

The Technology Cooperation Agreement Pilot Project



A Collaborative
Model for
Clean Energy
Technology
Transfer

October 1999



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Executive Summary

The Technology Cooperation Agreement Pilot Project (TCAPP) is helping developing countries design and implement actions to attract investment in clean energy technologies that will meet their economic development goals, while mitigating greenhouse gas emissions. TCAPP is currently facilitating voluntary partnerships between the governments of Brazil, China, Egypt, Kazakhstan, Korea, Mexico, and the Philippines, the private sector, and the donor community on a common set of actions that will advance implementation of clean energy technologies. TCAPP is also assisting 14 countries in the Southern African Development Community with a regional technology cooperation needs assessment that was recently initiated by the Climate Technology Initiative (CTI).

TCAPP was launched by three U.S. government agencies—the U.S. Agency for International Development (USAID), the U.S. Environmental Protection Agency (USEPA), and the U.S. Department of Energy (USDOE)—in late 1997. TCAPP provides a model for implementing technology transfer as described in Article 4.5 (see inset below) of the United Nations Framework Convention on Climate Change (FCCC).

The project employs a strategic and collaborative approach to facilitate large-scale international investment in clean energy technologies consistent with sustainable development needs of developing countries. The countries participating in TCAPP have made significant progress in developing strategies for building sustainable technology markets and have begun to implement actions aimed at mobilizing private investment and donor support to address country-specific technology cooperation needs.

“The developed country partners ... shall 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, particularly developing country Parties, to enable them to implement the provisions of the Convention.”

—Article 4.5 of the United Nations Framework Convention on Climate Change

TCAPP Goals

TCAPP is designed to achieve the following major goals:

- Foster private investment in clean energy technologies that meet development needs and reduce greenhouse gas (GHG) emissions
- Engage host country and international donor support for actions to build sustainable markets for clean energy technologies
- Establish a model for international technology transfer under the FCCC.

Principles of Technology Cooperation

The TCAPP approach reflects three key principles of climate change technology cooperation:

1. *Technology cooperation must be host-country driven.*
Climate change technology cooperation priorities

should be selected based on the potential benefits to the country as well as the potential GHG emission reductions. Countries should also build on existing programs and institutional roles, as well as previous climate change studies, national communications, or action plans.

2. *Large-scale technology transfer can best be achieved through a sustained, coordinated, and strategic set of actions to harness private sector action in sustainable markets for clean energy technology.* The most important role for government is to enable private sector activity, since commercial markets are the primary vehicle for technology transfer.
3. *Successful technology cooperation requires collaboration at many different levels.* This includes host country government agencies, businesses, nongovernmental organizations (NGOs), and technical experts working together to select priorities and design and implement actions.

TCAPP: A Collaborative Model for Clean Energy Technology Transfer

Country teams need to collaborate with developed country technical experts, international businesses and investors, and international donors to secure the international investment and technical support necessary for effective implementation of technology cooperation actions.

TCAPP Program Elements

As shown in Figure 1, TCAPP includes four major program elements:

- 1) A country-driven process for selecting priorities
- 2) International coordination and technical support
- 3) Business participation
- 4) Donor participation.

Country Driven Process—Perhaps the single most important feature of TCAPP is that it is host-country directed. Countries structure their approach, select technology cooperation priorities, develop strategies to promote long-term sustainable markets for these technologies, and define and implement actions to best meet national development priorities. The work of the country teams follows three basic phases of activities (see Figure 2).

Business Participation—TCAPP’s market orientation could not be achieved without the involvement of host country and international companies. These companies provide input on the priorities, market barriers, overall strategies, and design of investment actions. They also participate in implementation of the activities. The Business Council for Sustainable Energy (BCSE), a nonprofit association of clean-energy technology companies, facilitates the participation of more than 300 companies in the TCAPP business network.

Donor Involvement—Bilateral and multilateral donor agencies engage in the TCAPP process by helping to refine technology strategies, identify country actions that they can support, and integrate the country TCAPP activities with other donor programs. International donor agencies have also provided input on the design of TCAPP through various forums, including the special TCAPP meeting for international donors in October 1998. At this meeting more than 30 representatives of donor agencies discussed priorities with senior officials from each of the five countries participating in TCAPP at that time. TCAPP is also collaborating with international donor agencies through CTI, a developed-country-supported partnership. CTI recently initiated the Climate Technology Implementation Program (CTIP), which follows a similar approach to TCAPP.

International Coordination and Technical Support—TCAPP is a proactive intervention into the marketplace by a coordinated group of public and private organizations in the host country and from the international community. The USDOE’s National Renewable Energy Laboratory (NREL) leads and coordinates the work of the country teams, businesses, investors, international donors, and technical experts.

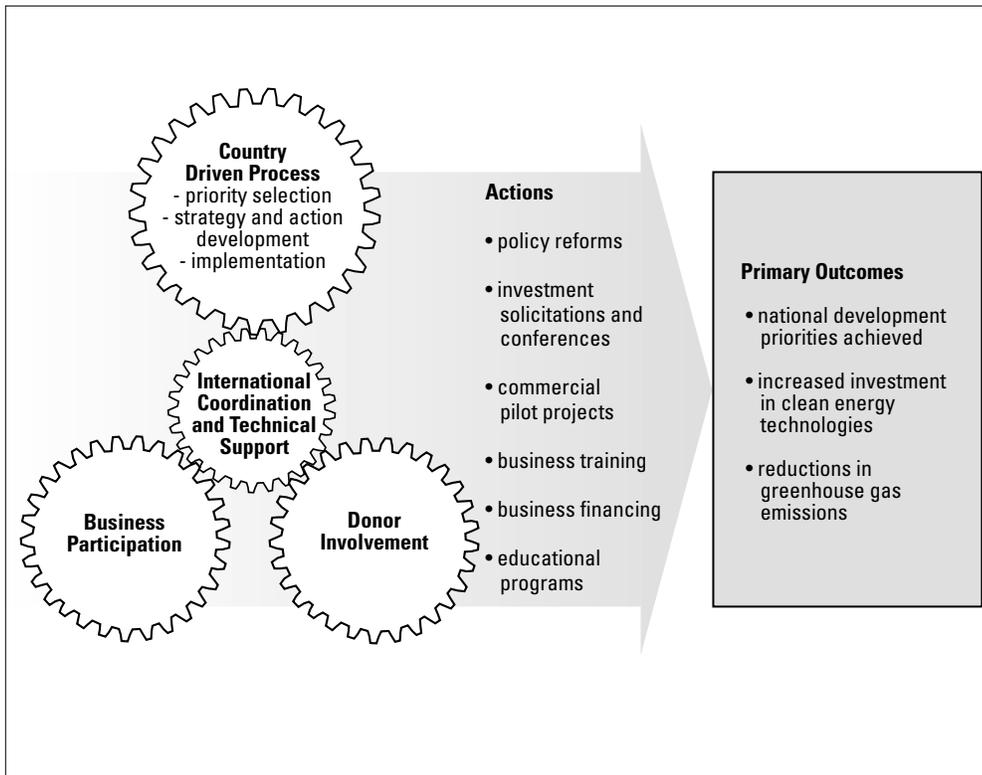
Actions and Outcomes—TCAPP programs are intended to further national development priorities while increasing investment in clean energy technologies and reducing greenhouse gas emissions. A variety of actions may be taken to help achieve these outcomes:

- Implementing policy reforms to remove legal or institutional barriers to clean energy development

Figure 2. The TCAPP Country Driven Process



Figure 1. Major Program Elements



- Implementing educational programs to encourage host country businesses to increase their investments in clean energy technologies.

TCAPP Country Progress

The countries participating in TCAPP have made excellent progress in defining priority areas and developing and implementing technology cooperation actions. Highlights for each country are summarized below and presented in Table 1 at the end of this section.

Brazil

The Ministry of Mines and Energy leads a very active and effective TCAPP

- Issuing investment solicitations to recruit company participation and convening investment conferences to help companies find partners and financing
- Running pilot or demonstration projects and programs
- Training to build local business capacity
- Assisting clean energy businesses in securing financing for business growth and technology implementation

program that is coordinated by a Brazilian TCAPP interagency committee. The Brazilian team has established five technology cooperation priorities: energy efficiency in truck and bus transportation, direct use (including cogeneration) of natural gas, industrial energy efficiency, rural renewable energy, and fuel cells. The organizations that participate in TCAPP have programs and projects in these priority areas. TCAPP collaborates with these national

Figure 2. The TCAPP Country Driven Process



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programs to design and implement specific investment actions. In this way, the TCAPP effort adds to the effort of these organizations to reach their shared objectives. The Brazilian team has made significant progress with the design and implementation of investment actions for these priorities. Among other activities, the team is finalizing an investment solicitation to attract companies into renewable energy market development, is organizing a transportation efficiency investment conference to attract new companies and technologies to Brazil, and is developing a cogeneration investment strategy together with the international private sector and technical experts.

China

The TCAPP effort in China is unique due to the high-level agreement that the minister of the State Development and Planning Commission recently signed with the administrator of the U.S. Environmental Protection Agency to formalize this climate change technology cooperation work. Results of this work will be provided as a contribution to the implementation of technology transfer under the FCCC. Under this agreement the Chinese TCAPP team will focus on the following technology priorities: high efficiency electric motors, grid-connected wind electric power, efficiency improvements in coal-fired industrial boilers, cleaner coal technologies for power generation, and two additional priorities to be selected this year. The Canadian government is also interested in the China TCAPP work and has participated in technology expert meetings held earlier this year.

China has just begun Phase II of its TCAPP work and over the next twelve months will complete in-depth market and technology analysis for wind and motors and propose technology cooperation actions; hold an interagency meeting to select at least six actions for implementation; prepare detailed action proposals; and initiate implementation of the six actions. Lead points of contact for boiler and coal technologies will also be established in both the United States and China.

Egypt

The Government of Egypt has identified technology transfer as one of its highest priorities under the FCCC. The Egypt TCAPP activity, which has just begun, is attracting the participation of all key agencies in the Egyptian government with the Egyptian Environmental Affairs Agency in the lead role. At meetings in Cairo in September 1999, agency representatives selected an initial set of

priority technology areas: industrial energy efficiency and enhanced natural gas use, lighting efficiency and renewable-powered lighting, renewable energy applications in rural areas, and small-scale cogeneration applications. Subject to revision by the National Climate Change Committee, these preliminary priorities will be presented for finalization at a meeting of the Egyptian Ministerial Committee on Climate Change in November.

Kazakhstan

Kazakhstan was one of the first countries to join TCAPP and has been a leader in developing this process. The Kazakhstan TCAPP team identified four technology priorities: power plant carbon efficiency program (fuel-switching, combined-cycle gas, and improved heat rate); energy-saving and district-heating improvements; wind power; and small hydro. Work was delayed due to changes in the government and on their team, but Kazakhstan has now formed a new TCAPP team, led by the Ministry of Energy, Industry and Trade, and its affiliate KEGOC, with broad-based participation from other key agencies. KEGOC is a joint stock company set up to develop improved electric utility systems. A new working group has selected promising investment projects from the following sectors: small hydropower, combined heat and power, and gas utilization from oil refineries. During the next year, the group will be working under TCAPP to move projects toward implementation while exploring other investment and policy actions that will help facilitate large-scale investment and remove market barriers.

Mexico

The TCAPP Mexico team is led by the National Commission for Energy Conservation (CONAE), the leading energy-efficiency implementing agency under the Secretary of Energy. CONAE led the prioritization process which resulted in the selection of three technology priority areas that build on current CONAE programs: efficient lighting in public buildings, solar water heating for residential and commercial uses, and improved steam generation and distribution systems. CONAE, in collaboration with other agencies in Mexico, is now designing investment actions for these three areas. These investment actions include: planning an energy service company (ESCO) workshop for the efficient lighting program, expanding the solar water heating pilot program, and assisting with the planning of Solar 2000, an initiative of the Secretary of Energy that is sponsored by the International Solar Energy Society.

The Philippines

The Philippines TCAPP effort has included a very strong consultative process with high-level support from the Philippines government. The Philippines Department of Energy (P-DOE) leads the TCAPP work in the country in close consultation with a broad group of other agencies and NGOs. The Philippines team selected priorities in mid-1998 including energy efficiency, renewable energy, and cross cutting initiatives. The office of newly-elected President Estrada became engaged in the TCAPP effort and, together with the P-DOE, determined that future TCAPP work should focus on increased use of renewable energy in rural areas to address their primary goal of poverty alleviation. Based on feedback from businesses in the Philippines and other key stakeholders, it was clear that policy reforms were needed to get the market moving. Therefore, the Philippines team developed a series of "fast track" policy recommendations (such as, increasing tax incentives, revising policy guidance, and providing other types of government support for use of renewable energy technologies). The Philippines Secretary of Energy has agreed to implement the fast track recommendations. In addition to assisting P-DOE implement the reforms, the TCAPP team is also identifying additional investment actions to facilitate private investment.

Republic of Korea

The Republic of Korea joined TCAPP in January 1999. The Ministry of Commerce, Industry and Energy (MOCIE) of the Republic of Korea chairs a TCAPP steering committee and has designated the Korea Energy Management Corporation (KEMCO) to lead the implementation of technical TCAPP activities for Korea. A scoping meeting in March 1999 resulted in the selection of three priority technologies: energy management, methane recovery from organic waste, and waste energy recovery using heat pumps. The Korean TCAPP team is currently developing specific actions to increase private investment in these technologies.

Southern African Development Community

The 14 countries in the Southern African Development Community (SADC) are initiating a regional program to identify the clean energy technologies that have the greatest potential across the SADC region for meeting sustainable development needs

while reducing GHG emissions through accelerated private investment. The SADC Environment and Land Management Sector (SADC ELMS), is managing the project's approval process within the SADC system. SADC ELMS directs this project in collaboration with teams of government officials, energy business representatives, and experts from each of the 14 countries. This initiative is in response to requests for a regional needs assessment by ministers and other senior SADC officials attending the CTI/Industry Joint Seminar on Technology Diffusion on March 17-18, 1999, at Victoria Falls, Zimbabwe. This project applies the TCAPP approach at a regional level in collaboration with CTI. A detailed project work plan is being finalized in consultation with SADC ELMS and was presented to a wider spectrum of SADC stakeholders on September 13-17, 1999, during a SADC climate change workshop in Gaborone, Botswana.

Future Directions

During the next year, the TCAPP effort will focus on four primary activities. The nature of the activities will be determined by host country teams:

- *Successful implementation of technology cooperation actions in each country/region.* TCAPP needs to continue to demonstrate to developing countries how climate change technology cooperation will accelerate investment in their technology priorities and meet their development needs.
- *Increased private sector participation.* While more than 300 international energy companies are participating in TCAPP through the BCSE's network, the level and depth of the participation of international and host country businesses and investors needs to be increased.
- *Enhanced participation of bilateral and multilateral donor organizations.* NREL will work toward expanding the participation of donor organizations to help countries secure donor support for key actions and will continue to encourage donor organizations to consider applying the TCAPP approach to other developing countries, as is occurring through the Climate Technology Initiative.
- *Evaluating TCAPP as a model for technology transfer under the FCCC.* The TCAPP developing country, business, and donor partners, together with NREL and other technical experts, will evaluate the effectiveness of the TCAPP approach as a potential model for implementing technology transfer under the FCCC.

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Table 1. Summary of Country TCAPP Activities

	Lead Agency	Technology Priorities	Selected Actions under Development/ Implementation
Brazil	Ministry of Mines and Energy (MME)	<ul style="list-style-type: none"> • Energy efficiency in diesel truck cargo transportation • Direct use of natural gas • Electrical energy efficiency • Fuel cells • Renewable energy in rural electrification 	<ul style="list-style-type: none"> • Efficient truck and bus transportation conference and trade show • Solicitation for Expanded Renewable Energy Field Test Program • Identification of engineers and energy auditors for industrial plants • Development of a cooperative R&D strategy for ethanol based fuel-cells • Cogeneration investment strategy workshop
China	State Development Planning Commission (SDPC)	<ul style="list-style-type: none"> • Higher efficiency power generation technology, specifically circulating fluidized bed combustion • High efficiency electric motors • Advanced industrial boilers • Wind power generation 	<p>China has just begun Phase II of its TCAPP work. During the next twelve months China will, in collaboration with the United States:</p> <ul style="list-style-type: none"> • Complete in-depth market and technology analysis for wind and motors and propose technology cooperation strategies and actions • Hold interagency meeting to select at least six actions for implementation in 2000 • Prepare detailed action proposals for the selected actions • Initiate implementation of the six actions by March 2000 • Lead points of contact for boilers and coal technologies will also be established in both the U.S. and China
Egypt	Egyptian Environmental Affairs Agency (EEAA)	<ul style="list-style-type: none"> • Industrial energy efficiency, natural gas use* • Lighting efficiency and renewable lighting* • Renewable energy in rural areas* • Small scale cogeneration applications* 	* Priorities are preliminary and subject to revision by the National Climate Change Committee
Kazakhstan	Ministry of Energy, Industry and Trade and the Kazakh Electricity Grid Operating Company (KEGOC)	<ul style="list-style-type: none"> • Power Plant Carbon Efficiency Program (fuel switching, combined-cycle gas, and improved heat rate) • Energy-saving and district-heating improvements • Wind power • Small hydro 	<p>Investment projects in the following sectors have been proposed by the TCAPP working group and are under development</p> <ul style="list-style-type: none"> • Small hydropower • Small combined heat and power systems • Utilization of gas from oil refineries
Mexico	National Commission for Energy Conservation (CONAE)	<ul style="list-style-type: none"> • Nationwide expansion of efficient lighting in public buildings • Solar water heating pilot program • Nationwide expansion of steam generation and distribution systems 	<ul style="list-style-type: none"> • Develop potential energy efficiency lighting projects • ESCO workshop • Expand Solar Water Heating Program • Support "Solar Millennium 2000" event
Philippines	Department of Energy (P-DOE)	<ul style="list-style-type: none"> • Renewable energy for rural development (photovoltaics, wind energy) • Energy efficiency and demand-side management (energy-efficient boilers, appliances, and equipment) • Cross-cutting technology support (renewable energy and energy efficiency technology center/policy development) 	<p>Implementing "fast track" policy reforms</p> <ul style="list-style-type: none"> • Revise new and renewable energy (NRE) project accreditation requirements • Exercise full P-DOE powers under the mini-hydro law • Use the host community fund for NRE development • Revise Executive Order 462 • Issue new policy statement on NRE <p>Developing additional investment actions</p> <p>Technology cooperation actions under development</p>
Republic of Korea	Korea Energy Management Corporation (KEMCO)	<ul style="list-style-type: none"> • Energy management • Methane recovery from organic waste • Waste energy recovery using heat pumps 	
Southern African Development Community	SADC Environment and Land Management Sector (SADC ELMS)	Technology cooperation priorities currently being established	

Introduction

Through the Technology Cooperation Agreement Pilot Project (TCAPP), developing countries are designing and implementing actions to attract investment in clean energy technologies that will meet their economic development goals, while mitigating greenhouse gas (GHG) emissions.

TCAPP was launched by three U.S. government agencies—the U.S. Agency for International Development (USAID), the U.S. Environmental Protection Agency (USEPA), and the U.S. Department of Energy (USDOE)—in August 1997 to establish a model for climate change technology cooperation with developing and transition countries. The governments of Brazil, China, Kazakhstan, Mexico, and the Philippines have participated in TCAPP over the past two years, with Korea joining the program in early 1999 and Egypt later in the year. TCAPP is also assisting 14 countries in the Southern African Development Community with a regional technology cooperation needs assessment that was initiated by the Climate Technology Initiative (CTI) with support from USAID and USDOE in late 1999.

TCAPP facilitates voluntary partnerships between the participating countries, the private sector, and the donor community on a common set of actions that will advance implementation of clean energy technologies. The participating countries have been actively engaged in shaping this initiative along with international donors and the private sector. TCAPP employs a strategic and collaborative approach to facilitate large-scale international investment in clean energy technologies consistent with sustainable development needs of developing countries. This program provides a model for fulfilling the obligation of the United States and other developed countries to support technology transfer to developing countries under Article 4.5 (see inset below) of the United Nations Framework Convention on Climate Change (FCCC). TCAPP also provides a mechanism to focus resources of the various international donor programs on the technology cooperation needs of developing and transition countries. A more detailed description of the TCAPP approach is provided in the following chapter.

“The developed country partners ... shall 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, particularly developing country Parties, to enable them to implement the provisions of the Convention.”

—Article 4.5 of the United Nations Framework Convention on Climate Change

This report describes the TCAPP approach and the significant progress made by the participating countries. It contains the following major sections.

- “The TCAPP Approach” provides a detailed description of the TCAPP methodology
- Sections on Brazil, China, Egypt, Kazakhstan, Mexico, the Philippines, the Republic of Korea, and the Southern African Development Community contain reports prepared by each of the participating countries plus a summary

of the regional work in southern Africa. These country reports describe the approach of each country team, significant accomplishments, and conclusions from their work to date.

- “Future Directions” contains a short summary of planned next steps for the TCAPP program.

The appendix to this report provides contact information for the TCAPP country teams, the National Renewable Energy Laboratory (NREL), and other international collaborators.

The TCAPP Approach

This chapter provides an overview of the primary program elements and a general description of the methods countries are using to implement TCAPP. Countries that participate in TCAPP tailor their approach to fit their situation and, as a result, follow different paths and demonstrate different approaches to climate change technology cooperation. This chapter will mention some of these differences in approach. The country reports presented later in this report provide more detail on each country's methods.

TCAPP Goals

TCAPP is designed to achieve the following major goals:

- Foster private investment in clean energy technologies that meet development needs and reduce GHG emissions
- Engage host country and international donor support for actions to build sustainable markets for clean energy technologies
- Establish a model for international technology transfer under the FCCC.

Key Principles

The TCAPP approach reflects three key principles of climate change technology cooperation:

1. *Technology cooperation must be host-country driven.* Climate change technology cooperation priorities should be selected based on the potential benefits to the country as well as the potential GHG-emission reductions. Efforts to foster technology cooperation should also build on the country's existing priorities and institutional roles and previous relevant initiatives. Such a country-driven effort is most likely to produce the greatest local benefits, to attract necessary domestic resources, and to integrate these actions with current national programs to ensure effective and sustained implementation.
2. *Large-scale technology transfer can best be achieved through a sustained, coordinated, and strategic set of actions to harness private sector action in sustainable markets for clean energy technology.* Because commercial markets are the primary vehicle for technology transfer, the most important role for government is to enable private-sector activity. The resources of government are insufficient to support the scale of technology transfer that is needed to achieve development goals or to benefit the climate. In

this regard, governments can play a critical role by removing legal and institutional barriers to market development and in addressing other impediments to technology deployment (such as lack of information, limited host country capacity and need for market aggregation).

3. *Successful technology cooperation requires collaboration at many different levels:*
 - Among host country government agencies, businesses, nongovernmental organizations (NGOs), and technical experts to define and implement technology cooperation strategies and actions (in-country teams led by senior government officials can lead this collaboration)
 - Between developing country and industrialized country technical experts to exchange technology information and experiences and to design technology cooperation actions
 - Between developing countries and international businesses and investors to attract private sector investment
 - Between developing countries and international donors to secure necessary financial and technical assistance.

Program Development

TCAPP has been designed in collaboration with the participating countries, international businesses and donors, and technical experts. Key steps in the design of the program include:

- A November 1997 workshop in which a group of more than 40 officials and experts from developing countries, international donors, private sector organizations, and technical institutions helped refine the TCAPP concept and approach.
- A meeting in 1998 with representatives of more than 20 international companies to design the program's activities for engaging international businesses and investors.

- The preparation and presentation of draft technology cooperation frameworks by the participating countries to over 30 donor organization representatives at the International Donor Workshop, which TCAPP hosted in October 1998.

- Following the donor workshop, countries have continued to shape TCAPP by working through a collaborative process of establishing their priorities and developing and implementing technology cooperation actions with the business and donor communities.

Major Program Elements

TCAPP includes four major program elements:

1. A country-driven process for selecting priorities
2. International coordination and technical support
3. Business participation
4. Donor participation.

Figure 3 illustrates how all four of the program elements work together to achieve an ambitious set of outcomes. The TCAPP goal of fostering investment in clean energy technologies that will meet development needs is best achieved through nationally significant programs and policies rather than implementation of a few isolated projects. The rest of this chapter provides more detailed information on each of these program elements.

Country Driven Process

Perhaps the single most important feature of TCAPP is that it is host-country directed. Countries structure their approach, select technology cooperation priorities, develop strategies to promote long-term sustainable markets for these technologies, and define and manage implementation of actions to best meet national development priorities. NREL staff and other technical experts assist countries with the design and implementation of their TCAPP programs and facilitate sharing of methods and experiences between countries.

The work of the country teams follows three basic phases of activities (see Figure 4). In the first phase, country teams are formed, and technology cooperation priorities established. In the second phase, the teams design specific actions to overcome market barriers and attract investment in these priority areas. At this stage, NREL and other international technical experts assist the country teams in attracting in-country and donor support for these actions. In the third phase, the country TCAPP teams implement the actions.

Phase 1—Priority Selection

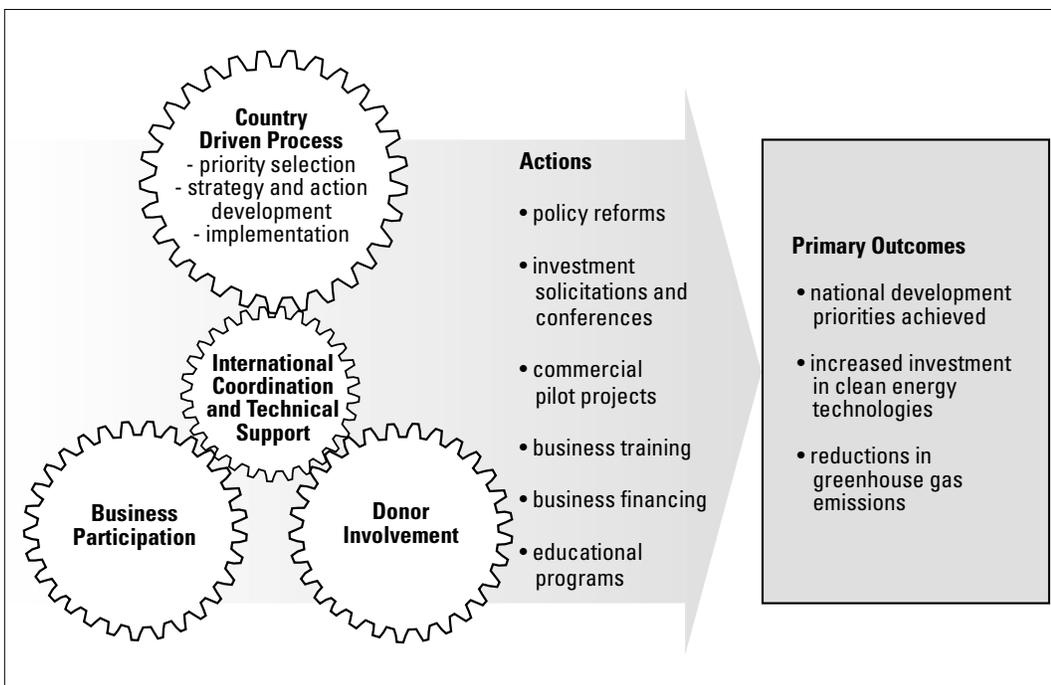
Priority setting is enormously important for an effective technology cooperation program. Well-selected priorities will have good prospects for

leading to economically and environmentally beneficial technology deployment. Perhaps just as important, the process of defining priorities will help build support for implementation among key agencies and stakeholders.

Key Steps

1. *Form a team to direct the TCAPP work.* The TCAPP country team should represent a broad range of interests, including: sectorial implementing ministries such as

Figure 3. Major Program Elements



TCAPP: A Collaborative Model for Clean Energy Technology Transfer

energy and transportation, environmental agencies, climate change officials, private companies and trade associations, technical experts and NGOs. The ministries that implement energy related programs and policies are particularly important, because TCAPP is an implementation-oriented program. Climate officials should be involved as well, even if they do not have implementation responsibilities, so that they can integrate this work with key climate change issues and identify opportunities to build on previous climate change studies and activities. In all cases, TCAPP country teams are led by federal government agencies.

Some TCAPP countries have formed more than one team. Additional teams enable specialization of expertise or interests, and can be formed at any point in the process. Examples of host country teams that have been formed in TCAPP include:

- Interagency teams to guide the TCAPP work and review and approve technology priorities and technology cooperation actions
- Priority area or technology teams made up of organizations with expertise or interests in a particular technology priority area who are responsible for design and implementation of actions for that area
- Teams of stakeholders such as domestic businesses, investment organizations, and nongovernmental organizations to provide input to the lead technical institution and the interagency team.

To support the lead agency and the country teams, a lead technical and coordinating institution may be established in each country. The country team, in consultation with NREL, selects this lead

technical and coordinating institution and NREL can sometimes provide funding to support the work of this institution. These coordinating institutions perform a wide variety of duties, depending on the needs of the team. The primary function, however, is to coordinate the involvement of all of the host country participants. They may also compile information on technologies, conduct market research, or design technology actions. Support organizations chosen so far have included technical institutions, private firms, and government agencies.

Lead Agencies for TCAPP Country Teams

Brazil	Ministry of Mines and Energy
China	State Development Planning Commission
Egypt	Egyptian Environmental Affairs Agency
Kazakhstan	Ministry of Energy, Industry and Trade
Mexico	National Commission for Energy Conservation
Philippines	Department of Energy
Republic of Korea	Ministry of Commerce, Industry and Energy
Southern African Development Community	Southern African Development Community Environment and Land Management Sector

Figure 4. The TCAPP Country Driven Process

1 Country Teams Formed



2 Establish Prioritization Process

3 Compile Information on Technologies and Barriers



4 Select Technology Cooperation Priority Areas

5 Prepare Technology Cooperation Framework

6 Prepare Strategy and Select Actions



Priority Selection

Strategy and

2. *Establish a process for selecting technology cooperation priorities.* An important component of this process is the definition of selection criteria. Most countries have included the following three criteria:

- *Development benefits*—How much will deployment of the technologies help the country meet economic, social, or environmental goals?
- *Market potential*—What is the scale of investment and market growth that can be achieved if market barriers are addressed?
- *GHG mitigation*—How significant are the carbon emissions that can be avoided?

The process should also define the information that will be considered and a consultative approach for reaching a decision on priorities.

3. *Compile information on technologies, priorities, and barriers.* Depending on the process, there are at least three types of information that could be gathered:

- *Information on the technology performance, costs, and benefits.* This information should include economic development, social and environmental benefits, market potential, and climate change mitigation benefits of various technologies. This approach may reveal gaps in the information that will require additional data collection and analysis. The country team must consider the time and resources it has at hand before it can commit to any significant data collection or analysis effort. NREL and other technical experts may assist the country in gathering this information.
- *Information on existing priorities and existing or planned national programs.* This information

includes plans and programs focused on energy, economic development, environment, and climate change issues, and will help the team determine how international technology cooperation can support existing priorities and programs. By defining actions that complement existing priorities, country teams have been able to engender broad support for their TCAPP work and integrate this work with current programs.

- *Information about market barriers.* A more extensive analysis of market barriers is recommended later in the TCAPP process, but a preliminary exploration is useful at this point, because it can help inform the selection of priorities. The identification of barriers can help the country team determine the breadth of the priority, or the appropriateness of technology cooperation approaches for addressing the barrier.

4. *Select three to six technology cooperation priorities.* Each country team uses the information on potential technology cooperation priority areas to select three to six specific priority technologies (e.g., energy efficient motors) or market areas (e.g., use of renewable energy for rural electrification). The selection usually begins by identifying all of the possible priority areas. Experience indicates that it is not practical to act on more than three to six priorities, but it is useful to consider a much longer list, perhaps as many as 15 or 20, as the prioritization decisions are made. Countries have taken very different approaches to applying the criteria and technology information. Some countries have held broad-based meetings

Figure 4. The TCAPP Country Driven Process



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where government and nongovernment stakeholders review the available information and select priorities through group consensus, or by using a ranking or sorting methodology. In other countries, priority sectors such as transportation, rural electrification, or industrial energy use were defined first and then separate sector meetings were held to define the specific priority technologies for that sector.

5. *Prepare a technology cooperation framework.* This is a document that communicates the priorities and the prioritization process to those outside the country team. It is an essential document for building support and for refining the priorities. It is used for host country audiences as well as for international business and donors.

The framework document begins by explaining the potential benefits of technology cooperation and the process and rationale that the country team used to select priorities. It also summarizes information on the development benefits, market potential, and GHG-mitigation potential of the priority areas and on market barriers and potential domestic and international donor actions, for each potential priority area. A central element of the frameworks are matrices that highlight the barriers, domestic and international actions and next steps for each priority area (see Table 2 for an example of such a matrix).

The matrix of barriers and of potential domestic and international donor actions has proven to be a useful structure for refining country priorities. Identifying the barriers and possible international actions helps clarify whether increased technology cooperation is likely to increase market activity. Technology cooperation is not meant for areas where commercial markets are thriving and where complete knowledge and access to the best clean energy technologies is widespread. Technology cooperation can help best in those areas where markets are not yet developed. It is in these areas that the TCAPP partners have a chance to intervene to help to develop the market.

Preparing and disseminating the framework documents not only helps focus the work of the country teams, but also helps capture the attention of the stakeholders that will have an interest in implementation as well as the international companies and donors whose support is needed. Brazil, China, Kazakhstan, Mexico, and the Philippines developed technology cooperation



Each participating TCAPP country presented its technology cooperation framework at a TCAPP donor meeting in October, 1999. Here Dr. Wei Zhihong presents China's priorities.

frameworks that ranged from 15 to 30 pages long, which they presented at the International Donor Workshop in October 1998.

Phase 2—Strategy and Action Development

The technology cooperation priorities establish the country's direction for TCAPP. In the second phase, countries develop a strategy and design actions for implementation. It is important for key stakeholders to participate in this phase and become supportive of implementation. Some countries have found it helpful to create specialized teams for each priority technology or subsector to provide the more detailed expertise that is needed to develop strategies or actions specific to a technology cooperation priority.

Key Steps

6. *Prepare a market development strategy for each priority area including actions to overcome key barriers.* TCAPP has found that host country government and private sector stakeholders are more interested and motivated to participate in technology cooperation efforts that aim at near term results. Market development is a challenging, long term process, however, requiring a strategic approach. If the strategy is to be effective and to meet the needs of the stakeholders, it must be action oriented, with both near term and longer term actions identified. Preparing the strategy need not be a painful and drawn out effort if it is developed incrementally, beginning with an assessment of the critical barriers to investment and technology transfer for each priority area. Preparing a market development strategy requires the involvement of specialists, familiar

Table 2. Technology Cooperation Matrix Example—Wind Power Generation in China (from China TCAPP Technology Cooperation Framework)

Development Barrier	Foreign Action	Domestic Action	Future Work Needed
Lack of resource data	Funding and technical assistance for data collection and assessment	Assess wind resource and create data center	Define geographic scope
Inadequate local capacity to manufacture, install, and operate turbines	Identify international investors and provide training and financing for new wind turbine companies and joint ventures	Identify local investors and expedite approval of new businesses and joint ventures	Characterize market potential for wind power
Lack of financing to purchase turbines	Provide assistance and facilitate funding for revolving loan funds	Establish project companies to manage loans and provide matching seed funding	Design loan and fund mechanisms
Lengthy approval process for wind power projects	Technical assistance to identify approaches to expedite approval of wind farm projects	Implement actions to streamline wind farm projects approval	Identify opportunities to streamline approvals
Lack of awareness of environmental benefits of wind power for local air pollution control	Provide data and tools for estimating air pollution benefits of wind power over conventional energy technologies	Disseminate tools to local environmental protection authorities and promote consideration of wind power as an alternative to conventional energy sources	Identify local users who would most benefit from these tools

with the priority area market and the information that exists on the market area, including feasibility studies and market assessments. Domestic and international businesses should be asked to provide input. The most critical market barriers may be legal or institutional, or they may be information or capacity barriers.

7. *Design actions to address legal and institutional barriers.* TCAPP’s experience in the Philippines, where “fast track” policy reforms are being enacted (see the example described later in this section, with additional detail in the Philippines chapter) and in other countries shows that there are a series of steps which can be taken to remove legal or institutional barriers:

- Acquire high-level support for barrier removal. If senior ministerial management or parliamentary support is not obtained up-front, the chances of success are minimal.
- Carefully investigate and document the legal source that identifies the barrier. The source could be a law, a ministerial policy, or a directive.
- Consult with local experts and stakeholders as recommendations are drafted. The divisions

and agencies that have authority over the legal and institutional barriers must also be involved.

- Present the findings to the agencies that have the legal authority to act and enlist their commitment to undertake the necessary administrative or legal procedures.
- Monitor progress. Keep stakeholders apprised and maintain an expectation that the authorities will follow through on the recommendations.

8. *Design direct investment facilitation actions.* In addition to removing legal or institutional barriers, TCAPP is playing a critical role in directly facilitating private investment in clean energy technologies. Host country governments working with international technical experts, businesses, and donors can implement a broad array of actions to foster sustained investment. These actions include:

- Investment solicitations and recruitment of company participation in responding to new investment opportunities
- Training to build local business capacity
- Investment workshops and other forms of

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matchmaking to help companies find partners and financing

- Assistance in accessing financing
- Educational and promotional programs to encourage host country businesses to invest in new technologies
- Pilot or demonstration projects and programs.

In designing these investment actions, the country teams first narrowed the definition of the opportunity area to focus on the most immediate and promising investment opportunities. Country teams have conducted two activities, often in parallel, in defining the most immediate investment opportunities:

- Synthesizing existing information about the economics of the technology choices and the size of the market for the relevant technologies; domestic and international businesses and investors should be actively engaged in this assessment
- Consulting with experts from national programs and private companies; the Brazil TCAPP team used this approach effectively, with the reasoning that their national programs, which were initiated to foster energy efficiency or renewable energy, had already assessed

opportunities and acquired a good understanding of the TCAPP priority areas; these national program managers could provide enough guidance to quickly narrow the definition of the opportunity, limiting the need for additional market assessment work.

Once the opportunity area is more narrowly defined, specific investment actions can be developed. Country teams consult with host country program managers, technical experts and businesses and also with international businesses and technical experts. The teams also work with NREL and with the host country TCAPP-coordinating institution to help secure the necessary domestic and international donor and business support for implementation.

Phase 3—Implementation

Implementation is a collaborative effort involving host country organizations, private sector companies and investment organizations, international donors, and international technical experts.

9. *Implement technology cooperation actions.* A wide variety of possible actions, many of which were listed in the previous section, may be taken.

Philippines “Fast Track” Policy Reform Measures

The initial focus of investment action for TCAPP in the Philippines was to recommend policy reforms that would facilitate private investment in rural renewable energy technologies. Secretary of Energy Tiaoqui has approved these recommendations and directed staff to implement them. Here’s how this process unfolded:

October 1998	Philippines country team completes prioritization process, identifying rural renewable energy as a high priority, and presents the technology cooperation framework to the International Donor Meeting.
December 1998	TCAPP consultations determine that legal and institutional barriers are significant obstacles to project development. Senior management at the Philippines Department of Energy (P-DOE) agrees to act on any recommendations on legal and institutional barriers that are within their authority.
March 1999	A TCAPP host country consultant, Preferred Energy, Inc., with NREL assistance, finalizes the “fast track” policy reform recommendations.
June 1999	The Secretary of Energy approves of the recommendations in principle and directs staff to implement them by developing the proper rules and directives.
September 1999	P-DOE completes the necessary legal review for the implementation documents.
Next Steps:	Complete implementation of these reforms and educate businesses and investors about these reforms and the resulting new market opportunities.

Fast track actions to remove policy and regulatory barriers include:

- Clarifying and streamlining project accreditation requirements and definitions that are used for government approvals and incentives for renewable energy development
- Enhancing P-DOE’s role in coordinating approval of mini-hydro projects
- Using the Host Community Fund (this fund compensates affected communities for the impacts of energy infrastructure) for renewable energy development
- Revising the executive order that establishes government ownership of ocean, solar, and wind resources and imposes contracting and permitting barriers to renewable energy development; replacing this with an executive order that establishes clear policies to facilitate renewable energy development.

Generally, this phase will proceed with:

- Lead agencies or national programs implementing actions with international technical expert assistance (donor support may be required in some cases before actions can be implemented)
- Businesses and investors participating in implementation, including responding to investment solicitations, participating in investment conferences, developing new joint venture projects, and taking other similar actions (NREL and the BSCE facilitate international business participation and the country teams facilitate host country business participation)
- The TCAPP country team reviewing progress and refining actions as needed.

As TCAPP progresses, there will be much to learn about the nature of these actions and the types of support that can be most effective. Examples of actions which are being implemented in the Philippines and Brazil are included at the bottom of this and the previous page.

10. *Evaluate lessons learned.* Country teams, together with international experts, will evaluate the effectiveness of the actions during the course of implementation to ensure they are meeting their development needs and responding to any changing circumstances. In addition, the country teams and international technical experts, business representatives, and donors will evaluate the merits of this collaborative approach as a potential model for technology transfer under the FCCC. This evaluation effort will likely include workshops in which country TCAPP teams can share experiences with each other and other similar activities.

International Cooperation and Technical Support

TCAPP is a proactive intervention into the marketplace by a coordinated group of public and private organizations in the host country and from the international community. NREL coordinates the

Brazil – Energy Efficient Transportation Conference

One of Brazil's priority areas is spurring energy efficiency investments in truck and bus transportation. The primary TCAPP action in this priority area is to assist CONPET, a Brazilian organization which operates energy efficiency programs out of Petrobrás, in convening an international conference as a mechanism to attract new energy efficient transportation technologies and companies to Brazil. CONPET has two programs which work directly with truck and bus fleet managers and drivers to encourage use of clean energy technologies. These programs are an excellent way to encourage implementation of energy efficiency technologies. Key steps in this process include:

July 1998	Brazil's country team selects energy efficiency in trucks and buses as a priority.
September 1998	Technology cooperation framework articulates the goal of attracting additional technologies to EconomizAr and SigaBem programs.
December 1998	CONPET recommends an international transportation conference be held which will offer a venue to attract international companies with efficiency technologies to Brazil.
March 1999	TCAPP's international business coordinator, BCSE, identifies companies and associations interested in participating in the conference, including potential cosponsors.
August 1999	CONPET receives the support of a key Brazilian association, the National Confederation for Transportation, for the idea of convening the conference.
September 1999	CONPET leads Brazilian conference planning discussions. NREL and BCSE secure necessary international support for the conference.

Next Steps:

- NREL and BCSE will secure international sponsors:
- NREL will recruit participants, including exhibitors and attendees for the conference.
- CONPET will lead the conference planning effort and coordinate with NREL and BCSE to ensure that international participants have an opportunity at the conference to hear about the Brazilian market opportunities and to meet possible business partners.

During and following the conference, NREL, BCSE, and CONPET will work together to elicit company commitments to invest in the Brazilian market.

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work of all these actors to help couple the work of the country teams with international donor support, business investment, and technical expert assistance. NREL's activities in TCAPP include:

- *Providing technical support to the country teams*—NREL has established an international team of technical experts which assist in providing technical support. This team includes experts from various national laboratories and other technical institutions, and representatives from the U.S. government agencies. Other participating technical institutions include Sandia National Laboratory, Lawrence Berkeley National Laboratory, Federal Energy Technology Center, Pacific Northwest Laboratory, Econergy International, the International Institute for Energy Conservation, and various other organizations.
- *Providing funding for lead technical or coordinating institutions and experts in each country*—Host countries provide in-kind support and, in some cases, matching funding.
- *Facilitating the participation of international businesses and investors*—This includes a business network coordinated by BCSE and various other forms of outreach to international businesses and investors to foster their participation in the design and implementation of country technology cooperation actions.
- *Coordinating donor participation and support*—NREL helps the country teams present their work to international donor agencies to attract donor support for implementation of actions that require such support. NREL also helps promote integration of TCAPP country activities with current donor programs.
- *Outreach to share TCAPP methods and results*—NREL convenes workshops, prepares reports, manages a website, and implements other outreach activities to share methods and results with the international community and to promote sharing of experiences between countries.

Business Participation

A primary goal of TCAPP is to foster private investment in clean energy technologies, in other words, to assist in the development of sustainable markets. The program puts a strong emphasis on actions that will attract private investment since such investment is the ultimate solution to most countries' technology needs. In addition, it is through the marketplace that most technology transfer occurs.



More than 20 companies with an interest in the international market for clean energy technologies gathered to discuss TCAPP at a meeting hosted by U.S. Agency for International Development Administrator Brian Atwood.

Therefore, TCAPP's success is largely determined by its ability to engage domestic and international energy companies and investors in working as partners, suppliers, consultants, or financiers for the deployment of clean energy technologies in the host countries. The private sector must be involved in each step of the process to ensure that TCAPP's design and operation are effective.

The private sector participated in the November 1997 TCAPP workshop, which was a key event in the program's design. In March 1998, BCSE joined TCAPP to facilitate private sector engagement and support for the country activities. Since then, more than 300 companies have begun to participate in the TCAPP business network. The network includes large multinational companies as well as small and mid-sized companies spanning multiple regions of the world.

Private sector participation in TCAPP takes a number of forms:

- Domestic businesses and investment organizations participate on the country teams where appropriate to assist with the selection of priorities and design and implementation of the technology cooperation actions.
- International companies and industry trade groups provide input on the selection of priority areas and on the design of investment actions.
- Private sector representatives participate in the implementation of investment actions such as by responding to solicitations, participating in investment conferences, and providing training to domestic businesses.

Companies and industry trade groups participate in TCAPP because they benefit from gaining access to new investment opportunities. For example, a solicitation under development in Brazil for an expanded renewable energy field-testing program is a result of

TCAPP's work with the Ministry of Mines and Energy (MME). This solicitation will open the door for companies involved in rural renewable energy technology to participate with MME in a long-term effort to develop a very large market. Companies also benefit from the policy reforms that TCAPP helps to initiate, such as the "fast track" measures in the Philippines. This is a good example of private sector involvement, because meetings organized by TCAPP for Philippines renewable energy businesses were instrumental in the design of the fast track policy measures. TCAPP also helped to inform and educate international businesses about the measures. As a result, some of these companies helped to reinforce the merits of these measures in their conversations with the Government of the Philippines.

International Donor Involvement

A key TCAPP goal is the active involvement of international donor* organizations in supporting actions by countries that will build sustainable markets for their clean energy technology priorities. International donor agencies participated in the design of TCAPP and are starting to provide support for implementation of the country actions. Starting in 1997, discussions were held with donor agencies on the design of TCAPP. Donors participated in the November 1997 workshop to launch TCAPP. A special TCAPP meeting for international donors was held in October 1998, where senior officials from each of the five countries participating in TCAPP at that time presented their technology cooperation frameworks to more than 30 representatives of donor agencies. A number of countries and donors identified areas of mutual interest and a number of steps were identified to broaden donor participation in TCAPP and further enhance the value of TCAPP to the donor community.

Donors have continued to be involved in a number of ways, through individual consultations and group meetings. Through these interactions, donor organizations identified three attributes of TCAPP of particular interest:

- TCAPP provides a common set of country 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 of private sector businesses and investors in clean energy initiatives.
- TCAPP can serve as a model of a constructive approach to technology transfer under the FCCC.

Several TCAPP country teams have already succeeded in attracting donor interest:

- The Canadian government is participating in China's TCAPP work and is exploring further collaboration with China on climate change technology cooperation.
- As a result of TCAPP's work in facilitating discussions between the European Commission (EC), USAID, and Brazil, the EC has identified areas where it will consider further assistance.
- More than a dozen donor agency representatives attended a TCAPP-sponsored meeting in the Philippines to discuss their possible interest in the Philippines TCAPP actions.
- USAID missions in Brazil and the Philippines have integrated TCAPP country needs into their work-planning process and are supporting implementation of selected actions which complement the core program funding provided by USAID headquarters. Another USAID related effort, the U.S. Asia Environmental Partnership, has provided funding for TCAPP activities in Korea.

TCAPP is also collaborating with international donor agencies through CTI, a developed-country-supported partnership. CTI recently initiated the Climate Technology Implementation Program (CTIP), patterned after TCAPP. TCAPP's work in the Southern Africa Development Community (SADC) is being done in collaboration with CTIP. The United Kingdom and the United States are providing support for the work in the SADC. Germany and several other Organization for Economic Cooperation and Development countries are considering providing additional support for the SADC work. Also through CTI, Australia is providing support for work in Thailand.

* In TCAPP, the term "donor" is used very broadly to include any organization that can provide any type of technical or financial assistance which can enhance the technology cooperation effort.

Brazil

This chapter is a slightly condensed version of a status report on TCAPP—"Brazil's Technology Cooperation Agreement Pilot Project, Draft September 14, 1999"—issued by the Brazil TCAPP Interagency Committee. The status report was prepared by the Foundation for Sustainable Development and the National Renewable Energy Laboratory in collaboration with the Ministry of Mines and Energy, the Electrical Energy Research Center, the National Council for Scientific and Technological Development, the National Program for Oil and Natural Gas Conservation, and the National Program for Electric Energy Efficiency.

When the Brazilian Ministry of Mines and Energy (MME) was first contacted, in August of 1997, by a representative of the National Renewable Laboratory (NREL), for considering participation in TCAPP, the program was not yet fully designed. But the basic principle of increasing the deployment of clean energy technologies that would benefit Brazilian development objectives while reducing greenhouse gases was appealing.

Brazil has been an active and influential participant in the international effort to deal with the problem of climate change, even though Brazil's per capita greenhouse gas emissions are relatively small. Almost 60% of Brazil's energy, and 95% of its electrical energy, comes from renewable sources. Brazil has long recognized that many of the technologies that can reduce greenhouse gas emissions can also produce an economic benefit. Developing an energy system that benefits the country, both economically and environmentally, is a high priority. Brazil recognizes that TCAPP is a program that can help produce both of these benefits. Brazil's goals in TCAPP are:

- to foster private investment in clean energy technologies that speed economic development*
- to engage host country and international donor support for actions to build sustainable markets for clean energy and clean energy technologies*
- to enhance Brazilian technology development in emerging technologies such as fuel cells and renewable energy (solar, wind and biomass)*
- to promote cooperative work between local and international technical groups.*

Brazilian Background Information

From 1970 to 1996, the Brazilian economy grew at an average annual rate of 4.5%, with fossil fuel use growing at nearly the same rate. Electricity demand was even more rapid, and capacity increased more than five times. The energy priorities tended to be industrialization in southern and southeastern Brazil, which encouraged rapid urbanization and the construction of large-scale hydroelectric production, oil refineries and the alcohol facilities. Although necessary to meet the growing demand of the most industrialized sectors, this effort did not fulfill needs in rural areas. Northern and central Brazil remain electrically isolated, and 65% of the rural population, about 20 million people, do not receive electricity.

In the next two decades, Brazil plans to triple the size of the electric power system—one of the world's most ambitious expansions. In order to face this challenge, Brazilian policy makers are transforming the electric power sector with deregulation

and privatization of state-owned companies. A host of legislation has been passed involving electric utility concessions and independent power production. For several years Brazil has been implementing an aggressive effort, known as the Real Stabilization Plan, to enhance the economy by increasing private sector participation. The plan included provisions designed to attract foreign capital and technology, based on the recognition that participation in the Brazilian economy by outsiders could be of mutual benefit.

The financial constraints of a deregulated market, combined with environmental pressures, should lead to smaller units of generation distributed closer to the load. There is a new perspective on alternative sources of energy, for which costs have been decreasing. An analysis of the role of alternative sources of energy is important considering the requirements of the future energy market, the emphasis on finding sustainable solutions for system expansion and isolated populations, as

well as the commitment of the Brazilian power sector to environmentally benign solutions.

The TCAPP Interagency Group

A number of different government ministries and departments have created the TCAPP Interagency Group to decide the scope and procedures to be followed by TCAPP in Brazil:

- The Ministry of Mines and Energy (MME), through the National Department of Energy Development (DNDE), is the lead agency for the establishment of priorities in the area of alternative energy. (This department has worked together with NREL since the beginning of TCAPP in Brazil.)
- The Ministry of Science and Technology is the lead agency on the National Assessment of Greenhouse Gas Emissions.
- The Ministry of Foreign Relations has the responsibility for reviewing and approving formal agreements with other countries. (If a new agreement is needed in TCAPP, it will be the Foreign Relations Ministry that will work on that subject.)
- The National Agencies for Fuel (ANP) and Electrical Energy (ANEEL) are responsible for the institutional framework and legislation for fossil fuels and electricity, respectively.
- The National Council for Scientific and Technological Development (CNPq) defines priorities for national development in the academic sector and supports human resources formation and development.
- The National Program for Oil and Natural Gas Conservation (CONPET) is responsible for the definition and implementation of actions regarding oil and natural gas products conservation. This is a nationwide program under coordination of MME and having PETROBRÁS as responsible for its Executive Secretariat. PETROBRÁS houses and supports CONPET.
- The National Program for Electric Energy Efficiency (PROCEL) is responsible for the definition and

implementation of actions regarding electric energy efficiency. This is a nation wide program under coordination of MME and having ELECTROBRÁS as responsible for its Executive Secretariat. ELECTROBRÁS houses and supports PROCEL.

- ELETROBRÁS and the Electrical Energy Research Center (CEPEL) are leading the process of renewable energy implementation in Brazil.

Figure 5 shows the implementing structure of TCAPP in Brazil.

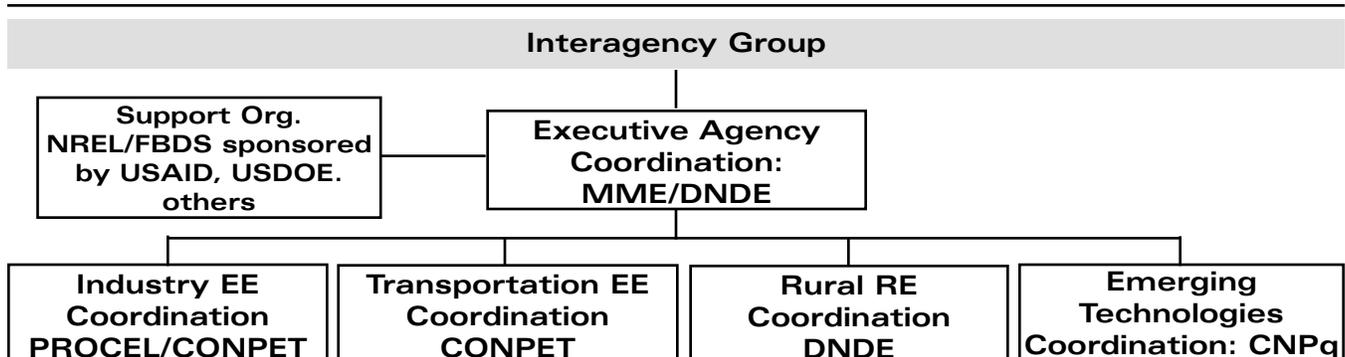
Priority Selection

An initial Brazil TCAPP scoping meeting was held in September 1997. Many options were discussed, using a number of criteria, and six technologies were selected as preliminary priorities: biomass for village power, zero and low head hydro for village power, hybrids for village power, water treatment for remote off-grid villages, energy efficiency, and transportation.

A Brazilian team formed and prepared a document that detailed some of the priorities for the November 1997, Golden, Colorado, (United States) workshop. International donor organizations and the private sector attended this meeting and offered support and advice to TCAPP. The Brazil team stated clearly that the document was preliminary and would require broader consultation before it could be considered representative of the national interest. Based on the experience of the Golden meeting, the Brazil team representatives concluded that it would be useful to participate in TCAPP.

A series of meetings were held in July, 1998, to finalize the consultations on the priorities. The MME Department of Energy Development agreed to continue to serve as the lead Brazilian agency on TCAPP. The U.S. Agency for International Development (USAID) office in Brazil, which includes technology cooperation as an objective in their strategy, provided guidance to NREL as the meetings were set up. An important new member of the

Figure 5. TCAPP Implementing Structure in Brazil



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TCAPP team, a host country consultant, was recruited to assist in this effort. The organization chosen to play this role was the Foundation for Sustainable Development (FBDS), a nongovernmental organization based in Rio de Janeiro and well known for its environmental protection efforts.

A number of Brazilian agencies have programs and projects in the same areas the TCAPP team identified as preliminary priorities. Due to the broad nature of the eight preliminary priorities chosen, FBDS recommended three TCAPP meetings: a meeting on energy efficiency with PROCEL, a transportation meeting with CONPET, and a meeting on renewable energy with MME. Several criteria for the selection of priority areas were used during the meetings, such as being consistent with Brazilian needs for development and the country's position in the climate change negotiations; avoiding duplication with other initiatives; being environmentally friendly; having national and regional focus; being oriented towards consumer demand for energy; improving Brazilian capacity; increasing competition and job opportunities; involving the private sector, and being able to serve as a pilot for other efforts. Five priorities were identified and selected:

- Energy efficiency in diesel-powered transportation
- Direct use of natural gas
- Electrical energy efficiency
- Renewable energy in rural areas
- Fuel cells—emerging technology.

Strategy and Action Development

Meetings were held with the Brazilian agencies that have programs and projects in these priority areas. These meetings were intended to ensure that



CONPET's transportation programs analyze the opacity of tailpipe emissions to help identify efficiency measures for trucks and buses.

the activities developed under TCAPP would add to the effort these agencies were making to meet their objectives. The Brazilian TCAPP action plan was developed in two steps. The first step was taken in December 1998, when the TCAPP team narrowed the priority areas and established objectives in nine action areas for the next year. The second step was taken at meetings in March and May 1999 which identified more detailed work plans for five of these action areas. A summary of the resultant action plans and an update on progress towards implementation is presented below.

Energy Efficiency in Truck and Bus Transportation

In Brazil, cargo is carried mostly by trucks (58.7%), with most of the remainder carried by rail (20.6%) and boats (17.2%). More than 95% of passengers travel on roads. The transportation sector accounts for 21% of total final energy consumption and almost 49% of the total oil demand. Diesel oil and gasoline are the main fuels consumed and have shown a continuous growth over the past 10 years.

The two main Brazilian energy-efficient transportation programs are the EconomizAr and Siga Bem:

- The EconomizAr Program, operated by PETROBRÁS/CONPET and the transportation union confederation since 1996, assists with storing fuel correctly and managing and optimizing a transportation company. The goal for the program is to help participants reduce energy use by 13%.
- The Siga Bem Program has been operated since 1994 by PETROBRÁS/CONPET. It consists of truck driver orientation about engine tuning, fuel, and ways to reduce consumption. Measures are recommended to the owner of trucks and efficiency gains of 10-20% can be obtained.

TCAPP Objective:

To attract international companies and technologies into Brazil's transportation energy efficiency effort by assisting CONPET in convening a transportation conference.

Rationale:

CONPET's EconomizAr and Siga Bem programs already improve the efficiency of thousands of trucks and buses each year. Both programs are expanding, and will be extended for another five years, which will provide the opportunity for greater implementation of energy efficiency measures.

CONPET intends to promote a conference that would be structured to attract all of Brazil's fleet managers, as well as the companies that provide them products or services. The conference will be a mechanism to attract a large amount of interest from companies in the Brazil market for energy efficiency in truck or bus fleets. A trade show would provide a venue for international companies to exhibit their products to prospective customers.

Progress to Date:

March 1999—TCAPP's international business coordinator, the Business Council for Sustainable Energy (BCSE), identified companies and associations that could be interested in the conference. NREL and BCSE contacted these companies and found that there was interest in participating in a conference.

May 1999—TCAPP drafted a description of a transportation conference and identified what it can do to support it.

August 1999—CONPET received the support of the National Confederation for Transportation (CNT), a key Brazilian organization, for the idea of convening the conference.

September, 1999—CONPET led the Brazilian conference planning discussions. TCAPP began to identify international support for the conference.

Next Steps:

- TCAPP will participate in the conference steering committee and lead in the recruitment of non-Brazilian sponsors, exhibitors and speakers.
- TCAPP will provide support to cover expenses for having international specialists at the event.
- CONPET will secure sponsorships and exhibitors in Brazil.
- TCAPP will utilize the conference to attract company commitments to the Brazilian market for transportation energy efficiency.

Direct Use of Natural Gas

The Natural Gas Program is being developed by the Brazilian government in order to increase use from the current level of 2.5% of total energy use to 11.8% in 2010. Brazilian natural gas reserves are relatively small, but Brazil has established international agreements with Bolivia and Argentina to import about 8 million m³ of gas per year beginning in 1999, increasing to 16 million m³ per year within 8 years.

TCAPP Objective:

To attract technologies which use natural gas directly, and which have economic and

environmental benefit. This will include assisting CONPET and others in developing a plan for promoting cogeneration in Brazil and developing an action plan for promoting other direct uses of natural gas.

Rationale:

CONPET and ELETROBRÁS have already begun to study how natural gas should be utilized in Brazil. Will the gas only be used for large-scale electric generation? Is this the highest value use for Brazil? What about direct use of natural gas in appliances, buildings, vehicles, or small-scale cogeneration plants? Cogeneration is a highly efficient method of using natural gas to generate electricity, and it is often more efficient to burn natural gas directly for some end-use applications. An example is in the area of inefficient electric showers (normally 2 to 5kW appliances), which consume up to 12 GW, normally during the peak time. Using natural gas directly and replacing the electric appliance is an application that can be cost effective.

Progress to Date:

TCAPP has compiled a document, which is in review, describing cogeneration issues and direct use of natural gas, including regulation, financing, tariffs, and technology.

Next Steps:

- TCAPP will send the cogeneration document to CONPET and ELETROBRÁS.
- CONPET and ELETROBRÁS will draft ideas of the items and constraints to be addressed.
- CONPET, ELETROBRÁS, TCAPP and other partners will host a planning meeting to review the framework and to develop a program to promote cogeneration.
- TCAPP will recruit some international companies and experts for a cogeneration planning meeting.
- TCAPP will work with CONPET to organize a small workshop to address other end uses of natural gas.

Electrical Energy Efficiency

Energy conservation from efficiency will reduce electrical energy consumption by 9% by 2006. PROCEL is the main governmental program in this area. It estimates that savings of 8-15% can be achieved in distribution and an extra 7-15% can be obtained on the end-use side. The amount of investment necessary to achieve the full modernization of industry to reduce its energy intensity is high, as it requires replacement of

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intensive energy use machinery. Additional resources to those already contemplated by PROCEL will be required. In this sense, TCAPP could play an important role, by targeting the private sector through innovative financing.

TCAPP Objective:

Assist PROCEL's industrial energy efficiency effort by providing access to the best expertise and support, including technical experts and organizations willing to provide financing to replicate demonstration projects in all similar facilities.

Rationale:

PROCEL is beginning an industrial energy efficiency program that will focus on industrial processes. This is traditionally a difficult area to identify and analyze energy efficiency measures because each industrial process is quite different, requiring specialized experience on the part of those conducting the energy analysis. TCAPP could provide a valuable service by helping PROCEL access engineers experienced in identifying energy efficiency for particular types of industrial facilities.

To begin with, TCAPP can help PROCEL find an expert to help with an energy audit of a very large iron processing facility.

TCAPP's involvement in the PROCEL industrial energy efficiency program could provide a large longer term benefit. Once the steel mill retrofit is underway, another idea for a TCAPP contribution is to assist PROCEL in identifying financing for companies that wish to replicate the successful retrofit measures they install with PROCEL.

Next Steps:

- Finalize a TCAPP workplan for PROCEL approval.
- Identify key industrial sectors. Compile a mailing list of experts, engineering firms, energy service companies (ESCOs), etc.
- Draft a solicitation for PROCEL.

- PROCEL issues solicitation, selects experts.
- Identify possible providers of financing and ESCO services, in Brazil and internationally.
- Draft solicitation for financing and ESCO services.
- PROCEL selects lenders and ESCOs.

Rural Renewable Energy

About 20 millions residents of Brazil (15% of the total population) living in remote regions do not receive electricity. The rural electrification program is traditionally based on line extension. However, depending upon consumption level and distance from the grid, (looking from a strictly economical viewpoint), the investment in rural electrification projects may be optimized using new renewable sources of energy (solar, wind, biomass and small hydro). Considering this, the federal government established, through the Presidential Decree of 22 December 1994, the Program for Energy Development in States and Municipalities (PRODEEM). The objective of PRODEEM is to promote the supply of energy to communities that are far away from conventional systems, using renewable and technically feasible energy sources that are affordable, commercially possible, politically acceptable, and environmentally sound.

TCAPP Objective:

Support PRODEEM's efforts to attract and create markets for new technology for rural renewable electrification. Create teams of private sector partners to participate in PRODEEM's field test and subsequent market development efforts for icemaking, refrigeration and desalinization.

Rationale:

PRODEEM has thus far concentrated almost totally on solar energy. MME will be spending some of their budget in the next few years on projects

Table 3. PRODEEM—from 1995 to 1999

Year	Communities Assisted or under Assistance		Population Directly Assisted	Applied Budget R\$1,000 ¹	
	Foreseen	Carried Out		MME	Partners
1995	27	9	—	1,878	365 ³
1996	100	116	34,403	4,288	60 ⁴
1997	300	200	68,633	3,650	750 ³
1998	1,000	1,776 ²	351,200	3,660	3,838 ⁵
TOTAL	1,427	2,101	454,236	13,476	5,013
1999	3,000		800,000	17,200	37,034

¹ The exchange rate in late 1999 is about R\$1.7/US\$1.0, before 1998 it was about R\$1.0/US\$1.0

Source: DNDE/MME

² Emergency water pumping systems for NE (1,036), Fundação Teotônio Vilela (44), Energy Company of Minas Gerais (71), and States and Municipalities (606).

³ PETROBRÁS

⁴ Furnas Electrical Generators, Inc.

⁵ NCRA (R\$2,038); States and Municipalities (R\$1,800).

designed to field test other technologies. PRODEEM's intention is to ensure that the full range of existing and new renewable technologies is accessible for practical application in PRODEEM. A solicitation of the private sector for partners to a field test will enable all companies and all technologies to be considered as PRODEEM expands into other technology areas.

Progress to Date:

- TCAPP provided the first draft of a solicitation for private sector partners for the field test. DNDE and TCAPP worked together to revise the solicitation.
- DNDE and TCAPP each announced to the business community that the solicitation will be issued soon. More than twenty companies have contacted the BCSE, TCAPP's international business coordinator, expressing interest in the solicitation.

Next Steps:

- DNDE will coordinate the issuance of the solicitation.
- TCAPP will disseminate the solicitation and promote participation from business.
- TCAPP will assist PRODEEM in reviewing and selecting proposals.
- Winning proposers will install systems in Brazil to be field tested.

Fuel Cells

Ethanol is a major industry in Brazil, with an installed production capacity of 15 million m³ per year. The prominence of ethanol has generated interest in the use of ethanol for fuel cells. Pilot studies and projects relating to fuel cells in Brazil are mostly of an academic nature, including work undertaken at Rio de Janeiro Federal University during the 1980s and at the Physics and Chemistry Institute of São Paulo University in São Carlos. CEPEL has undertaken a technical-economic assessment of the feasibility of installing a fuel cell of cast carbonate at an isolated site, operating with ethyl hydrate produced locally from sugar-cane crops.

TCAPP Objective:

To foster the development of ethanol-based fuel cells for the Brazilian market. This will involve creation of a team, in Brazil and internationally, whose goal will be to create a multi-year ethanol based fuel cell development program in Brazil.

Rationale:

Fuel cell technology is moving rapidly from the research and development stage to the marketplace. Fuel cells can be powered by a variety of fuels, but ethanol could be an ideal fuel for Brazil, because the ethanol industry is very large. Competitively priced, ethanol based fuel cells have

the potential of dramatically changing the way renewable energy could be delivered in rural Brazil. It is precisely this market that may offer some of the most attractive returns on a fuel cell investment.

Next Steps:

- A letter will be prepared by DNDE inviting NREL to organize a U.S. committee, to work in partnership with a Brazilian committee, to develop the first phase proposal.
- DNDE and CNPq will form a Brazilian committee to begin organizing an experts work shop in Brazil. The Brazilian committee should be composed of the following national organizations: CNPq, Agency for Funding of Projects and Studies, CEPEL, University of São Paulo, CENPES, and Copersucar.
- The two committees will begin working together to prepare proposals to be presented to national and international agencies. The work will be proposed in three phases:
 - Phase 1 - Training and strategy development
 - Phase 2 - Laboratory research
 - Phase 3 - Pre-commercial activities.

Conclusions

TCAPP can now be considered an important instrument of cooperative work between national and international organizations, linking financing agencies, technology development institutions (research centers and universities), and the private sector (industries and engineering companies). TCAPP created during its first stage an effective network of cooperative institutions.

TCAPP has established a diverse set of priorities that span the energy sector in Brazil, including transportation, efficient use of natural gas, industrial end use, rural electrification with renewables, and an emerging technology—fuel cells. Each of these priority areas contains the potential for technology cooperation that could be beneficial to Brazil while reducing future greenhouse gas emissions.

The first phase of TCAPP, in which a team was established and priorities selected, is now complete. The second phase of TCAPP, in which specific actions were designed, has reached the point of completion for at least two of the priority areas that implementation is underway.

FBDS, with support from NREL, continues to act as a facilitator of technology cooperation in TCAPP. The USAID mission in Brazil has agreed to provide some of the funding for TCAPP's in-country support. FBDS has the local permanent staff that can work, with NREL's support when necessary, with any interested international agency that wants to join in the TCAPP initiatives.

China

This chapter was prepared by staff from Tsinghua University and the National Renewable Energy Laboratory.

Though China is facing the arduous tasks of developing its economy and improving the living standards of its people, the Chinese government is concerned with and active in the issues of global climate change. The Chinese government participates in international cooperation activities under the United Nations Framework Convention on Climate Change (FCCC), and believes that some effective mechanisms for transfer of, or access to, environmentally sound technologies should be established to promote the implementation of Article 4.5 of the FCCC.

A collaborative project has been established between the U.S. and Chinese governments to contribute to the implementation of technology transfer under the FCCC. This technology cooperation project targets technologies which have the dual benefits of promoting efficient economic development and reducing air pollution and greenhouse gas (GHG) emissions at the project level. The project supports the provisions of FCCC and relevant decisions made by the Conference of the Parties on Development and Transfer of Technology. The objectives of this project are to expand the cooperation between the governments of China and the United States in the area of global climate change through the following activities:

- (1) further identifying priority energy technology areas that support the sustainable development priorities of China, and simultaneously reduce greenhouse gas emissions at the project level*
- (2) identifying environmentally sound energy technologies that are suitable for China and can be facilitated through Sino/U.S. bilateral cooperation*
- (3) analyzing and identifying barriers to priority technology transfer to China*
- (4) putting forward proposals for overcoming barriers to priority technology transfer.*

For this project, technology cooperation is defined as collaboration between the United States and China that enables China to adopt, manufacture, install, operate, maintain, or diffuse priority energy technologies. This chapter discusses the selection of technology priorities, current work progress and next steps for this collaboration.

Priority Selection

In early 1998, TCAPP was initiated in China through cooperation between the U.S. National Renewable Energy Laboratory (NREL), the Chinese Ministry of Science and Technology (MOST), and Tsinghua University (TU) of China. During this time, MOST was one of the major coordinators for Chinese climate change activities, and both MOST and TU were involved in international projects that analyzed GHG mitigation strategies, such as the U.S. Country Studies Program and the Asia Least-Cost Greenhouse Gas Abatement Strategy. The reorganization in late 1998 led to the designation of the State Development Planning Commission (SDPC) as the lead organization in China's National Coordination

Committee for Climate Change. The Office of National Coordination Committee for Climate Change of SDPC coordinates the negotiations for China in the FCCC, and staff from this office participate in the subsidiary body and Council of the Parties events. As a result, SDPC assumed responsibility for this technology cooperation project on the Chinese side.

In Phase I of this project, a one-day scoping meeting was held in Beijing to select clean energy technology priorities for China. Both domestic and U.S. technical experts from a variety of energy sectors participated. After extensive discussion, priority GHG mitigation technology areas in China were preliminarily identified using an analytical hierarchical process.

First, the experts identified the following criteria to screen technology priorities:

- environmental benefits
 - GHG mitigation
 - other pollutants reduction
- economic development
 - new economic growth
 - job creation
- conditions for technology transfer
 - local capacity
 - localization of manufacturing
- investment
 - scale of investment
 - investment time period
 - state corporations
 - private investment.

Second, the experts listed mitigation technologies in different sectors and proposed 19 technologies for further consideration based upon these criteria. Third, about 20 domestic technical experts in the meeting were asked to score each of the 19 technologies according to each criterion. Each criterion was given equal weight and scores were added. The top five technologies were identified as the priority energy technologies for GHG mitigation in China. The selected priorities were:

- cleaner coal technologies for power generation
- efficiency improvements in coal-fired industrial boilers
- high efficiency electric motors
- grid-connected wind electric power
- coal bed methane recovery.

Using this methodology, the Chinese ensured that their technology priorities had substantial environmental and economic benefits, were viable candidates for successful technology transfer, and had sizeable investment opportunities.



Dr. Wei Zhihong of Tsinghua University presents China's technology cooperation framework to more than 30 representatives of international donor agencies at a TCAPP meeting in October, 1998.

During 1998, TU and NREL staff guided a team of Chinese technical experts through the process of developing a technology cooperation framework that discusses barriers and options to overcome these barriers for each technology priority.

Bilateral Agreement on Technology Cooperation

In April, 1999, Minister Zeng Peiyan of the SDPC and Administrator Carol Browner of the U.S. Environmental Protection Agency (USEPA) signed a statement of intent to build on and greatly expand this collaborative technology cooperation process over the next three years. This bilateral agreement will support the development and implementation of projects and their action proposals in the first four priority energy technologies. (Coal-bed methane was later taken out of this project and became a separate bilateral project.) The agreement will also identify two additional priority energy technologies for inclusion of a total of six. Results of this technology cooperation and project development work will be a contribution to the implementation of technology transfer under the FCCC. Project concepts developed in this work may also serve as the basis for future Clean Development Mechanism projects.

The overall tasks for the three-year project are:

- (1) To conduct surveys and studies for the six priority technology areas to define China's needs and requirements and potentials for advanced energy technologies
- (2) To analyze financial demand, funding approaches, and barriers
- (3) To provide suggestions on actions for addressing these barriers and initiate implementation of these actions as appropriate
- (4) To make recommendations on technology transfer mechanism under the specific situation of FCCC
- (5) To prepare annual progress reports to share methods and results.

On the Chinese side, the main institutions and teams are:

- **SDPC** – lead Chinese agency, provides guidance and direction for the program and ensures participation of relevant ministries
- **Interagency Team** – broad-based stakeholder group, includes key members of the National Coordination Committee for Climate Change which reviews and approves every key step of

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the project process including the selection, design, and implementation of actions

- **TU** – lead focal point and technical institution, coordinates all project activities and serves as main counterpart for NREL
- **Technology Teams** – lead analysis and design and implementation of specific technology actions.

On the U.S. side, the main organizations are:

- **USEPA** – lead U.S. agency, provides overall guidance and direction for U.S. team work and financial support
- **NREL** – U.S. focal point, lead technical institution, and main counterpart for Tsinghua University, coordinates U.S. technical assistance, assists in attracting donor support and international business participation
- **Business Council for Sustainable Energy** – coordinates and engages international private sector businesses and investors through their network of more than 300 international businesses
- **Other Technical Support** – national laboratories and other experts provide specific technology, business and project development, and financing expertise, includes the Lawrence Berkeley National Laboratory (LBNL), Pacific Northwest National Laboratory (PNNL), and the Federal Energy Technology Center (FETC).

Strategy and Action Development

A delegation including officials from USEPA and technical experts from NREL, LBNL, PNNL, and FETC visited Beijing, China during July 1999. Because of Canadian interest in participating in TCAPP and utilizing the TCAPP process as a basis for donor response to Chinese needs, a Canadian government delegation from the Canadian

International Development Agency, Natural Resources Canada, and the Canadian Embassy also attended these meetings in Beijing as observers.

A common understanding was reached on most aspects of the project and its importance. One major difference in approach related to the terms of the technology transfer. The U.S. side emphasized that market-based approaches held the most promise for successful implementation of technology transfer, while the China side noted that preferential terms were warranted and necessary for technology transfer under FCCC. Both sides hope to learn more about this issue from the analyses, case studies, and implementation of various kinds of actions in this project.

To provide a forum to invite comments from experts on the work plan of the project, TU held a series of informal technical meetings in each of the four priority technology areas: high efficiency electric motors, grid-connected wind electric power, efficiency improvements in coal-fired industrial boilers, and cleaner coal technologies for power generation. Participants included Chinese technical experts, experts from local offices of foreign corporations and institutions, and experts from U.S. national laboratories and institutions. For each priority technology, a briefing document was assembled, including information from lead Chinese technical experts and private sector businesses from the U.S. During the meetings, a lead Chinese technical expert presented background information, including the general technology situation and analysis of the potential of GHG mitigation.

NREL, TU, and SDPC worked together intensively to formulate the work plan for the cooperative project. The work plan for this first year period (1999-2000) has the following tasks:

- (1) To establish the inter-agency team, technology teams for wind power and motors, technology team leaders for clean coal and boilers, and a project office at TU
- (2) To identify two priority technology areas in



Wind farm in Dabancheng, Xinjiang, the largest wind farm ever built in China.

Egypt

This chapter was authored by Dr. Ibrahim Abdel Gelil, Egyptian Environmental Affairs Agency and Dr. Zeinab Fargaly Mohamed, Climate Change Expert, Egyptian Environmental Affairs Agency.

As part of the work of the Science and Technology Subcommittee and the Subcommittee on Environment and Development under the Gore-Mubarak Cooperative Agreement, Egypt identified technology transfer as one of its highest priorities. The Egypt Technology Cooperation Agreement Pilot Project aims to further this technology transfer objective.

The project has the following overall goals:

- Develop consensus among key Egyptian organizations on a set of high priority, climate-friendly mitigation technology areas where both domestic and international actions are necessary to promote their effective deployment in the Egyptian economy.*
- Identify and prioritize the actions necessary to remove barriers to the penetration of these actions*
- Develop and carry out a plan to implement these actions, leading to the development of projects in the priority technology areas.*

An initial set of meetings was held in Cairo during the first week of September 1999. Representatives from all key agencies in the Egyptian government participated in these discussions. The Egyptian Environmental Affairs Agency has the lead role in this effort. These meetings resulted in the selection of four candidate technology areas—subject to the endorsement of the National Committee on Climate Change—on which the technology transfer efforts will focus. The areas are:

- Industrial energy efficiency measures and fuel switching to natural gas
- Lighting efficiency technologies and renewable-powered lighting in semi-remote applications

- Renewable energy applications in rural areas
- Small scale cogeneration applications.

These priorities will be presented and finalized at the meeting of the Egyptian Interministerial Committee on Climate Change, to be held in November 1999.

This work will be closely coordinated with efforts sponsored by the U.S. Country Studies Program to continue developing Egypt's Climate Change Action Plan and to assess the economic benefits of the measures included in the plan.

Kazakhstan

This chapter was prepared by the Kazakh Electricity Grid Operating Company and the National Renewable Energy Laboratory

Kazakhstan was one of the first countries to join the Technology Cooperation Agreement Pilot Project (TCAPP) and has been a leader in developing this process. Through previous work under the U.S. Country Studies Program and Support for National Action Plans, Kazakhstan developed a national greenhouse gas (GHG) inventory and conducted vulnerability, adaptation and GHG-mitigation assessments for important national economic sectors. In August 1997, a team composed of representatives from the government Research Institute for Environment Monitoring and Climate (KazNIIMOSK) under the State Organization Kazhydromet, the Ministry of Energy, Industry and Trade (Ministry of Energy and Natural Resources at that time) was established. The Kazakhstan TCAPP team identified four technology priorities in October 1997:

- (1) Power plant carbon efficiency (fuel switching, combined-cycle gas, and improved heat rate)*
- (2) Energy saving and district heating improvements*
- (3) Wind power*
- (4) Small hydropower.*

The Kazakhstan TCAPP team is now designing projects to remove barriers to and attract investment in these four priority areas.

The Kazakhstan TCAPP team drafted a technology cooperation framework for the four priority areas and presented it at the National Renewable Energy Laboratory (NREL) TCAPP workshop in late 1997. This document effectively detailed the situation of the technology priorities, the GHG-mitigation potential, key barriers and actions to overcome these barriers, and current initiatives and needs for further cooperation. As a result, this framework was subsequently used as a model for TCAPP.

In 1998, the TCAPP team, including experts from KazNIIMOSK, the Kazakh Electricity Grid Operating Company (KEGOC), the Kazakh Research and Design Institute for Energy (KazNIPIENERGOPROM) and the Kazakh Research and Design Institute for Rural Energy (KazSEENERGOPROEKT), integrated current national programs and strategies into a revised technology cooperation framework.

However, during the next year, TCAPP activities were considerably slowed as the country underwent major restructuring. During 1998, the capital was physically moved from Almaty to Astana and in early 1999 elections were held. Also that year, a key member of the TCAPP team, Olga Pilifosova of KazNIIMOSK, was appointed to the FCCC Secretariat in Bonn, Germany. This was a testament to her substantive contribution to TCAPP and the effectiveness of her TCAPP team.

The Kazakhstan TCAPP work is fully expected to regain momentum, however, as the TCAPP team has recently reorganized around a strong new

group of specialists including:

- K. Suleymenov, the Ministry of Energy, Industry and Trade, coordinator
- S. Katyshev, KEGOC, coordinator
- O. Erekeev, KazNIE
- G. Papfanasopulo, KazNIPIENERGOPROM
- I. Vilkovissky, AlmatyGydroprom
- I. Yesserkepora, KazNIIMOSK.

TCAPP activities are now moving into Phase II in selecting, defining and implementing investment and policy actions. Specific technology team meetings will be held to develop one to three action proposals for each priority.

In April 1999, the Government of Kazakhstan approved the Program of the Development of the Power Sector until 2015. The program outlines prospective projects such as small hydropower and wind power and reiterates the government's commitment to state support of combined generation of heat and power and centralized heating. The Kazakhstan TCAPP team evaluated these projects and selected the most promising projects based on which ones could be released in a short period of time and could be achieved with limited investment resources. Details of these projects, to be developed under TCAPP, follow.

Small Hydropower

One potential small hydropower project is on the Uzyn-Karagaly river near the settlement in the Karagaly, Zhamnul region, Almaty oblast. This

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site has a 30 meter head and a flow of 1.5 m³/s. Electrical capacity is about 350 kW, and electrical consumers would be the local population, a cloth factory, and Almaty Power Consolidated. Existing electrical grids are 10 kV, sufficient road infrastructure exists to support the station, labor force is redundant, and the area is located on private property.

Small-Scale Combined Heat and Power

After thermal power, one of the main sources of heat in Kazakhstan is “boiler house” steam generation. The boilers produce steam at a pressure of 13-14 kgs/cm² and a temperature of 190-230°C. These boiler houses include the North-East Boiler House in Almaty, and the heating systems in various cities, including Kapchagai, Kostanai, Kokshetau, and Kzyl-Orda. Presently, these boiler houses have no buyers for their steam. The hot water, however, continues to be used for district heating. Accordingly, the main issue is power generation using small-capacity turbo generators in the base of the boiler houses. This activity will not directly decrease the volume of fuel consumed by boiler houses, but will offset total electrical consumption at larger thermal power stations. The benefits of the program are threefold. First, decreased electrical generation at large thermal power plants; second, lower transmission losses; and third, the heat from the steam turbine can be used as a heat supply by the local population. Combined, the above activities should lower consumption of fuel at large thermal power stations and, in turn, improve the local ecological situation.

The project can be first implemented on the base of the North-East Boiler House under the auspices of the Kazakhstan Scientific Research Institute of Energy. Nine boilers with a capacity of 20 tons of steam per hour, a pressure of 13 kgs/cm² and a temperature of 250°C are in place at the North-East Boiler House in Almaty. Two 500-kW steam turbines can be installed here. The whole complex is in need of a total capacity of 850-900 kW during peak heating hours. Preliminary estimates indicate it is technically possible to install the steam turbines at the North-East Boiler House to cover the electricity demand. The Kazakhstan government owns 47% of the plant; private ownership is at 53%.

Combined-Cycle Plants

The 100-MW gas turbine in operation near the city of Aktubisk does not have sufficient capacity

to meet the city's electrical demand. A 40-MW boiler could be installed here to utilize the heat generated by the turbine. This would generate an additional 250-280 million kWh with no additional fuel consumption, and lower CO₂ emissions by 250 thousand tons per year.

Oil Refinery Gas Usage

There are four potential projects proposed for the utilization of gas:

- The Shimkent oil refinery plant is interested in installing a 17-MW gas turbine to cover the heat and electrical needs of the plant. The fuel for this project would be the gas which is produced as a by-product of the oil refinery process. Some of this gas is used in the processing of oils but most is burned after the processing. This project would generate 130 million kWh of electricity and 120 thousand Gcal of heat. Successful implementation of the project would decrease CO₂ emissions by approximately 90 thousand tonnes per year.
- The “Condensat” plant near the Karachganak gas deposit (western Kazakhstan oblast) is interested in installing a 51-MW (three turbines at 17 MW each) gas turbine power station. Mazut, the gaseous waste after processing the condensed gas can be used as fuel for the project. At present this gaseous waste is burned. Annual electricity generation would be 180 million kWh and successful implementation of this project can result in the lowering of CO₂ emissions by 180 thousand tonnes per year.
- Associated gas from the oil deposit “Kumkol” (Kzyl-Orda oblast) could be used to fuel a 35-MW gas turbine power station. This would generate 250-275 million kWh annually and decrease CO₂ emissions by approximately 250 thousand tonnes per year.
- Associated gas from the oil deposit “Prorva” (Atyrau oblast, western Kazakhstan) could be used to fuel a 18-MW gas turbine power station. The associated gas is presently burned. This project would generate 125 million kWh annually.

Kazakhstan is unique among TCAPP countries in that during COP5, Kazakhstan will be considered to join Annex I of the FCCC. As an Annex I member, Kazakhstan will take on a binding GHG emissions reduction target under the Kyoto Protocol and will be allowed to utilize flexibility mechanisms, including international emissions trading, as a means to meet its commitment.

Mexico

This chapter was co-authored by Ing. Odón de Buen, General Director, and Ing. Ubaldo Inclán, Director of Planning and Environment from Mexico's National Commission for Energy Conservation with assistance from the National Renewable Energy Laboratory.

The main objectives of the Technology Cooperation Agreement Pilot Project (TCAPP) Mexico effort are to:

- *Strengthen public policy activities towards a clean and efficient use of energy, as well as take advantage of renewable energy*
- *Implement established priorities in energy efficiency and renewable energy, continuing with the efforts developed during the recent years by several public and private institutions*
- *Increase private sector participation, either in its own energy use or as products and service providers, in energy efficiency and renewable energy programs, including nongovernmental organizations and research institutes.*

Mexico's TCAPP activities are not directly driven by environmental policies for climate change, but as coordinated efforts by energy and environmental agencies to promote energy efficiency and renewable energy. TCAPP, together with the National Commission for Energy Conservation (CONAE), the National Ecology Institute (INE), and other Mexican participant institutions, will evaluate alternative approaches for international technology cooperation that could be a model for implementing technology transfer under the United Nations Framework Convention on Climate Change (FCCC).

Mexico's Interests and Objectives in TCAPP

Clean and efficient use of energy has long been an objective of Mexican public policy. A rich supply of energy resources has fueled rapid growth in demand. Increasing use of energy is an important part of Mexico's economic development, but is also a major environmental problem. Energy-related activities contribute to a variety of environmental problems, including global climate change. Mexico's contribution to global greenhouse gas (GHG) emissions is small, but the country has been an active participant in the FCCC.

Mexico has a history of policies and programs that encourage energy efficiency and renewable energy, implemented in an effort to meet the country's growing demand for energy services in a manner that benefits the economy and the environment. These policies and programs have encouraged deployment of energy efficiency and renewable energy technologies in a wide variety of ways. In Mexico, as in any large modern economy, the purchase and installation of up-to-date technologies involves the international business community. Mexico delivers much of its own technology and services, but is an active importer and exporter in the energy sector as well.

The TCAPP program in Mexico is oriented to obtain greater support, in the country and internationally, for the implementation of established priorities in energy efficiency and renewable energy and continues with the efforts developed by several public and private institutions. Mexico's interest in TCAPP is based on the fact that technology cooperation can further these established priorities, which include the expansion of two pilot projects into large-scale national programs and the start-up of a major renewable energy initiative. Mexico is in Phase II of TCAPP, which includes exploring actions that can be taken by Mexican organizations, international donors, and private businesses to support these priorities.

The participation of Mexico in TCAPP supports the goals of Mexico's National Climate Action Plan. The primary focus of Mexico's National Climate Action Plan is to reduce greenhouse gases and support the development goals of Mexico. Representatives from INE played a major role in developing the National Climate Action Plan and also participate on Mexico's climate negotiations team. INE's participation in TCAPP provides an important link to the international climate community and to the FCCC.

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Priority Selection

Over the past year, the TCAPP Mexico team has developed a technology cooperation framework that fits within the government of Mexico's development goals. CONAE developed the draft framework, which includes three priority technology areas:

- Efficient lighting in public buildings
- Solar water heating for residential and commercial uses
- Improved steam generation and distribution systems.

The strength of these program areas is that they build on pilot projects and studies that CONAE has already initiated, thus facilitating multiagency buy-in to the concepts.

To select the priorities, CONAE developed selection criteria and adopted the three priorities that had already been established as national programs. The selection criteria included activities with known potential to create significant impacts by technologies with proven technological and economic viability. Based on experience with energy efficiency and renewable energy programs, technologies were selected based on their potential impacts in the following areas:

- Reductions in fossil fuel consumption and related emissions
- Economic payback (i.e., private sector growth, new jobs) as related to level of investment needed
- In-country private sector involvement (i.e., manufacturing capacity), assisted by international technology cooperation.

During a series of meetings in July 1999, several actions for each technology priority were identified, and a decision was made to first focus on two of the priorities: expansion of the efficient lighting in public buildings program, and expansion of a solar water heating pilot program. The TCAPP team will focus on the third priority, improved steam generation and distribution systems, after investment actions are initiated for the other two technology priorities.

Strategy and Action Development

Efficient Lighting Program

The Efficient Lighting Program (ELP) is a nationwide, mandatory program aimed at reducing by at least 20% the energy use of the lighting systems in



This meeting of Mexican National Commission for Energy Conservation (CONAE) officials with international technical consultants and the lead coordinating institution for Mexico TCAPP contributed to the design of investment actions for the priority technology areas. Pictured from left to right are Charles Hanley, Sandia National Laboratories; Jeannie Renne, NREL; Daniel Shepherd, consultant, Inter-American Development Bank; Ubaldo Inclán and Gerardo Oseguera, CONAE.

1,000 of the largest federally owned and/or operated buildings. This will save an estimated 1,600 GWh (270 GWh per year during a six-year period), and will result in the replacement of nearly 1.3 million luminaires. While the program focuses primarily on lighting systems, a strategy to include air-conditioning systems is also being developed. Further outreach activities will be conducted in an effort to utilize related, voluntary activities in the private (commercial) sector.

To expand the ELP, CONAE will submit proposals to the World Bank and other donors for funds to develop mechanisms to assure the quality and performance of the lighting retrofits. The goals that CONAE identified to expand the program include:

- Expanding the identification of the energy savings potential in public and private buildings, primarily in the lighting systems
- Creating a demand for services, products, and equipment necessary to achieve energy efficiency
- Developing a database of public buildings that will allow the definition of benchmarks for buildings
- Linking with financial organizations and/or investors to implement the recommended actions to achieve energy efficiency.

The TCAPP team is planning investment actions in order to assist CONAE in the expansion of the ELP. One of these actions is to hold an energy services company (ESCO) workshop to draft a plan for a pilot project that could involve ESCOs in some of the buildings in the program. There are many Mexican companies interested in pursuing

ESCO work in Mexico, though ESCO presence is not strong in the country at this time.

In this activity, CONAE and the TCAPP team will identify Mexican companies interested in becoming ESCOs. CONAE will also identify the technical and organizational requirements to become an ESCO. TCAPP will assist by identifying international ESCOs, as well as technical experts to attend or sponsor the workshop. In addition, TCAPP will research how to create incentives for ESCOs in Mexico, based on experience in other countries. The anticipated result will be a draft plan for an ESCO pilot project that will directly expand the ELP, by encouraging the creation and operation of both domestic and foreign ESCOs in Mexico.

Solar Water Heating Program

Solar water heating systems have been manufactured in Mexico for more than 50 years. As of March 1998, more than 25,000 m² of solar collectors were in operation at several sites in the country. Most of these systems are used to heat water for swimming pools owned by high-income families, but a market for commercial, industrial and residential uses is growing. Recent increases in liquefied petroleum gas prices have created new opportunities for domestic solar water heating. Analyses performed by CONAE show that flat-plate collectors installed in houses in Mexico City for domestic water heating will pay for themselves in just two years.

The main objective of the Solar Water Heating Program is to design a large-scale program, together with the necessary regulatory framework and institutional capabilities, for the use of water heating systems in the Metropolitan Zone of the Valley of Mexico (MZVM), to reduce the use of LPG, in order to moderate the present and future use of fossil fuels and to mitigate the emission of both local and global pollutants.

CONAE and the TCAPP team, along with other key Mexican organizations such as the National Association of Solar Energy, the National Ecology Institute, and Mexico's Autonomous University's Energy Program, will:

- Develop a proposal, with World Bank support, for a large-scale program for the use of solar water heaters in the MZVM; this program shall be the base for the establishment of similar ones in other regions all over the country
- Develop a set of voluntary standards for the systems, as well as for their installation and

maintenance procedures

- Develop financial mechanisms for the installation of solar water-heaters in the residential and commercial sectors, including the development of proposals for additional donor agency funding
- Identify testing laboratories and a certification organization for those standards.

Another TCAPP solar technology priority is to assist in the planning and organization of the Solar Millennium 2000 Forum. The goal is to attract a broad array of investors to Mexico and to discuss renewable energy policies. The Secretary of Energy, together with the International Solar Energy Society, the National Solar Energy Society of Mexico, and CONAE will hold this forum on September 17-22, 2000. The forum will consist of a series of seminars, workshops, individual matchmaking meetings, and a trade show. TCAPP will assist in the planning of Solar 2000 by:

- Identifying potential sponsors of the forum —private sector and donor support
- Helping to attract international companies
- Identifying and inviting companies to participate in the trade show.

Nationwide Expansion of Steam Generation and Distribution Systems

This Steam Generation and Distribution Systems Program is based on a pilot project that CONAE carried out with the support of U.S. Agency for International Development. The pilot activity allowed the analysis of 37 large and small installations that use steam in their processes. Besides the impact it has had on these installations, the program helped identify potentials for a large-scale program. The initial goal of the steam generation and distribution systems program is to increase by 20% the energy efficiency of three hundred steam generation and distribution systems in privately owned installations. This will result in overall energy savings on the order of 14.3 Peta Joules (4.3 x 10¹⁵ Joules)/year. The program will operate for two years, extend nationwide, and involve at least three hundred privately owned systems.

During a July 1999 TCAPP scoping meeting held at CONAE, a decision was made to focus on the steam generation program after investment actions have been initiated for the other two technology priorities.

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Table 5. Mexico TCAPP Timeline

Activity	Date
Previous Activities	
International Workshop, NREL, Golden CO	November 1997
Initial TCAPP Consultation	March 1998
Technology Cooperation Framework Development	April–October 1998
Technology Cooperation Framework Presented at Donor Workshop, Washington DC, USA	October 1998
Informal presentation of the TCAPP framework to the Inter-institutional Committee on Systems for Environmental Management and Sustainable Government, Mexico City, Mexico	November 1998
TCAPP Strategy Meetings	April–July 1999
Efficient Lighting Program proposal submitted to World Bank–build TCAPP activities from proposal	July 1999
Next Steps	
TCAPP's work plan for the period 1999–2000	September 1999
Involvement of foreign and domestic institutions in the programs	September–November 1999
Catalog of concepts for energy efficiency lighting projects	September 1999–January 2000
Solar Water Heating Program proposal to World Bank	September 1999
Working groups coordination for the development of Mexican standards on solar water heating	September 1999–February 2000
Follow-up on the design and implementation of the large-scale program for solar water heating	September 1999–2000
Follow-up on the implementation of energy efficiency program for lighting systems	September 1999–2000
Support for the organization of the event Solar Millenium 2000	September 1999–August 2000
Organization of ESCO workshop	To be defined
Support for CONAE's website updating	September 1999–2000

Conclusion

CONAE and the TCAPP team recognize that there is an enormous energy saving potential in Mexico and are discussing several actions regarding energy savings that will also contribute to GHG mitigation. These actions will be performed first for the MZVM. One of the most important activities in the indicated period (Sept. 1999–Sept. 2000) will be the organization of an ESCO workshop. Representatives from international donor agencies will be invited along with national Mexican corporations who might be interested in becoming an ESCO. The outcome of this event will be the ability to analyze more energy saving potential, to encourage Mexican ESCO participation, and to explore mechanisms to incorporate efficient technologies and to attract financing.

The Philippines

This chapter was authored by Undersecretary Cyril del Callar, Philippines Department of Energy, with assistance from the National Renewable Energy Laboratory.

The Philippines has been active in the Technology Cooperation Agreement Pilot Project (TCAPP) program since its inception. This chapter describes the accomplishments of the Philippines TCAPP team, including descriptions of priority selection, action development, and implementation. By participating in TCAPP, the Philippines is looking at possible technology transfer models. However, the country's participation in TCAPP does not indicate an official Philippines position with respect to technology transfer.

The Philippines is implementing TCAPP because the project provides an opportunity to address governmental sustainable economic development priorities. Most important among those priorities is improving energy services to support economic development in rural areas. The government of the Philippines seeks to improve these services using clean energy technologies due to concerns about climate change.

The Philippines' vulnerability to climate change impacts and the projected growth of its greenhouse gas (GHG) emissions contribute to the government's active role in the U.N. Framework Convention on Climate Change (FCCC) negotiations. One example of the government's proactive stance on climate issues is its participation in TCAPP. The following objectives of the Philippines National Action Plan on Climate Change guide the approach to TCAPP:

- To integrate climate change concerns into the country's national development plans and programs;
- To develop adaptation responses to climate change impacts;
- To design mitigation measures which are "no regrets"¹ in character.

Policies conducive to sustainable economic development are crucial to implementing climate actions. Therefore, the initial focus of investment action for TCAPP in the Philippines was to research and recommend policy reforms that would facilitate private investment in clean energy technologies. The resulting approval of "Fast Track Action Recommendations" by Secretary Tiaoqui (Department of Energy) represents a significant accomplishment of the TCAPP effort during 1999. As this and other investment actions proceed, Philippines implementation of TCAPP supports the National Action Plan to address climate change in a manner

consistent with the preeminent concern of the government for economic development.

Table 1 on the next page shows a timetable of significant activities of the Philippines TCAPP team.

Priority Selection

The Philippines TCAPP activities started in November 1997, through an international workshop to design TCAPP. The process for setting TCAPP priorities included a series of steps, as shown in Table 6 (1. Country teams formed. 2. Establish prioritization process. 3. Compile information on technologies and barriers. 4. Select technology cooperation priority areas. 5. Prepare technology cooperation framework. 6. Prepare strategy and select actions. 7. Design actions to address legal and institutional barriers. 8. Design investment actions. 9. Implement technology cooperation actions 10. Evaluate lessons learned.) The Philippines country team (step 1) has forged strong ties to President Estrada's administration by linking TCAPP to the government's poverty alleviation goals through the Office of the President's National Anti-Poverty Commission. The country team includes participation from technical contacts, interagency coordination, a lead coordinating government institution, international technical

¹ Measures that can be justified for other reasons besides mitigating GHG emissions.

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Table 6. Philippines TCAPP Team Activities and Events

Actions	Date
• Participation in NREL international workshop to design TCAPP	November 1997
• Participation in COP-3 event	December 1997
• Consultation to initiate TCAPP activities	March 1998
• Preparation of Technology Cooperation Framework	August–September 1998
• Presentation of Framework at Donor’s Meeting	October 1998
• Philippines delegation highlights TCAPP in intervention at COP-4	November 1999
• Actions development begins: P-DOE request for Fast Track Actions	December 1998
• Industry consultation on Fast Track Actions	December 1998–February 1999
• Development of Fast Track Actions	February 1999
• Secretary Tiaoqui’s approval of Fast Track Action Recommendations	March 1999
• Fast Track Action Recommendations finalized and implemented	June–December 1999
• Develop and implement other investment actions	June–December 1999

experts, an international business network, and international development organizations. Preferred Energy Incorporated (PEI)² served as technical contact, guiding TCAPP efforts as a contractor. Members of the Renewable Energy Network of the Philippines and Manila Observatory (MO), the lead climate research institution, have provided the technical direction for the TCAPP Philippines process. Government agency contacts in the Office of the President, National Anti-Poverty Commission, the Department of Energy, and the Department of Environment and Natural Resources (DENR) have provided technical and policy direction for the TCAPP efforts. The Department of Energy, through the Energy Utilization Management Bureau serves as the lead coordinating institution. International technical experts have consulted with Philippines counterparts and provided information on technologies during the TCAPP International Donors Meeting in October 1998. The international business network and international development organizations have received periodic updates on Philippines TCAPP progress.

Preparation of a Philippines framework document to express technology cooperation priorities (steps 2-5) involved collecting technology and project information, selecting priorities, defining

barriers and actions for each priority area, defining key barriers to investment, developing proposed actions to address barriers, and preparing and adopting a framework to describe priorities, barriers, and proposed actions.

The Philippines Department of Energy (P-DOE) Philippines National Oil Company– Energy Research Division, and NREL prepared a work plan for the preparation of the framework document, and requested the assistance of the Institute of Climate, Energy and Environment and the MO in developing further the Technology Cooperation Framework. This framework development team began work by gathering data and reviewing past and present projects on energy efficiency and renewable energy. Gaps in data on projects and technology were identified and filled. The framework development team developed TCAPP priority selection criteria (see sidebar on next page) that had already been established in other national programs and activities³.

The framework development team refined the priorities that it had identified, using a consultative workshop. Then, it wrote the Philippines framework, describing the priority setting process, the priorities that were selected, the barriers, and the actions to address those barriers. The Philippines delegation to the TCAPP International Donor’s

² “A nonprofit organization that promotes renewable energy, energy efficiency and demand-side management in the Philippines” (PEI Corporate Profile).

³ Data and priorities from the following contributed to the development of the Philippines TCAPP framework:

- a) Renewable energy agenda of the Philippine Renewable Energy Network;
- b) Energy Resources for the Alleviation of Poverty Program of P-DOE;
- c) National Action Plan on Climate Change;
- d) Asia-Least Cost Greenhouse Gas Abatement Project.

TCAPP Priority Selection Criteria

Priorities for TCAPP should:

- Be priorities of the energy efficiency and renewable energy sectors
- Require reasonably achievable financing
- Contribute to social development and improvement of the environment and human health
- Have commercial potential
- Develop enabling mechanisms and build capacity.

Workshop in October 1998 from the P-DOE and the President’s Office included presentation of the framework in its remarks.

The TCAPP priorities that were identified in the Technology Cooperation Framework center on three areas: renewable energy for rural development, energy efficiency and demand-side management, and cross cutting technology support-policy development. Active participation of P-DOE during the past year has been important to align implementation of the TCAPP priorities with government goals. In particular, because poverty alleviation is the prevailing emphasis of President Estrada’s administration, renewable energy for rural economic development is of highest importance. The actions that have been undertaken in the past year to address the priorities reflect this emphasis, as shown in Table 7.

Although the implementation of the cross cutting technology support (policy development) priority and the renewable energy for rural development priority is more advanced than implementation of energy efficiency and demand-side management, all three priorities remain important to TCAPP efforts. The goals and rationale for each of these priorities is described below.

Renewable energy for rural development was selected because development of rural areas of the Philippines is fundamental to the poverty alleviation goals of the Government of the Philippines. This TCAPP priority supports P-DOE’s goals for rural electrification that are likewise focused on the alleviation of poverty. Renewable energy systems can provide energy for a wide variety of rural applications, increasing the productivity of agriculture, manufacturing, and commercial enterprises in rural areas.

Energy efficiency and demand-side management was selected as a TCAPP priority because this area represents an opportunity for very large GHG-emission reductions at relatively low cost, while providing economic benefits associated with lower energy expenditures and improved balance of trade, and enhancing national energy security. Within this area, efficiency of industrial boilers and energy efficient appliances and equipment were considered especially important.

Cross cutting technology support was considered a priority because cross-cutting information and policy actions play a crucial role in facilitating the transfer of clean energy technologies. Crucial technology support includes Renewable Energy/ Energy Efficiency (RE/EE) Technology Center and Policy Development. The RE/EE Technology Center would aid market development through improved understanding of the target clients, demand, and end-use applications, providing information services to project developers, policy-makers, researchers, and others to support their RE/EE projects and programs. The policy development area was identified because clear policies and consistent implementation of those policies are a necessary condition for commercialization and market development of RE/EE. Furthermore, the need for implementation of new policies has been a barrier in the Philippines.

Table 7. Status of Philippines Technology Cooperation Priorities Identified in Framework

Priority	Status
Renewable energy for rural development	Investment actions encourage renewable energy market development Linked to poverty alleviation
Energy efficiency and demand-side management	Actions under development
Cross-cutting technology support	Fast track actions recommended and implemented

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A consultation meeting in March, 1998 endorsed the Philippines participation in TCAPP and the Department of Energy as the lead agency.

Strategy and Action Development

To develop TCAPP actions (steps 6-8) based on the Technology Cooperation Framework, the National Renewable Energy Laboratory (NREL) organized a series of consultations (December 14-18, 1998) with representatives from the Office of the President, P-DOE, DENR, U.S. Agency for International Development (USAID), NREL, PEI, ICEE, and the Philippines Renewable Energy Industry to select actions for immediate development and implementation. During these meetings, participants decided that TCAPP should first address one of the TCAPP priorities: policy development. TCAPP would recommend policy reform actions that P-DOE could take to stimulate market activity in clean energy technologies, because such actions were considered necessary for strong private investment.

P-DOE agreed to consider these options and select actions for implementation from the recommendations. Through this process, P-DOE would demonstrate its commitment to renewable energy market development. After identifying the options and supporting their implementation, TCAPP would also communicate these results to industry and the international development community to show the steps that DOE is taking to remove market barriers. The process and results of these Fast Track Action Recommendations is described in greater detail below.

In addition to the development of the Fast Track Action Recommendations and facilitation of the recommended policy reforms, TCAPP is initiating

other investment actions that are now being selected and defined, and for which implementation is being planned.

Implementation

The first investment action to be implemented (steps 9-10), the fast track actions, addresses the TCAPP priority areas that are most directly related to poverty alleviation: cross-cutting technology support and renewable energy for rural development.

Fast Track Action Recommendations

The Philippines TCAPP team, with NREL technical assistance, addressed the policy development area of the cross-cutting technology support priority by developing the Fast Track Action Recommendations to identify a set of actions that P-DOE could take to stimulate renewable energy market activity (see sidebar). Market development, especially in rural areas, supports the poverty alleviation goal of the Estrada administration. In December 1998, P-DOE therefore requested recommendations on policy actions that it could take, independent of legislative or other actions, to encourage the development of renewable energy markets.

In response to this request, NREL and PEI consulted with the renewable industry in the Philippines to identify high-priority policy barriers to address. They also provided information about the initiative to the international business network through the Business Council for Sustainable Energy (BCSE). Drawing upon these consultations with industry, NREL and PEI developed the fast track action recommendations, and presented



Secretary of Energy Mario Tiaoqui accepted the TCAPP "Fast Track" recommendations in March, 1999 and directed staff to develop an implementation plan.

Summary of Fast Track Action Recommendations

(Note: The following reflects the recommendations from the TCAPP team. The final form of implementation may differ, and is determined through normal P-DOE processes)

Revise New and Renewable Energy (NRE) Project Accreditation Requirements

A suite of revisions to these accreditation requirements⁴ would facilitate renewable energy projects, especially small projects that could contribute to rural economic development. These would:

- Clarify accreditation requirements
- Revise the thermal efficiency requirement for cogeneration projects
- Remove the “spinning reserve requirement” for small NRE generation projects
- Remove the ten-year power purchase agreement requirement, and the associated requirement for DOE review and approval of power development plans of certain distribution utilities
- Review all pertinent P-DOE regulations to identify those that discourage development of reasonably priced NRE
- Revise the definition of NRE used by the National Power Corporation. P-DOE should clarify that the definition of NRE that is now in the energy regulations will be applied and enforced by P-DOE in the future.

Exercise Full P-DOE Powers Under the Mini-Hydro Law

The Mini-Hydro Law gave P-DOE broad powers to consolidate permitting and accreditation processes and to promote policies to facilitate mini-hydro development. DOE should use its authority more aggressively, because current permitting and accreditation processes impose barriers to project development.

Use the Host Community Fund (HCF) for NRE Development

Communities that energy installations affect, “host communities,” are entitled to benefits (because of the negative impacts of the installations), but the guidelines for planning compensatory projects do not include NRE projects as acceptable for proposal by communities. This exclusion is apparently based on the belief that host communities, being close to generation, have access to the grid. Non-Conventional Energy Division can confirm that this is the exception, not the rule. P-DOE should convene a task force charged with developing an approach that maximizes the ability of the HCF to contribute to rural electrification and economic development.

Revise Executive Order 462

Executive Order (E.O.) 462 was intended to encourage NRE. However, in practice it raised barriers to NRE and discouraged private investment, because it incorporates prior government policies governing the extraction of depletable resources. E.O. 462 should be revised to remove these barriers, and to offer new incentives for NRE development and use.

Issue New Policy Statement on NRE

P-DOE should issue an NRE Policy Statement using whatever means appropriate and normally available to the department for such a purpose. P-DOE could incorporate the new policy in a Revised E.O. 462.

⁴ Accredited NRE projects receive regulatory advantages.

them to P-DOE. Secretary Tiaoqui accepted the recommendations and directed P-DOE to develop an implementation plan in March 1999. Through coordination and consultation within P-DOE and its attached agencies, this plan was developed and is being finalized. Full implementation of selected actions will immediately follow.

P-DOE's interest in pursuing policy reform to facilitate market development builds upon its previous efforts to streamline renewable energy policy. For example, Executive Order 462 was an initial step towards improved renewable energy policy, and P-DOE is implementing one of the recommended fast track actions to revise that executive order. Also, the previous efforts, consultations, and experience of PEI and

Philippines industry laid the groundwork for the development of the fast track action recommendations themselves.

P-DOE (Energy Planning and Monitoring Bureau, Energy Utilization Management Bureau, Non-Conventional Energy Division, Mini-Hydro Division, and Energy Information Administration Bureau) and the National Power Corporation (Strategic Power Utilities Group, Corporate Planning) are the primary institutions involved in implementation of the fast track actions. These institutions convened an implementation planning meeting on June 17, 1999, and on July 22, 1999, prepared a memo with the implementing language for a Department Circular amending Energy Regulation 1-95, amending Department Circular 97-01-001,

Table 8. Details for Actions for Renewable Energy for Philippine Rural Development

Action Description	Lead Agency	Status	Next Steps
Policy actions to facilitate renewable energy development	P-DOE	P-DOE is implementing selected actions from Fast Track Action Recommendations	See individual fast track action, below
<ul style="list-style-type: none"> Revise New and Renewable Energy project accreditation requirements 	P-DOE	Fast Track Action Recommendations	For implementation
<ul style="list-style-type: none"> Exercise full P-DOE powers under the Mini-Hydro Law 	P-DOE	Fast Track Action Recommendations	For implementation
<ul style="list-style-type: none"> Use the Host Community Fund for NRE development 	P-DOE	Fast Track Action Recommendations	For implementation
<ul style="list-style-type: none"> Revise Executive Order 462 	P-DOE	Fast Track Action Recommendations	To be completed by December 1999
Additional investment actions to facilitate international private-sector investment	P-DOE ⁵	Selection process for investment actions is underway	Actions to be selected by December 1999

⁵ In consultation with the Philippines Inter-Agency Committee on Climate Change.

and proposing amendments to Executive Order 462. Once they take effect, these amendments will implement the Fast Track Actions.

Future Investment Actions

Similar to the selection of the Fast Track Actions, additional investment actions will be selected through a participatory process of consultation. These actions will remain focused on renewable energy for rural economic development, including policy development and technology information in support of that priority.

The implementation of TCAPP investment actions to date shows that the TCAPP Philippines team, with technical assistance from NREL, has been effective in removing barriers to private investment in clean energy technologies. Implementation of the Fast Track Actions will be the first in a set of investment actions to facilitate market development of renewable energy markets, with an emphasis on rural economic development.

Table 8 shows an overview of the status and timing of the entire set of investment actions.

Similar to the selection of the Fast Track Actions, additional investment actions will be selected through a participatory process of consultation. These actions will remain focused on renewable energy for rural economic development, including policy development and technology information in support of that priority.

Conclusion

Through its initiative in TCAPP, the Philippines DOE has improved the policy environment for renewable energy market development. The next steps for the TCAPP effort will further facilitate private sector investment in renewable energy markets. The Philippines will continue its international leadership in sustainable economic development and active role in climate initiatives, with TCAPP as one example among many.

Republic of Korea

This chapter was authored by Mr. Jong Whan Noh, General Manager, Center for Climate Change Mitigation Projects, Korea Energy Management Corporation.

Korea joined the Technology Cooperation Agreement Pilot Project (TCAPP) in January 1999. The Ministry of Commerce, Industry and Energy (MOCIE) of the Republic of Korea designated Korea Energy Management Corporation (KEMCO) to lead the implementation of technical TCAPP activities for Korea. NREL (National Renewable Energy Laboratory) is leading implementation of the TCAPP work in Korea for the United States, in partnership with the U.S. Environmental Protection Agency (USEPA), the United States Asia-Environmental Partnership (US-AEP), the U.S. Agency for International Development, and the U.S. Department of Energy.

In July 1999, KEMCO and NREL signed a memorandum of understanding to implement TCAPP-Korea. KEMCO intends to provide appropriate Korean expertise to collaborate with NREL and other U.S. experts in achieving the objectives of this agreement. The role of NREL is to provide technical support and guidance to KEMCO for the implementation of the project, particularly focusing on involvement of the international private sector.

The purpose of this project is to find opportunities for international cooperation to accelerate investment in clean energy technologies which will address development needs and reduce greenhouse gas emissions in Korea. The United States and Korea are evaluating TCAPP as a model for assessing technology transfer potential in support of Article 4.5 of the United Nations Framework Convention on Climate Change.

The general approach of TCAPP is to

- (1) identify priority energy technologies which support the sustainable development priorities and simultaneously reduce greenhouse gases, and to*
- (2) identify the barriers to the application and dissemination of those technologies and design actions to overcome these barriers.*

Priority Selection

Since 1988, the Korean government has supported the research and development (R&D) activities of energy technologies in the fields of energy conservation, alternative energy, and clean energy technology. The government is also actively promoting the demonstration and dissemination of R&D results for commercialization. Despite these efforts, there still remain numerous barriers such as:

- Cost
- Lack of funds
- Immature technology
- Inefficient institutional systems.

To overcome these barriers, Korea established a ten-year energy technology development plan in 1997 and has entered the implementation stage.

Korean experience in the field of clean energy technology development and dissemination tells us the barriers of technologies with high GHG-mitigation potential are complex and difficult to remove. In

addition, it is not the public sector but private companies that actually exchange clean energy technologies and know-how. It would be very difficult to garner active participation of private companies that are not confident in their real benefit from this project on the basis that the project will have significant GHG reduction potential or the possibility of making a considerable contribution to sustainable development of the national economy.

The TCAPP-Korea team feels it is important to try to establish successful examples and operating mechanisms that will encourage private companies to come to KEMCO and NREL for assistance. The project should not focus on expending a great amount of time compiling lists of technologies for cooperation.

Therefore, the TCAPP team selected those priority technologies considered most likely to result in actual cooperative projects. That is, we are proposing international cooperation projects related to removing rather simple and clear barriers first,

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and will enlarge the scope incrementally as our technology cooperation capacity grows.

To select the priority technologies, KEMCO utilized the experience of planning and implementing the ten-year Energy Technology Development Plan (ETDP) and held a scoping meeting in March 1999 to consult the interagency steering committee of TCAPP-Korea. Technology research committees were established for 20 priority energy technologies selected during the development of the ETDP. These committees act as advisory groups, providing additional technical support to facilitate this endeavor.

The four criteria of TCAPP-Korea for the selection of priority technologies are as follows:

1. The technology must be close to commercialization (pre-commercialization stage or pre-standardization stage)
2. The application of the technology needs some intervention by public institutions: (public oriented technology)
3. TCAPP Korea must succeed in creating a demonstration case. (trigger-effect to create new markets with advanced technologies)
4. Given the various barriers related to technology transfers, TCAPP-Korea, as a means to conduct meaningful cooperation, welcomes the “know-how” of soft technologies such as energy management systems. There are many cases in which new facilities for energy efficiency were already introduced but they seldom reach the designed operational efficiencies due to incomplete transfer of technical and managerial skills. We are interested in the ‘software’ that means scientific and engineering knowledge as well as managerial and operational skills.

Three priority technologies were selected under these criteria for the development of cooperation framework regarding barriers, GHG-mitigation potential and market potential study. Working groups were formed to pursue each technology. The technologies are:

Energy Management

(Know-how in energy management, advanced energy auditing and ESCOs, etc.)

- Present the issues of the climate change convention and the purpose of TCAPP-Korea in the ESCO meetings hosted by KEMCO, to identify concerns about this initiative
- Comprise a working group to summarize experience in this field and to explain barriers to implementation and our needs for cooperation
- Prepare a concept paper including suggestions

for holding a joint meeting in Korea

- Review comments from the U.S. ESCOs and develop a detailed work plan for further cooperation. This work plan will define specific actions to be implemented to help attract investment in this technology and the roles of institutions in implementing these actions
- Upon receiving a positive response, prepare a detailed proposal for cooperation projects including GHG reduction potential, total cost, domestic funding sources available, proposed international funding amount, schedule for implementation, etc.

Methane Recovery from Organic Waste

- Summarize experience for this technology application including assessment on the cost-effectiveness and GHG reduction of two pilot plants currently being operated
- Assess the potential GHG reduction possible if fully implemented
- Explain barriers to implementation and needs for domestic action and donor support
- Prepare a concept paper for review and comments from international business community
- Upon receiving a positive response, prepare a detailed proposal for cooperation projects including GHG reduction potential, total cost, domestic funding sources available, proposed international funding amount, schedule for implementation, etc.

Waste Energy Recovery Using Heat Pumps

- Consult the unused energy utilization technology research committee, heat pump manufacturers, and other experts in this field to summarize our experience and find out their needs for international cooperation
- Convene a meeting of experts to exchange past experiences on the issues at hand as well as discussion on the purpose of TCAPP and its expected outcomes.
- Comprise a working group and prepare a concept paper
- Based on comments from the international business community, develop a detailed work plan for further cooperation. This work plan will define specific actions to be implemented to help attract investment in this technology and the roles of institutions in implementing these actions
- Upon receiving a positive response, prepare a

detailed proposal for cooperation projects including GHG reduction potential, total cost, domestic funding sources available, proposed international funding amount, schedule for implementation, etc.

Strategy and Action Development

Working Group 1 (WG1): Energy Management

TCAPP-Korea Working Group 1 was formed in June 1999 to find the opportunities for international cooperation in the area of energy management. Three ESCO companies and three KEMCO staff participated in the working group and prepared the concept paper that identifies the need for cooperation, GHG reduction potential and market opportunity, barriers and possible actions to address them, and the scope of the cooperative activities.

A joint meeting, energy auditor exchange, and three joint projects were suggested in the concept paper. The expected role of each participating organization is as follows:

1. Korean ESCOs find and coordinate prospective cooperation projects.
2. Foreign ESCOs provide technological support and search for international funding sources in cooperation with NREL.
3. KEMCO provides co-financing in consultation with the government.
4. NREL and KEMCO facilitate communication between private companies and try to get supporting funding from US-AEP and other sources.
5. If the result of energy auditing is favorable and funding sources are arranged, ESCOs of both countries implement the joint project.

KEMCO sent the concept paper to NREL and NREL distributed it initially to ten companies seeking their responses and comments.

Working Group 2 (WG2): Methane Recovery from Organic Waste

TCAPP-Korea Working Group 2 was formed in June 1999 to find opportunities for international cooperation in the area of recovering methane from organic waste. Korean government, research, and industry representatives have been

appointed to the working group. WG2 has begun work preparing a concept paper that identifies needs for cooperation, GHG reduction potential and market opportunity, barriers and possible actions to address them, and the scope of the cooperative activities.

Working Group 3 (WG3): Waste Energy Recovery Using Heat Pumps

TCAPP-Korea Working Group 3 was formed in June 1999 to find the opportunities for international cooperation in the area of recovering waste energy using heat pumps. Korean government, research, and industry representatives have been appointed to the working group. WG3 has begun work preparing a concept paper that identifies needs for cooperation, GHG reduction potential and market opportunity, barriers and possible actions to address them, and the scope of the cooperative activities.

Future Plans

If NREL and KEMCO receive favorable responses from the international business community on the concept paper of TCAPP-Korea WG1, a joint meeting will be held in Seoul in September 1999 for detailed discussions on the joint projects and the exchange program.

KEMCO is using a similar methodology regarding methane recovery from organic waste and waste heat recovery using heat pumps, as they did with WG1.

- KEMCO is asking guidance from the Technology Research Committee and other experts about their experiences and opinions on the need for international cooperation in each technology area.
- In cooperation with experts, KEMCO will prepare a concept paper and distribute it to the international business community through NREL.
- At the end of this year, KEMCO will summarize the activities and the concept paper of each technology area to prepare the technology cooperation framework and the work plan for further cooperation.

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Table 9. TCAPP-Korea Timeline (tentative)

The following schedule can be changed according to the responses of international business community and the schedule of each cooperation project.

Actions	Date
• Prepare concept papers for methane recovery and waste heat recovery	August 1999
• Review responses and comments on the concept paper of WG1	August 1999
• Inform the steering committee and request their guidance	August 31, 1999
• TCAPP-Korea WG1 joint meeting	September 1999
• Review comments on the concept papers for methane recovery and waste heat recovery	September 1999
• For the technologies receiving favorable responses, define the most promising actions and develop a detailed work plan	October 1999
• Draft Technology Cooperation Framework	October 1999
• Strategy and methodology for next phase of TCAPP	October 1999
• Inquire the opinions of donor through NREL and ask the steering committee for their guidance	October 31, 1999
• Finalize technology cooperation framework	November 1999

Conclusion

TCAPP-Korea is in its initial stage of implementation, it is not easy to tell whether TCAPP is a good model for technology cooperation. During the course of the work outlined above, the TCAPP team will evaluate the applicability of this approach as a model for technology transfer to reduce greenhouse emissions.

Flexibility is important to the success of TCAPP projects. Between Phase I and Phase II, we can implement various steps which depend on the concrete circumstances of each country and each technology. Each project and each technology could have its own form and characteristics of cooperation. Each project must be designed to a specific form. Each project should be designed in the most effective approach possible to satisfy its own characteristics. The example is a demonstration case, a workshop, exchange of information and international partnership, etc.

Southern African Development Community

This chapter was prepared by the Southern African Development Community
Environment and Land Management Sector.

The 14 countries in the Southern African Development Community (SADC) are preparing a regional program to assess their needs in the area of clean energy technology. This effort is designed to identify the clean energy technologies that have the greatest potential across the SADC region for meeting sustainable development needs while reducing greenhouse gas emissions through accelerated private investment and to assist the SADC countries in mobilizing this investment. The SADC Environment and Land Management Sector (SADC ELMS) in Maseru, Lesotho, which will administer the project, is currently facilitating the project's approval process within the SADC system.

The Southern Center for Energy and Environment, an energy and environmental research organization based in Harare, Zimbabwe, will assist SADC ELMS in project implementation. Technical and financial support is provided by the National Renewable Energy Laboratory (NREL) on behalf of the Climate Technology Initiative¹ (CTI) and the U.S. government. NREL is assisting CTI in implementing a program referred to as the Cooperative Technology Implementation Program that is similar to TCAPP. Through this program, CTI promotes the diffusion of climate friendly technologies.

This initiative is a response to a request for a regional needs assessment by ministers and other senior SADC officials attending the CTI Industry Joint Seminar on Technology Diffusion in Southern Africa on March 17-18, 1999 at Victoria Falls, Zimbabwe. This project is aimed at applying the TCAPP approach from the work with other countries at a national scale to this regional effort conducted in collaboration with the Climate Technology Initiative.

Goals

The project goals were defined over a number of consultations and consolidated into a work plan at a special meeting of SADC officials in Zambia in May 1999 to develop and refine the project work-plan.

- Identify shared priorities within SADC for attracting investment in clean energy technologies that will meet sustainable development objectives and reduce greenhouse gas emissions.
- Develop a cooperative technology implementation plan that identifies actions that SADC countries and regional institutions can undertake in partnership with international donors and the private sector to accelerate investment in these technologies.
- Assist SADC in securing international donor support and private sector participation in

implementation of actions to attract private investment.

- Enhance the technical and institutional capacity of SADC countries and regional institutions to attract international investment in clean energy technologies.

Activities

A detailed project workplan is currently being finalized in consultation with SADC ELMS and was presented to a wider spectrum of SADC stakeholders on September 13-17, 1999, during a regional clean energy scoping workshop in Gaborone, Botswana. This workshop started the process of selecting priority clean energy technologies for the SADC region. Participants at this conference identified appropriate next steps to define market barriers and potential actions to overcome these barriers and attract investment for these priority technologies.

¹ The Climate Technology Initiative (CTI) is an initiative of developed countries to promote the diffusion of climate friendly technologies.

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Nearly 100 government officials, business representatives, and technical experts from the 14 countries in the SADC region and from the international community participated in this workshop. The selection of priority technologies at this workshop was performed cognizant of a wide range of technological options including soft technologies. This scoping workshop also addressed other climate change capacity building needs of the region.

The project workplan will be sent to the SADC environment ministers for their approval in October 1999. Once the project is approved by the environment ministers, each participating country will initiate consultations with their key stakeholders to refine the priorities discussed at the scoping workshop, identify market barriers, and propose specific actions that could accelerate investment. CTI will provide technical assistance with this process and will get input on market barriers and actions from international business and technical experts.

Future Directions

Developing countries participating in TCAPP are making excellent progress in designing and implementing actions to attract investment in their priority clean energy technologies. Each country's TCAPP team has established direction that shows real promise of producing development benefits for the country while reducing GHG emissions. During the next year, the TCAPP effort will focus on four primary activities:

- *Successful implementation of technology cooperation actions in each country/region.* TCAPP needs to continue to demonstrate to developing countries how climate change technology cooperation will accelerate investment in their technology priorities and meet their development needs. This can only be demonstrated through collaborative implementation of technology cooperation actions in each country or region.

- *Increased private sector participation.* While more than 300 international energy companies are currently participating in TCAPP through the Business Council for Sustainable Energy's TCAPP network, the level and depth of the participation of international and host country businesses and investors needs to be increased as implementation of TCAPP investment actions increases. Private sector participation is critical to ensure that the actions that are implemented are effective at mobilizing private investment in country technology needs and building in-country business capacity. In addition to more active participation by the international energy companies and investors, TCAPP also needs to increase the engagement of in-country businesses and investors that will drive technology deployment in the long term.

- *Enhanced participation of bilateral and multilateral donor organizations.* Several bilateral and multilateral donor organizations are participating in TCAPP and related Climate Technology Initiative work with the countries. NREL will work toward expanding the participation of these donor organizations to help countries secure donor support for key actions that require donor funding. In addition, NREL will continue to encourage these donor organizations to apply the TCAPP approach to other developing countries, as is occurring through the Climate Technology Initiative.

- *Evaluating TCAPP as a model for technology transfer under the FCCC.* NREL will work with TCAPP developing country, business, and donor partners to evaluate the TCAPP approach as a potential model for implementing technology transfer under the Framework Convention on Climate Change. This evaluation will occur through in-country meetings with key climate change and energy officials, international workshops where officials from all of the countries can share their experiences and views with each other, reports and papers on the TCAPP methodology and results, and meetings with international businesses and donors.

TCAPP will continue to be a country-driven program. The TCAPP teams in each country will determine how to best structure the above activities to meet their needs, so the nature of these activities will vary from country to country.

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**Visit the new TCAPP website
at <http://www.nrel.gov/tcapp/>**

Abbreviations

BCSE	Business Council for Sustainable Energy
CTI	Climate Technology Initiative
CTIP	Climate Technology Implementation Program
EC	European Commission
ESCO	energy service company
CCC	United Nations Framework Convention on Climate Change
GHG	Greenhouse Gas
NGO	nongovernmental organization
NREL	National Renewable Energy Laboratory
R&D	research and development
TCAPP	Technology Cooperation Agreement Pilot Project
US-AEP	United States-Asia Environmental Partnership
USAID	United States Agency for International Development
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency

Brazil

ANEEL	National Agency for Electrical Energy
ANP	National Agency for Fuel
CEPEL	Electrical Energy Research Center
CNPq	National Council for Scientific and Technological Development
CNT	National Confederation for Transportation
CONPET	National Program for Oil and Natural Gas Conservation
DNDE	National Department of Energy Development
FBDS	Foundation for Sustainable Development
MME	Ministry of Mines and Energy
MRE	Ministry of Foreign Relations
PROCEL	National Program for Electric Energy Efficiency
PRODEEM	Program for Energy Development in States and Municipalities

China

FETC	Federal Energy Technology Center
LBNL	Lawrence Berkeley National Laboratory
MOST	Ministry of Science and Technology
PNNL	Pacific Northwest National Laboratory
SDPC	State Development Planning Commission
TU	Tsinghua University

Kazakhstan

KazNIIMOSK	Research Institute for Environment Monitoring and Climate
KazNIPIENERGOPROM	Kazakh Research and Design Institute for Energy
KazSEENERGOPROEKT	Kazakh Research and Design Institute for Rural Energy
KEGOC	Kazakh Electricity Grid Operating Company

Republic of Korea

ETDP	Energy Technology Development Plan
KEMCO	Korea Energy Management Corporation
MOCIE	Ministry of Commerce, Industry and Energy
R&D	research and development
US-AEP	United States-Asia Environmental Partnership
WG1	Working Group 1
WG2	Working Group 2
WG3	Working Group 3

Mexico

CONAE	National Commission for Energy Conservation
ELP	Efficient Lighting Program
ESCO	energy services company
INE	National Ecology Institute
MZVM	Metropolitan Zone of the Valley of Mexico

Philippines

DENR	Department of Environment and Natural Resources
E.O.	executive order
HCF	Host Community Fund
ICEE	Institute of Climate, Energy and Environment
MO	Manila Observatory
NRE	new and renewable energy
P-DOE	Philippines Department of Energy
PEI	Preferred Energy Incorporated
RE/EE	renewable energy/energy efficiency

Southern African Development Community

CTI	Climate Technology Initiative
ELMS	Environment and Land Management Sector
SADC	Southern African Development Community



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