Caracas aquifer has been identified as the primary means of reducing the dependency on surface resources. However, proper management of this resource requires knowledge of the chemical and physical properties of the aquifer and groundwater dynamics. A Model Project has focused on providing new information for the rational exploitation of the aquifer based on the availability and quality of groundwater. The results of the project will influence the location and design of 50 new wells planned or underway and it is expected that this new source of groundwater will contribute around 112,000 m^3 per day or make up about 43% of the present shortage.

Human Health

6. Uruguay is being assisted in screening **neonatal hypothyroidism**. The programme is co-ordinated by the Nuclear Medicine Centre, responsible for processing about two-thirds of the 54,000 newborn blood-samples collected each year. The National Vaccination Programme is collaborating in the collection of samples from all over the country. The screening revealed four positive cases and appropriate treatment was given. Since 1997 the programme has been screening all newborn babies.

In Tunisia a screening programme for neonatal hypothyroidism was launched in three centres in Tunis, Sousse and Sfax. About 2,000 newborn babies are being screened every month,

about 12% of the total. The first positive case identified so far is undergoing treatment and about 10 others have been recalled for verification. Tunisia has radioimmunoassay (RIA) facilities in nine hospitals, each of which receives support through training and supplies of reagents.

7. Under a regional technical co-operation project, **Modernisation of Nuclear Medicine**, and related national projects in Albania, Armenia, Bosnia and Herzegovina and FYR Macedonia, inexpensive PC-based interface cards and clinical imaging software were installed on more than 25 older, mostly analogue gamma cameras in ten countries in order to improve their performance, quality and speed of imaging and capabilities to conduct new nuclear medicine studies. The results still need to be assessed in order to determine to what extent these upgrades of older equipment have been effective. A training course for technicians and engineers on preventive maintenance and quality control of gamma cameras was organised with participants from eleven countries. Regular supplies of radioisotopes, radiopharmaceuticals, and radioimmunoassay kits were provided to a number of countries throughout the year in cases where this was critical to the survival of nuclear medicine activities, and new SPECT cameras were installed in two countries.

The IAEA is assisting the Nuclear Research Institute Rez and the Ministry of Health of the Czech Republic to introduce positron emission tomography (PET) and a capability for production and distribution of advanced short-lived radiopharmaceuticals for advanced nuclear medicine. The country's first PET camera and a cyclotron for production of radioisotopes have been purchased in a multi-million dollar cost-sharing arrangement between the IAEA and the Government of the Czech Republic. The new facility is expected to be completed by the middle of 1999 at the nuclear medicine department of the "Na Homolce" Hospital in Prague. The total investment has been estimated at close to US $10 million. PET and advanced nuclear medicine diagnostic capability are expected to yield significant improvements in the quality and effectiveness of health care, particularly in areas such as heart disease and cancer, allowing more cost-effective treatment and better results.

8. **Radiotherapy** - In modern cancer treatment, a planning computer is used to perform the complex calculations that are required to deliver the highest possible dose without injury to the surrounding tissue. Under a regional project, "Upgrading Radiotherapy for the Treatment of Cancer," treatment planning systems were delivered and installed, and on-site supplier training was provided to radiotherapy departments in seven countries in the Europe region. Later in 1999 a training course will be organised to provide medical physicists who have received these systems with hands-on-training in clinical treatment planning for teletherapy and brachytherapy. A Co-60 unit was delivered to Bosnia and Herzegovina and another, through a direct contribution by the recipient country, to the FYR Macedonia. Radiation therapy using Co-60 technology offers the advantages of being a relatively simple and dependable technology, of moderate initial capital investment, relatively simple installation and operation, and low maintenance and repair. Older, obsolete units in Albania and FYR Macedonia were decommissioned and their spent sources removed for safe disposal in a third country.

9. Training has been emphasised under another regional project - "Building Capacity in Medical Physics." Since 1997, thanks to continued co-operation with the

European Society for Therapeutic Radiology and Oncology (ESTRO), the IAEA has been able to support over 100 radiation oncologists and persons working as medical physicists to attend teaching courses organised by ESTRO. These persons were drawn from 20 countries and over 30 radiotherapy departments. More than 30 fellowships, ranging from one to six months at hospitals in Western European countries, were also awarded.

Production of Energy

10. **Geothermal energy** development for electricity generation, where 20% of activities on water resource management is concentrated, is most intensive in the Pacific Rim area. This is reflected in the increase of IAEA geothermal projects, currently assisting 14 Member States which cover at least 17 major geothermal systems in this area. Techniques for geochemical investigations, including isotope methodologies, have been developed for the management of geothermal reservoirs where electricity is generated from 2 MW(e) up to about 1900MW(e) in Ethiopia, in Central America in Mexico, Nicaragua, Guatemala, Costa Rica and El Salvador as well as in Asia in China, Indonesia, Philippines and Thailand. The countries of Peru, Ecuador and Uganda have just obtained technical assistance for their respective geothermal exploration programmes. Through at least two decades of Technical Co-operation on geothermal energy development , each country has developed its own unique expertise to investigate problems inherent in their geothermal system.

Driven by a common interest of the different countries to share experiences and expertise, a collaborative effort was established under Technical Cooperation among Developing Countries (TCDC) through a regional geothermal project on geothermal hydrology and environmental management which has extended beyond the regional boundaries of Asia towards the other side of the Pacific Rim area, in Central America. A core group organized in 1998 in Mexico established a mechanism to facilitate transfer of technology across regional boundaries. The transfer of technology is established through a) exchange of results of investigations by circulating reports and through informal electronic consultations, b) regular round-table discussion to assess results and follow-up activities; c) field visits to demonstrate technologies and discuss strategies for reservoir management; and d) commitment to respond to requests for assistance or to scientific queries.

In the longer term, this collaboration will catalyse the use of indigenous geothermal resources for electrical and non-electrical applications. The development of low temperature systems for non-electrical applications, such as drying and aquaculture, would create employment opportunities in the vicinity thereby improving the socio-economic conditions of local communities. The development of high temperature systems will augment national power supplies. The concern for environmental issues will help maintain the balance between geothermal development and environmental protection.

Food and Agriculture

11. Chile is the only country in South America that is internationally recognised as being free of **Mediterranean fruit fly**, and has developed a multi-million dollar fruit export industry. Until recently however, Chilean fresh fruits were still excluded from certain

markets, because of the fear of outbreaks originating from medflies in the Arica region in northern Chile next to Peru. In 1990 after a decade of unsuccessful attempts to eradicate medfly using insecticides in the region, the Chilean Agricultural Service requested support to establish a SIT eradication programme. By 1993 a medfly mass rearing facility was built in Lluta, Arica, with a capacity to produce 60 million sterile flies per week. After considerable staff training and expert support, sterile fly releases were initiated in Arica in late 1993. By mid-1995, these releases were expanded under a co-operative agreement signed between Chile and Peru to co-ordinate their actions against medfly in the valleys of southern Peru. As a result, no wild medflies have been detected in Arica since mid-1995, and in December 1995 Chile was formally declared a fly-free zone by international experts. This could mean an annual increase of up to $100 million in fruit exports per year.

12. In Mali a Model Project evaluating the field performance of improved varieties of **sorghum and African rice** has made steady progress. Five mutant varieties of sorghum and a control were grown on demonstration plots, and two of the mutants produced 33% and 38% higher yields than the control variety. With an average yield of sorghum in Mali of around 800 kg/ha, the mutants have the potential to produce over 1,200 kg/ha. In 1998 eight of the best performing improved varieties have been released officially and two tons of seeds produced. These were distributed to a semi-private company and to farmers in various regions of the country for multiplication. In 1999 the company is expected to produce 6.5 tons of seeds, which will be distributed in packets of 500g to farmers in potential regions. The improved varieties of African rice also confirmed their superiority in yield (10-15 % as compared to the parent) and in colour (a major characteristic). The best performing varieties will be released officially in 1999.

13. In Zimbabwe about 90% of the rural community are smallholders, living in zones with poor soil quality and insufficient and erratic rainfall. Crop production in communal areas is generally low owing to inadequate nitrogen and phosphorous in the soil. Since 1996, with the help of the IAEA, the Government has been promoting the use of **biofertilizers** as an alternative to chemical fertilizers, which are unaffordable for most small farmers. Through the application of isotope techniques, Zimbabwe's Soil Productivity Research Laboratory has been able to demonstrate the benefits of legume inoculation country-wide and to select bacterial strains that have a high nitrogen fixation potential. The IAEA assistance has greatly contributed to popularizing the use of biofertilizers as an inexpensive and cost-effective technology by poor farmers. A packet of 100-200 gms, enough to inoculate seeds for one hectare, costs only a few dollars. The return on investment to the farmer is about 1:100. Field trials conducted in three provinces show that inoculation of soybean seeds with biofertilizer more than doubled soybean grain yields on average, resulting in significant mineral fertilizer savings of about 150 kg N/ha. The project outputs have enabled more than 2,000 small farmers to increase their main source of food and income and have prompted the Government to expand the use of biofertilizer technology to small farmers throughout the country.

PAPER NO. 10: GLOBAL ENVIRONMENT FACILITY (GEF)

Technology Transfer and Market Development Promoted

Since its inception in 1991, the Global Environment Facility (GEF) has promoted technology transfer of energy efficiency and renewable energy technologies through a series of projects in developing countries. An initial three-year pilot phase focused on making cost-effective greenhouse-gas emissions reductions. Following the pilot phase, the GEF in 1996 adopted an operational strategy, followed by three specific operational programs for promoting energy efficiency and renewable energy technologies by reducing barriers, implementation costs, and long-term technology costs (GEF 1996, 1997). A significant aim of these programs is to catalyze sustainable markets and enable the private sector to transfer technologies. Additional operational programs for energy-efficient transport and carbon sequestration are now being developed.

From 1991-1998 the GEF approved grants totaling $610 million for 63 energy efficiency and renewable energy projects in 38 countries (GEF 1998a; GEF Council work program 10/98). The total cost of these projects is $4.8 billion, as the GEF has leveraged financing through loans and other resources from governments, other donor agencies, the private sector, and the three GEF project implementing agencies (UN Development Program, UN Environment Program and World Bank Group). An additional $180 million in grants for enabling activities and short-term response measures have been approved for climate change.

GEF projects are testing and demonstrating a variety of financing and institutional models for promoting technology diffusion. For example, fourteen projects diffuse photovoltaic technologies in rural areas through a variety of mechanisms (see Annex A): local community organizations (Bolivia), financial intermediaries (India and Sri Lanka), local photovoltaic dealers/entrepreneurs (Peru, China, Zimbabwe and Indonesia), and rural energy-service concessions (Argentina). Several other projects assist public and private project developers to install grid-based wind, biomass and geothermal technologies (China, India, Philippines, Sri Lanka, Indonesia, Mauritania, Mauritius). For energy-efficiency technologies, projects promote technology diffusion through energy-service companies (China; see Annex C), utility-based demand-side management (Thailand, Mexico and Jamaica; see Annex B), private-sector sales of efficient lighting products (Poland; see Annex B), technical assistance and capacity building (China), and regulatory frameworks for municipal heating markets in formerly planned economies (Bulgaria, Romania, Russia). In addition, projects provide direct assistance to manufacturers for developing and marketing more efficient refrigerators and industrial boilers through foreign technology transfer (China; see Annex C).

Achieved energy savings and renewable-energy capacity installed through GEF-supported projects are small but not insignificant relative to world markets. For example, windpower capacity directly installed or planned for approved projects is 350 MW, relative to world wide installations of 5000 MW from 1991 to 1997 (which brought the total installed capacity worldwide to 7200 MW in 1997, 1200 MW of which is in developing countries). Solar thermal capacity planned for approved projects is 165 MW, while planned installations

by the private sector (the one major global supplier of solar thermal) from 1995 through the early 2000s is 400 MW. The GEF has approved close to 500 MW of geothermal projects, which compares with over 1100 MW installed worldwide from 1991 to 1996. Yet because implementation progress overall has been slow, the actual installed capacity as of 1998 was still a small fraction of the total capacity in approved projects. Solar home systems is one area where the direct GEF impact is expected to be very significant. There are an estimated 250,000 solar home systems now installed in developing countries, and approved GEF projects would add about 1 to 1.5 million systems to this total in the next several years, greatly expanding the installed base (see Annex A).

Installed capacity or direct energy savings is only part of the GEF impact (Martinot 1998). GEF projects have attracted considerable attention among policy-makers and industry in host countries and among the international community. Through policy changes, stakeholder dialogues, and project design activities and studies, GEF projects have provided an important stimulus for technology transfer beyond direct project impacts. These "replication" or "indirect" effects are key aspects of GEF project designs, but are not guaranteed to occur from direct project impacts. For example, the private sector participates in GEF projects in several ways: as equipment suppliers developing and marketing a new product, as local project developers responding to new regulatory and enabling conditions, or as local dealers/distributors responding to expanded market demand. Replication and commercial sustainability depend not only on host governments, but on the future actions of these private-sector participants given the conditions they face after the GEF project is completed.

Capacity building is a central feature of most GEF projects and is resulting in indirect impacts on host countries' abilities to understand, absorb and diffuse technologies. Projects build the human resources and institutional capacities that are widely recognized as important conditions for technology adoption and diffusion. For example, the China Energy Conservation project is building capacities of private-sector energy service companies, as well as those of public agencies to disseminate information, experience and best practices (see Annex C). In West Africa, a GEF project is helping develop regulatory frameworks, standards, tariff structures, and technical capacity for more efficient buildings. In Bolivia, a GEF project is developing the capacity of rural community-based organizations and households to finance, contract, and oversee installation and maintenance of renewable energy systems.

Several GEF projects are designed to directly mobilize private-sector finance. In the Poland Efficient Lighting project, a $6 retail price reduction for energy-efficient lamps was possible with only a $2 grant because of manufacturer contributions, and 1.6 million lamps were installed (see Annex B). The Thailand DSM project successfully orchestrated a voluntary agreement among Thai lighting manufacturers and importers to convert their production and imports to more efficient models. Through the International Finance Corporation, four GEF projects--the Renewable Energy/Energy Efficiency Fund, the Photovoltaics Market Transformation Initiative, the Solar Development Corporation, and the

Hungary Energy Efficiency Cofinancing program are designed to leverage $490 million in private-sector financing for technology transfer with $105 million in GEF grants (see Annex D).

While most approved projects are still under implementation, there are emerging project experiences, impacts, and lessons learned (GEF 1998a, 1998b, 1999, other GEF reports forthcoming). For example, a completed GEF project for solar home photovoltaic systems in Zimbabwe promoted technology transfer of components for 10,000 systems through direct subsidies, lower import duties, and stimulation of the country's dealer/installer industry (see Annex A). In Costa Rica, a significant private-sector wind-power industry has emerged from new dialogue and policy frameworks engendered by the GEF project (even though the project has not directly installed wind turbines itself). In India, almost 1000 MW of wind turbines have been installed in recent years through joint ventures with Western wind turbine manufacturers and by domestic Indian producers and project developers, in part due to favorable tax regimes and enhanced willingness of commercial banks to finance these projects; the GEF has helped to canalize these outcomes (see Annex E). In Hungary, the GEF helped establish an energy-service company (ESCO) for energy-efficiency investments and is supporting development of other ESCOs in partnership with local banks (see Annex D).

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Annex A: Solar-Home-Systems Projects

The GEF has approved fourteen solar home systems projects in 16 countries (India; Sri Lanka; Indonesia; China; Ghana; Zimbabwe; Benin; Togo; Peru; Bolivia; Argentina; a regional project in India, Kenya, and Morocco; and the global Solar Development Corporation). The designs of these projects differ in several keys respects, but all projects address in some combination and with different emphasis what are considered the key generic barriers to solar home system diffusion:

- high first-cost
- unfamiliarity with technology and its expected performance by users
- poor credit-worthiness of households from financier perspective
- lack of sales and service firms to market and maintain systems
- poor long-term system performance
- difficult to determine system quality and identify “fly-by-night” vendors
- lack of financing and difficulty of dealer/installer firms to finance systems
- difficulty of local entrepreneurs to establish viable businesses

Early Projects

The two early projects took place in India and Zimbabwe starting in 1991. The India project provided credit through the India Renewable Energy Development Agency (IREDA) to commercial financiers. The financiers were supposed to purchase systems from manufacturers and supply them to households. A separate service firm, under contract to the manufacturer, was supposed to provide marketing, installation, commission, and after-sales service. This approach proved infeasible in India because the commercial financiers were unwilling to lend to rural households due to credit risk concerns.

In 1998 the India project started implementing a new modified-ESCO-approach using local, community-based ESCOs. These ESCOs are often religious organizations with strong ties to the community. In this approach, the ESCOs lease systems from commercial firms. The commercial firms purchase the systems from manufacturers and receive a tax break, which they share with the ESCO. Ownership of the system remains with the commercial firm, not the ESCO.

The Zimbabwe Photovoltaics for Household and Community Use Project was designed to enhance and upgrade indigenous solar manufacturing and delivery infrastructure, to develop an expanded commercial market in rural areas for affordable domestic solar electric lighting by providing low-interest financing through existing institutions, and to establish new credit mechanisms at the grassroots level to benefit lower income groups in rural areas (households and community-based institutions). Over the five-year project period, the project expected a direct impact of about 9,000 PV systems installed on concessional financing terms provided by the project. The project also originally expected an indirect impact of up to another 9,000 systems sold without credit or subsidies, during the five-year project period, due to the market development fostered by the project. The project has had a number of impacts on the market for PV systems in Zimbabwe:

> *Number of producers and dealers in the market*. Prior to the project there was one PV module and systems manufacturer, plus three smaller firms performing installation and system integration. At the completion of the project, 60 firms were registered with the Solar Energy Industries Association, although only 30 have since renewed and only six accounted for 80% of the market share under the project. No new module assembly companies have emerged as a direct result of the project due to lack of funds for plant and machinery.

Changes in market prices. Import duties of 40% on imported components were waived during the project, but there was speculation these duties would be put back in place after project completion. This will have a significant bearing on future market prices.

Technical knowledge. Technicians from five installer companies were trained during the project. Two colleges and one polytechnic institute will begin to provide courses on PV technology initially in the form of adult education courses. The University of Zimbabwe began to offer a M.Sc degree in Renewable Energy Systems in 1996. The PMU and the Solar Industries Association have produced a solar magazine.

Standards enacted and in use. The Standards Association of Zimbabwe and the Solar Energy Industries Association were working on PV standards and several have been drafted.

Certification procedures and institutions exist and active. Certification procedures were instituted for suppliers during the project, but it is not clear if these procedures were institutionalized after project completion. The Project Management Unit (PMU) enforced component standards and installation standards during the project, assisted by its own small laboratory for device tests. A code of conduct for the Solar Energy Industries Association has been included in the organization's constitution.

Operating financing mechanisms. The Agricultural Finance Corporation has successfully provided concessional credit to consumers through a revolving fund mechanism. No data is available on the repayment rates and turnover of the revolving fund, and thus what additional resources will be required to sustain it. "It is obvious now that the prevailing interest rate of 15% is sub-economic and as such the fund will certainly deplete to zero if no corrective action is taken" said the project's terminal evaluation. During the project an additional credit facility was established to help suppliers with cash flow, and to enable suppliers to procure imported components (from the PMU) before they were paid for the systems. This credit was available based upon PMU certification of suppliers. Financing mechanisms through community organizations were not functioning because Rural Councils are not allowed to borrow money and hence could not administer a credit scheme.

Perceptions of commercial credit viability. Prior to the project, ZIMBANK was making loans for solar PV, but stopped. The project demonstrated that loans for solar PV systems are viable under the terms given (Z$8000 to Z$9000 principal, 15% nominal interest rate (but negative real interest rate), 3 to 5 year term).

Degree and quality of information available and known by consumers. "There is now much greater awareness by government, NGOs, public about home PV systems than before the project" said some of the evaluation reports. "Public awareness of the PV project has been achieved to an unknown extent" said the terminal evaluation.

Presence and function of market intermediaries. During the project, the Project Management Unit (PMU) played a critical market intermediation role in reducing barriers. These "market intermediation" functions included long-term credit for purchasers, certification of suppliers, commercial credit for certified suppliers to assist with cash flow, technical standards for components and systems, and bulk procurement and import of components. It is not clear how these functions will be sustained and to what degree they will still be necessary. A Solar Industries Association was established prior to the project and continues to function.

Number of systems installed. As the *direct* market impact, 10,000 systems had been installed by 1997. An estimated 3000 PV systems had been installed prior to the project, mostly in rural and semi-urban centers like health clinics, schools, community centers, and commercial farms. An estimated static baseline projected sales of 320 home systems per year, or roughly 1600 systems over the five-year project life.

Recent Projects

The Sri Lanka Energy Services Delivery project provides credit to financiers ("Participating Credit Institutions"), who on-lend the credit to private enterprises, NGOs and cooperatives for installing solar home systems. The project does not specify which specific delivery model these private enterprises ("developers"), NGOs, or cooperatives should use in dispersing the credit, so this project should have a combination of cash sales, commercial credit sales, micro-credit sales and perhaps even leasing. [To explore in subsequent work: what has recently happened during the project—which models are been proven in practice?]

In the Indonesia Solar Home Systems project, a commercial-credit sales program was designed in which entrepreneur/dealers are the central delivery mechanism. As rural banks in Indonesia only offered two-year loans at high rates of interest for consumer durables, they were not considered to be appropriate financial intermediaries. By contrast, an entrepreneur in West Java had already shown that it was possible to manage four-year loan schemes on a commercial basis, at lower rates of return than that offered by the rural banks. In addition, this entrepreneur had been able to develop and sustain an extensive rural delivery and after-sales servicing mechanism. Entrepreneurs/dealers were selected based upon existing business competence and market infrastructure in related rural sales/service markets. Because cash flow was recognized as the key constraint on the emerging enterprise in selling solar home systems on credit, training efforts were specifically targeted at how to develop an attractive business plan and approach a banker. Many of the entrepreneurs could not even develop a spreadsheet, and this lack of competence was recognized as being critical to a financier's decisions. The entrepreneur/dealers received World Bank financing on-lent through commercial banks to satisfy their working capital needs and a $100/system grant from the GEF.

In the China Renewable Energy Development project, extending credit to rural households was not considered feasible, so a cash sales model is used. In this case, the project supports development of local PV entrepreneurs similar to the Indonesia project, and provides the winners of a competitive selection process with a $100/system grant from the

GEF. Any entrepreneur who passed the project's established eligibility criteria could participate in the project.

In contrast, in Argentina, a quite different approach was taken using an ESCO model. Instead of ESCOs competing for business in the same service territory, the government awards a monopoly concession to a specific ESCO to serve the users in a specific territory. The concession provides and maintains solar home systems for households and collects a monthly fee-for-service. The World Bank provides financing that is on-lent to provincial governments, which then on-lend it to concessions. A GEF grant reduces the first-cost of the systems by providing a payment to concession of $100 for each system installed.

Rural community organizations are targeted in the Bolivia Program for Rural Electrification with Renewable Energy Using the Popular Participation Law. The projects supports development of these organizations and builds their capacity to obtain financing for renewable electrification investments, procure renewable energy services from private-sector providers, oversee installation, and contract for maintenance.

Support for private-sector PV companies in Kenya, India, and Morocco will also be provided by the Photovoltaic Market Transformation Initiative (PVMTI). PVMTI will make selected investments in private sector PV market development projects received in response to a competitive solicitation. The project will provide companies with concessional financing in the range of $0.5-5 million. A $30 million grant is expected to leverage additional co-financing of $60-90 million from project sponsors and other sources (including commercial banks). PVMTI is expected to remove barriers to PV markets and deliver sustainable and replicable projects by providing successful and replicable examples of good business and technical practices.

Annex B: Energy-Efficient Lighting Projects

The GEF has funded four energy efficiency projects with lighting components in Poland, Thailand, Mexico, and Jamaica:

Mexico High Efficiency Lighting Project (1993-95). Under this project, the national electric utility (CFE) purchased CFLs and sold them directly to consumers through its offices. The utility purchased the CFLs in bulk under competitive procurement from manufacturers, receiving a significant discount over retail market prices. The programmatic approach was essentially a utility DSM program with extensive consumer marketing and outreach. The project took place in two states in Mexico, Nuevo Leon (capital Monterrey) and Jalisco (capital Guadalajara). These two capital cities are the largest in the country that the national electric utility serves. Low-income consumers were particularly targeted, because of the large subsidy paid by the utility for electricity purchased by these consumers (Friedmann 1996, 1997 and 1998; Friedmann et al 1995; Sathaye et al 1994; GEF 1994).

Poland Efficient Lighting Project (1995-97). This private-sector project was designed to stimulate the national market for energy efficient lighting in Poland and accelerate the market by five years through four components: (1) CFL subsidies were provided on a

competitive and contractual basis through manufacturers to reduce wholesale prices to dealers and retail prices to consumers (also called "wholesale buy-down"). Manufacturers competed to provide the largest guaranteed sales at the lowest project subsidy cost, and contributed additional price reductions themselves. (2) A pilot peak-load-shaving DSM program in three towns was conducted by municipal governments and local electric utilities. Through a special promotion program, discounted CFLs were sold to residents in specific districts where peak electric capacity was constrained. (3) A wholesale buy-down was also conducted for CFL luminaires. (4) A public education program, with the participation of non-governmental organizations, created a special logo to promote CFLs, conducted television and press advertising campaigns, and conducted an energy/environmental education program in over 250 primary and secondary public schools (Granda 1997 and 1998; Jarosz 1997; NECEL 1997a and 1997b; EEI 1997; Tulej 1997; GEF 1996).

*Jamaica Demand Side Management Demonstration Project (1995-)***.** This project created a DSM program unit within the Jamaica Public Service Co (JPSCo) utility and is demonstrating a broad-based utility DSM program. As part of this program, the utility gave free CFLs to 100 homes (about 300 lamps) to test them and to establish technical criteria regarding equipment performance, customer response, and installation problems. Subsequently, the utility has begun to sell a planned 100,000 CFLs to approximately 30,000 households at discounted prices. The utility sells CFLs to consumers as part of an overall energy savings package along with combinations of other equipment like low-flow showerheads and outdoor lighting controls. Consumers have the option of paying cash or applying for financing with 12 monthly payments through electricity bills. The program also involves a substantial public education and information campaign through utility mailings, offices, and the media (Harris 1997; GEF 1992).

Thailand Promotion of Electricity Efficiency Project (1993-). This project is a comprehensive five-year utility DSM program by the national electric utility responsible for power generation (EGAT). The DSM office is developing and implementing a number of different market intervention strategies for energy efficiency. EGAT was very keen in this project to avoid subsidy programs, and instead has tried to rely on voluntary agreements, market mechanisms, and intensive publicity and public education campaigns. Under a high efficiency fluorescent tube program, EGAT elicited a voluntary agreement with all five Thai manufacturers and the sole importer of T-12 fluorescent tubes to switch from producing and importing T-12 tubes to T-8 tubes. Under a CFL program, EGAT is purchasing in bulk a planned 1.5 million CFLs and selling them through a distribution network of 7-11 convenience stores. EGAT also expects to promote low-loss magnetic ballasts through bulk procurement (Ratanopas 1997; GEF 1993).

These projects highlight nine principal barriers to expansion of CFL markets:

- Lack of information and conviction by consumers about the benefits of CFLs
- High first-cost of CFLs (high consumer discount rates), compared with standard bulbs
- Lack of low-transaction-cost credit mechanisms in markets with low per-capita incomes
- Lack of manufacturer initiative to expand markets due to low consumer demand

- Lack of institutional capacity within electric utilities to carry out DSM programs and to market energy-efficient technologies
- Lack of understanding by government regulatory agencies about the opportunities and benefits of energy efficiency, and thus reluctance to approve energy-efficiency investments and create new regulatory incentives
- Early product failure and poor product quality
- Lack of compatibility with existing luminaries
- Intangible consumer-preference factors, including disappointment with performance (other than lamp life) and aesthetics

In non-OECD countries with immature markets, the first three barriers (information, first-cost, and credit) are especially significant, although all the barriers are important. To overcome these barriers, especially the first three, the main CFL program approaches taken have been a combination of subsidized retail prices, creation of new distribution-system innovations or capacities, new financing mechanisms, and consumer education and information campaigns.

The Thailand project is an example of a program without direct price subsidies. Lamp distribution through the chain of 7-11 convenience stores and price reductions solely through bulk purchases appears to be working well. This approach has made CFLs more accessible to a larger base of consumers, although this approach can also create market distortions at the distribution level by discouraging competition. With bulk purchases but no subsidies, the retail prices of CFLs (estimated at US$9) are about 40% lower than normal retail prices. In 1996-97, the program sold 230,000 CFLs, but recent economic difficulties in Thailand will undoubtedly increase the first-cost barrier among a larger segment of consumers and reduce program delivery.

The Mexico and Jamaica utility DSM programs also lowered retail prices. In Mexico, consumers received a very favourable retail price estimated at about US$5 to US$8 (compared with a market price of up to US$25 or more) due to a utility subsidy (estimated at about US$7 to US$10 per lamp) and economies from bulk purchases by the utility. The Mexican utility sold 1.7 million CFLs with no difficulty. In Jamaica, an estimated subsidy of US$6 per lamp, combined with bulk purchases by the utility led to an estimated retail price of around US$6 per lamp (price data are sketchy).

The Poland subsidy program was unique in the way subsidies were channelled through the private-sector. The intention was to use manufacturers' knowledge of the marketplace to maximize CFL sales per dollar of available subsidy. In this case, a large retail price reduction (about US$6) was possible with a smaller program subsidy (about US$2) because of manufacturer subsidy contributions and the multiplier effects of VAT tax and retail markups. During 1995-1997 in two separate promotions, consumers bought 1.2 million CFLs through the project (half within the first month of each promotion), with over 40 different models represented. This program was easy to manage, was considered cost-efficient, and allowed use of available distribution channels. Five manufacturers participated in the subsidy program, although two manufacturers (General Electric and Philips Lighting) dominated the program. Both were seriously pursuing the Polish market and Phillips was the

most aggressive player in the Polish market before the project began. Further, at every step of the project, an open and competitive process was used and the GEF executing agency (IFC) went to considerable lengths to avoid any conflicts of interest in administering the program.

In Jamaica, a CFL sales program by the utility began slowly with mail solicitation only, but participation greatly accelerated once a direct-contact strategy, in which applicants could interact with a customer service office staff, was tried. Half of the consumers paid for the energy efficiency measures with credit provided by the utility, suggesting the high-first-cost barrier is significant.

Another successful approach was a voluntary agreement by manufacturers to produce more efficient lighting products in the Thailand program. Such an agreement was instrumental in transforming the entire Thai market for T-12 lamps into a market where only the more efficient T-8 lamps are sold. This market is estimated at 45 million lamps per year. Under the voluntary agreement, all manufacturers and importers of T-12 lamps agreed to produce or import T-8 lamps exclusively. In return, the Thai electric utility (EGAT) engaged in an extensive public education and information campaign during 1993-95. EGAT also conducted testing to ensure uniform performance of the new T-8 lamps. By 1995, all lamp manufacturers and importers had complied with the agreement, and almost all T-12 lamps had been eliminated from the market. Success was aided by a zero net cost to manufacturers (reduced T-8 production costs paid for the production conversion), and T-8 retail prices similar to those for the T-12 lamps. Success was also attributed to cultural factors; the utility stated that the public considered such voluntary agreements more desirable and fairer than price incentives like rebates or subsidies.

The educational and marketing effectiveness of these programs is more difficult to assess, and evaluations are generally limited to anecdotes. For example, in Poland survey results indicated that a majority of consumers felt that special labelling for environmentally-friendly products was of “great or decisive importance” in their decision-making (NECEL 1997a). The school education program was commended by the Polish Ministry of National Education, which wrote a letter to the project management in June 1997 saying “it is apparent that as a result of the project large numbers of students and teachers have gained a useful insight into the use of energy and its impact on the environment.” In the view of project management, the public education component was most successful with print media and educational efforts involving NGOs and local governments.

Market Transformation Impacts

The Poland case provides the best data so far on the potential market transformation effects from a CFL program because of extensive pre-project and post-project market research that has been carried out in conjunction with the project. For example, retail prices of CFLs are lower by approximately 30% in real terms after the project. A global manufacturer of CFLs and foreign companies from Germany, China, and Japan have all entered the Polish market. The project led to a large change in consumer awareness about CFLs and the number of households with CFLs increased from 11.5% to 19.6% of all

households. The percentage of retailers stocking CFLs climbed from 70.5% to 74.6% of retail lighting stores. A sustainable market is also aided by word-of-mouth from those with positive experiences; in one survey, 97% of consumers said they were "satisfied" or "very satisfied" with the CFLs, while in another, 43% said CFLs performed better than expected--and only 3% said worse (NECEL 1997a; EEI 1997). One set of obstacles to market transformation in a situation like Poland is that high inflation, electricity tariff increases, and quarterly or semiannual utility billing can obscure the bill savings from CFLs because the amounts of utility bills from one bill to the next keep changing. This will tend to diminish the verification of savings by the public over the longer term.

In the case of a utility-implemented program like Mexico, continued replication of the program depends upon continued utility implementation and financing, although when program participants were asked in a survey if they would buy CFLs in the future at market prices, only 30% answered no. Market transformation effects are difficult to assess in the Mexico case because of the lack of established baselines and surveys of non-participants. The CFLs installed under the program are likely to have a demonstration effect, but this may be insufficient to catalyze a broader market. Although there is no data available on the current private-sector CFL market and distribution networks in Mexico, the utility-distribution mechanism may tend to have a dampening effect on market development at the retail level. It appears that wealthy consumers are leaders in technology adoption, due to ability to pay, knowledge, and/or higher electricity rates. Surveys of program participants have shown that 50% already knew about CFLs before the program, both through seeing them in supermarkets and hearing about them through friends. From 9% to 19% of participants had already purchased CFLs before participating in the program. No surveys data is available of non-participants to see how overall public awareness has changed.

Like Mexico, the Thailand CFL program is being implemented by a utility, but distribution is occurring through a convenience-store distribution network. The Thailand program is thus creating new private-sector distribution networks that presumably can lead to lasting market transformation once the utility program is finished. The Thailand program also differs from Mexico in that subsidies are not provided, so the functions of bulk purchasing and marketing could more readily be taken over by private-sector entities once the utility program is completed.

Besides the indirect market impacts of the programs discussed above, there are also additional follow-on activities initiated by these programs which deserve note. Of course the sustainability of utility rebate programs depends upon continued utility financing, but such financing appears likely in several cases. In Mexico, the utility has gained extensive experience in implementing CFL projects, and has considered the project successful. With the revenue from the sales of CFLs already purchased under the program and with additional contributions, CFE was reportedly planning to purchase an additional 900,000 lamps, which would bring the project total to 2.5 million. It is also planning a nationwide CFL project to sell consumers four million CFLs by 2000 using the Ilumex model. In Poland, there are plans for a new program to push purchases of hard-wired luminaires by housing cooperatives, and a new "Green Lights" program is beginning with demonstration lighting replacements in a few schools.

Cost-Effectiveness of GHG Reductions

Direct cost effectiveness of the CFL programs appears to vary from a low in the US$5 to US$10/ton CO2 range (Poland and Thailand) to a high in the US$25 to US$40/ton CO2 range (Mexico and Jamaica). Aside from the direct cost effectiveness numbers cited above for subsidy approaches, the indirect cost effectiveness of market transformation approaches appears to be below US$5/ton CO2. A prime example is the Thailand T-12 to T-8 replacement program, in which production for the entire country was converted from T-12 to T-8 lamps, saving 10% of electricity consumption from these lamps with an estimated cost-effectiveness of less than US$1/ton CO2. Based upon an indirect program delivery over five years for the Poland program equal to the direct program delivery, an additional 1.6 million lamps would be purchased in the next five years as a result of the project. This would mean the combined (direct plus indirect) program cost-effectiveness would be doubled, to US$3 or US$4/ton CO2.

Annex C: China Energy Efficiency Projects

Four GEF projects are promoting energy-efficiency technology transfer in China through a variety of approaches:

(1) The China Efficient Industrial Boilers project aims to develop affordable, energy-efficient, and cleaner industrial boiler designs, to mass produce and market these high-efficiency boiler designs, and to disseminate more energy-efficient and cleaner boiler technologies throughout China. Proposals from Chinese boiler manufacturers were solicited; nine were selected for participation in the project. The project provides technology transfer and technical assistance to these nine participating boiler manufacturers to develop high-efficiency boiler models. The project provides GEF grants for acquiring advanced equipment from abroad to upgrade production with new boiler models. Technical assistance is provided for developing production, marketing, and financing plans for the new boiler models and for strengthening customer service programs. The project also provides technical assistance and training for industrial enterprises to understand, procure, and operate the higher-efficiency boilers, and for design and research institutes and government agencies to disseminate the technologies to other boiler manufacturers.

(2) The China Energy Conservation project aims to achieve sustainable investments and increases in energy efficiency through the proliferation of energy performance contracting to a variety of companies in China and through improved access to information on successful experiences with energy efficiency. The project supports the establishment and pilot demonstration of the first Energy Management Companies (EMCs--similar in concept to energy-service companies) in China, followed by a program to support proliferation of the EMC concept. These commercial companies will engage in self-sustaining energy-efficiency investments through energy performance contracting. The project also seeks to increase energy efficiency by strengthening China's national efforts to improve access to specific information about successful domestic experiences with energy energy-efficiency measures and projects. This information is directed in particular to financial decision-makers in

enterprises. The project creates an EMC Development Unit (EMCDU) to disseminate information about performance contracting, and an Energy Conservation Information Dissemination Center (ECIDC) to distribute information about experiences with energy efficiency.

(3) The China Efficient Refrigerators Project takes a similar approach to the Efficient Boilers project in addressing both the demand side of the refrigerator market in China and upgrading the technologies used by Chinese refrigerator manufacturers through technology transfer. The project will remove barriers to the widespread commercialization of energy-efficient refrigerators. The project addresses the key market, technological, social, and commercial barriers both to the adoption of high-efficiency refrigerator technology by Chinese manufacturers and to the acceptance of high-efficiency refrigerators by Chinese consumers. Activities include technical assistance and training for compressor and refrigerator manufacturers, incentives for energy efficient product design or modification and conversion of factory production lines, national efficiency standards, a national labelling program, consumer education and outreach, dealer and manufacturer incentive programs, and a consumer buyback/recycling program.

(4) The China Energy Conservation and Pollution Control in Township and Village Enterprises aims to raise the energy efficiency of the rural industrial sector in China by selecting several key Township and Village Enterprises (TVE) to carry out demonstration projects involving improved technologies. Four subsectors are targeted: brick making, coking, metal casting and cement.

Annex D: Investment Funds for Energy Efficiency and Renewable Energy

The GEF has approved a number of investment funds for energy efficiency and renewable energy, including:

Hungary Energy-Efficiency Co-Financing Program. To overcome critical financing barriers to investments in energy efficiency (EE) in Hungary and to promote local EE markets and capacity, the project will create an EE co-financing program to facilitate and leverage private sector capital (including domestic bank capital and credit lines with international financial institutions) for EE investments. In addition to technical assistance, it will provide partial credit guarantees, whereby funds would be reserved to cover the guarantee liability, and medium-to-long term co-financing loans, targeting three subsectors: lighting, district heating and industrial motors and processes. The project will reduce credit risk on EE financing for eligible local financial intermediaries, facilitate longer term financing terms, provide targeted technical assistance, and reduce transaction costs borne by project participants.

Renewable Energy and Energy Efficiency Fund. The project will provide supplemental funding to a $150-210 million Fund being established by International Finance Corporation (IFC) and other investors. The Fund will make debt and equity investments in private sector projects in the renewable energy (RE) and energy efficiency (EE) sectors. The Fund will focus primarily on RE and EE projects or project portfolios in the $5-30 million

range, a range which is often considered too small, too complex or too risky by institutional investors. The GEF funding will be used (1) to help overcome incremental costs and risks in the financing of individual projects through a co-financing facility capable of providing grants, equity, loans and guarantees to project sponsors (up to $24 million); (2) to pay the incremental costs associated with the higher-than-average fund management costs of identifying, analyzing and investing in a portfolio of RE/EE projects ($5-67 million; and (3) to cover IFC's eligible funds for co-administering the GEF support (up to $1 million).

Annex E: India Alternate Energy Project

Summary

A World Bank/GEF project helped catalyze important technology transfers and market changes for wind power and solar photovoltaic systems in India. Tax incentives, capacity building, and new market delivery mechanisms promoted private-sector activity. In just a few years, 968 MW of wind farms were installed and operating in India, almost all commercial and privately operated. The wind industry jumped from three companies to 26, many of them joint ventures. Technology development and exports accelerated and costs declined.

Background

The India Alternate Energy project was started in 1991 by the World Bank and Global Environment Facility (GEF) to promote commercialization of wind power and solar PV technologies in India. The project was designed to support existing government policies to promote wind power through special tax incentives.

Approach

The project was designed to pioneer financing and market delivery mechanisms based on private-sector intermediaries and suitable incentive schemes and policies for small independent power producers. Markets for these technologies were catalyzed through large-scale demonstration, increased consumer confidence, and enhanced willingness to pay. The project strengthened the capabilities of the India Renewable Energy Development Agency (IREDA) to promote and finance private-sector investments, and channelled financing through that agency. One component of the project directly financed wind farm installations by private-sector developers, with a target of 85MW to be financed through the GEF and the International Development Association (IDA), and with co-financing from the Danish government and from other resources mobilized by IREDA. A second component provided a marketing campaign, credit facilities, and subsidies to rural consumers for purchasing solar PV systems. The project targeted 2.5 to 3.0 MWp of solar PV. The project also supported policies that encourage small-scale independent power producers to invest in wind farms and mini-hydro installations.

Impact

By 1998, over 270 MW of wind power had been financed by IREDA and commissioned, including 41 MW commissioned with GEF and IDA financing and 10 MW commissioned with Danish funds. Only 0.3 MWp of PV had been commissioned, but an additional 1.0 MWp was in the active pipeline. In parallel with these direct project impacts, a total of 968 MW of wind farms were installed and operating, of which 917 MW were commercial and privately operated. Highly favorable investment tax policies strongly influenced these commercial installations. New suppliers entered the wind power and solar PV markets. Before the project there were three major companies involved in the wind industry, but by 1998 as many as 26 companies were engaged in the wind turbine manufacturing industry, many with foreign partners. High-technology wind turbine designs up to 600-kW with variable speed operation were produced by 14 companies. Domestic production of blades began and exports of blades and synchronous generators to Europe was underway. Wind turbine exports to other countries also began. The installed costs of wind turbines in India declined. Domestic production capacity for solar modules went from 3 MWp in 1991 to 8 MWp by 1996 and the number of companies involved in the PV industry went from 16 in 1991 to more than 70 1998.

The World Bank/GEF project indirectly helped catalyze these market changes and technology transfers: the project helped to raise awareness among investors and banking institutions on the viability of wind power technology and helped to lobby for lower import tariffs for both wind and solar PV systems. Many more financial institutions decided to offer financing for wind farms, and a wind-power loan portfolio among commercial banking institutions emerged (this was a key project goal). The number of Indian consultants capable of developing wind power investment projects increased dramatically, in part because of GEF-supported training and networking activities for consultants, technicians and private firms (a roster of consultants was available from IREDA for reference by investors). Promotional efforts and numerous business meetings organized by IREDA increased awareness of various PV applications among potential users.

Lessons Learned

Investment tax credits appear to be a powerful stimulus to technology transfer and market development, and have had a huge impact in a very short time. However, the sustainability and viability of the markets and joint ventures created if the credits are removed is uncertain.

There have been problems in extending credit to potential rural PV consumers. Evidence suggests that financial institutions perceive rural consumers as unwilling to repay loans and therefore have not extended credit. Also, the lack of infrastructure for after-sales support and service has emerged as an additional difficulty in rural markets.

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