

**Methods for Climate Change Technology  
Transfer Needs Assessments and  
Implementing Activities**

**Developing and Transition Country  
Approaches and Experiences**



**March 2002**

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## PREFACE

The Climate Technology Initiative (CTI) has prepared this document to provide developing and transition countries with a summary of methods for conducting climate change technology needs assessments and implementation activities. These methods are based on the experiences of countries that have conducted technology needs assessments and implemented technology transfer programs, as well as the perspectives of technical experts from governments, the private sector, international donor organizations, financiers, and research institutions working in this area. This report is provided for the use of countries undertaking technology needs assessment activities, including countries currently undertaking such assessments sponsored by the Global Environment Facility through the United Nations Development and Environment Programmes (UNDP and UNEP, respectively).

Drawing on these experiences, this report presents the various elements of an integrated framework to promote technology transfer. In order to provide a methodology that is more robust than a series of steps, each major implementation step is discussed in depth, including fundamental elements, recommended steps, variations that can adapt the methods to country-specific considerations, case examples of approaches in different countries, and schematic representations of various processes.

The methods and step-wise approaches presented here are oriented toward a country-driven approach and allow for adjustments to fit national circumstances. Experience has shown that technology needs assessments and implementation activities are most effective when they are undertaken through a strategic approach that brings together a broad based group of stakeholders and considers multiple objectives.

Previous versions of this report have been subject to extensive review so that it now reflects input from an array of experts from developing, transition, and developed countries, and international institutions. The Climate Technology Initiative prepared a first draft of this report in May 2001 with input from various experts. This first draft was discussed and refined during a CTI workshop with over 40 officials and experts from various countries, the UNFCCC Secretariat, the IPCC, UNDP, and UNEP. A second draft was distributed for discussion at COP-7 in October 2001. This document is a third draft that reflects comments received on the second draft distributed at COP-7.

The Climate Technology Initiative wishes to acknowledge and thank many people for their valuable contributions to this report, including the following key contributors from developing countries: Chow Kok Kee (Malaysia), Zou Ji (China), Sheik Mohamed Khan (Guyana), Suk Hoon Woo (Korea), Ubaldo Inclan (Mexico), David Lesolle (Botswana), and Ricardo Sales (Brazil). CTI also would like to thank the various representatives and officials from numerous developed countries and from UNDP, UNEP, the UNFCCC Secretariat, the IPCC, the IEA, and the European Commission that contributed to this report.

## EXECUTIVE SUMMARY

Technology transfer has been the focus of considerable attention in the effort to mitigate and adapt to global climate change. Country experiences with technology transfer activities along with a growing body of literature examining these experiences provides valuable lessons to countries and organizations intending to pursue technology transfer programs. The negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) have created a framework to promote the transfer of technologies. Other important technology transfer initiatives include a Special Report on “Methodological and Technical Issues in Technology Transfer” by the Inter-governmental Panel on Climate Change (IPCC), a consultative process under the UNFCCC, workshops, and other fora supported by a variety of organizations, including the Climate Technology Initiative.

In response to a request from the Parties to the UNFCCC to help countries “identify and submit their prioritized technology needs,” the GEF has made available, through the UNDP, additional financing for capacity building in priority areas, including technology transfer.<sup>1</sup> This document is designed to provide guidance to countries utilizing these funds and other resources to conduct climate change technology needs assessments and implement the resulting plans for technology transfer activities. The document draws from countries’ experiences with these technology transfer activities and the growing body of knowledge on technology transfer issues to produce a step-by-step methodology that nations may undertake to promote the transfer of technologies. Countries are encouraged to adapt these methods to fit their national circumstances and needs.

### **Overview of the Technology Transfer Process**

Successful technology transfer programs have included variations of the following 5 steps:

- 1. Establishment of collaborative partnerships between key stakeholders with the common purpose of enhancing technology transfer.*
- 2. Implementation of technology transfer needs assessments (including both evaluation of alternative technologies and definition of technology transfer priorities).*
- 3. Design and implementation of technology transfer plans and specific actions.*
- 4. Evaluation and refinement of the actions and plans (an ongoing process).*
- 5. Dissemination of technology information.*

Several alternative arrangements and organizational designs have successfully been used to carry out these basic steps. The following discussion, along with the schematic at the end of this section, provides a more detailed overview of the steps and methods that have been used in past efforts.

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<sup>1</sup> For further information, see: Decision 2 CP/4, Paragraph 2 at [www.unfccc.int](http://www.unfccc.int).

### **Forming Institutional Arrangements to Engage Relevant Stakeholders**

Forming an effective team with the appropriate authority at the beginning of the process is critically important to the success of the technology transfer enterprise. Teams can be formed in a number of ways. The two primary options are to have the entire group consider all technologies, or to divide the technologies among smaller, more specialized sub-groups. The formation of the team as a whole must address the following considerations:

1. Identifying, consulting, and engaging the relevant stakeholders;
2. Defining the objectives and desired outcomes of the technology transfer effort;
3. Forming a team to carry out the work, typically including an overall coordinating agency, a lead technical institution, and relevant experts and/or organizations; and
4. Defining a process that includes ongoing involvement of all relevant stakeholders.

The goal of this part of the process is to engage all the relevant stakeholders in a collaboration that builds on their mutual interests. While each country's national circumstances will define its key stakeholders, a list of prospective stakeholders includes:

- Government agencies, e.g. Environment, Energy, Infrastructure, Transportation Agriculture, Forest, and Water;
- Local and international businesses, including project developers, technology suppliers, and sales and service groups;
- Trade organizations;
- Technical institutions;
- Technology end-users;
- International financial and donor institutions;
- Non-governmental organizations and community groups; and
- International technical experts.

Once these arrangements are in place and the team has been formed, the substantive work can proceed along the lines discussed below.

### **The Needs Assessments Process**

Technology transfer under the UNFCCC is fundamentally a country-driven process. The needs assessment phase of the work constitutes a country's primary means to define its technology transfer priorities and the most effective mechanisms to address them. The needs assessment process should be tailored to fit each country's particular circumstances. Past efforts have generally proceeded through the following sequence of steps.

1. *Establish Criteria for Selecting Technology Transfer Priorities.* The aim here is to create a common, objective framework for identifying the highest priority technologies and

technology transfer activities. Many countries have used three basic criteria to evaluate priority technologies and activities: (1) development benefits, (2) implementation potential, and (3) contribution to climate change response goals.

2. *Define Priority Sectors and Sub-Sectors.* Once established, the selection criteria can then be applied to determine which sectors (e.g., energy, forestry, agriculture, water resources, etc.) should be the primary focus of technology transfer activities. A subsequent review process should also be planned for a later stage after further technology and market information is available to confirm that the initial sector selections are most appropriate.
3. *Compile and Supplement Technology and Market Information.* After identifying the sectors of interest, country teams together with international experts can then proceed to collect information on alternative climate change response technologies, their potential markets and impacts, implementation barriers, and existing and planned programs to promote their adoption and diffusion. Such information may be available from existing studies and development plans and through further stakeholder consultations.
4. *Select Priority Technologies and Sectors.* Using the compiled information on alternative technologies for the priority sectors and sub-sectors, country teams can proceed with selection of priority technologies and practices. While countries may develop extended lists of priority technologies, experience suggests that it is not practical to act on more than 3-4 priority technologies at a time. The selection of priority technologies has most often occurred through convening a meeting (or several meetings) of all key stakeholders to rank the priority technologies according to the criteria established in Step 1 and based on the information collected in Step 3. The prospects for market success of the candidate technologies should be considered at the earliest stages of the selection process.
5. *Further Technology and Barrier Assessment, and Stakeholder Consultations.* The prioritization of technologies and sectors in the preceding step offers the opportunity for more focused, in-depth analysis of the prioritized technology needs. The purpose of the technology assessments at this stage is to support decisions on the actions that will be pursued to overcome key technology transfer and diffusion barriers. The product of this step will form the basis for further development and selection of high priority actions to promote technology transfer and implementation.
6. *Define Alternative Actions.* While the previous step usually includes identification of actions to address key barriers to technology transfer and diffusion, countries have generally found it helpful to further define the scope and impact of these actions before finalizing their selection of implementation actions.
7. *Select High Priority Actions for Further Development and Implementation.* In previous experiences, countries have generally selected 1-3 priority actions for further development and implementation for each priority technology. The selection of these actions has most often occurred through consultations with government program managers, businesses, technical institutions, and other key stakeholders.

8. *Prepare Needs Assessment Report.* A summary report may be prepared that describes the process countries used to select their priority actions, the results of each stage of this process, and a description of each action. Countries may also want to describe the proposed roles of key stakeholders and preliminary ideas on needs for technical and/or financial assistance to support implementation of these actions. This needs assessment report will be an important determinant of a country's success in attracting international interest and resources for its technology transfer efforts. Key to that success will be the clarity with which the report can specify the development and environmental benefits that can be achieved, a plausible path for achieving the plans's objectives, and the opportunities it provides for the domestic and international partners in the process.

### **Preparing and Implementing Technology Transfer Actions and Plan**

The needs assessment process produces an initial plan for the implementation of technology transfer. The implementation phase can usefully be thought of as an iterative process in which the plan is periodically revised in view of what has been learned along the way.

1. *Securing Resources for Action Design and Implementation.* After country teams complete their needs assessments and define their priority technology transfer actions, they can proceed to work with donor organizations and domestic agencies to secure the necessary technical and financial assistance to support detailed design and implementation of these actions.
2. *Development of Implementation Strategies.* Once resources are secured, country teams in collaboration with international experts and donors can then develop detailed implementation strategies for each action.
3. *Integration with Existing Development Programs.* By integrating their technology transfer actions with other national, local and international development programs and related stakeholder activities, countries can ensure that their actions complement and support existing programs and do not create unnecessary burdens on government program managers.
4. *Preparation of Technology Transfer Plans.* After detailed implementation strategies for each priority action are developed, countries may want to present these strategies together in one integrated technology transfer plan. Such a comprehensive document can be useful both for planning purpose and for publicizing and explaining the program at home and abroad.
5. *Implementation of Technology Transfer Actions.* Implementation of the technology transfer plan can begin once resources and stakeholder support are secured and the implementation strategies are approved or adopted by the key decision-makers. In many cases, it is not possible to implement all actions immediately, so countries may want to focus their initial efforts on a few of their highest priority actions.
6. *Ongoing Review and Refinement of Actions.* In order to identify areas for improvement so as to refine and replicate this process, countries are advised to establish systems for ongoing evaluation and refinement of technology transfer actions.

For quick reference, the diagram on the following page is a simplified compilation of the step-by-step methodology presented throughout this report to develop a strategic approach to Climate Change Technology Transfer Needs Assessments and Implementing Activities. While technology transfer approaches will vary somewhat according to each country's national circumstances, these steps capture the fundamental activities that form the core of a successful technology transfer program.

***A Simplified View of the Needs Assessment Process and of  
Implementation of Technology Transfer Activities***

***FORMING  
INSTITUTION ARRANGEMENTS***

①  
Identify Relevant Stakeholders; Consult Key Agencies

②  
Convene Meeting to Explore Objectives and Scope

③  
Establish Team  
  
~ Lead Agency  
~ Lead Technical Institution  
~ Other Players

④  
Define Process for Ongoing Involvement of all Stakeholders

***NEEDS ASSESSMENTS PROCESS***

①  
Establish Criteria for Selecting Technology Transfer Priorities

③  
Compile and Supplement Technology and Market Information

⑤  
Further Technology & Barrier Assessment & Stakeholder Consultations

⑦  
Select Actions

②  
Define Priority Sectors and Sub-Sectors

④  
Select Priority Technologies

⑥  
Define Alternative Actions

⑧  
Prepare Needs Assessment Report

***PREPARING & IMPLEMENTING  
TECHNOLOGY TRANSFER  
ACTIONS & PLANS***

①  
Securing Resources

②  
Development of Implementation Strategies

③  
Integration with Existing Development Programs

④  
Preparation of Technology Transfer Plans

⑤  
Implementation of Technology Transfer Actions

⑥  
Ongoing Review and Refinement of Actions

## **The Role of Technology Information**

The availability and distribution of accurate, up-to-date technical information is a critical component of the technology transfer process. The technology transfer team must draw from multiple types and sources of information to develop its technology priorities and implementation plans. Distribution of this information will in turn help to secure domestic resources and international technical and financial assistance to implement technology transfer activities.

A wide variety of information sources and distribution channels exist or are under development to support these activities. In addition to a number of existing information networks and clearinghouses, the UNFCCC Secretariat is developing a web-based information clearinghouse and database system that is dedicated to assisting countries engaged in climate change technology transfer activities. Other useful information resources can be found in the Appendix.

## **Conclusion**

Technology needs assessments allow developing and transition countries to identify their climate change technology transfer priorities and develop effective strategies to address them. They can be powerful instruments for focusing the attention of government agencies, the international donor community and private sector investors on a well-defined set of priority activities. These needs assessments will be most successful when they focus on technologies and actions that meet national development goals while also responding to climate change concerns, and when implementation actions complement existing development programs. Effective technology needs assessments actively engage all key stakeholders, including government officials, businesses, technical institutions, and international partners in the selection of technology priorities and design of actions to overcome barriers to technology implementation.

Experience has shown that the individual actions of the step-by-step methodology presented in this report are much less effective if performed in isolation. A comprehensive, integrated approach—spanning identification of priority technologies, evaluation of implementation barriers, design and implementation of priority actions, and follow-up evaluation—maximizes the chances of success for any technology transfer program since it not only results in well-informed, detailed technology transfer strategies but also provides the basis for countries to secure the technical and financial support necessary to implement their technology transfer activities.

# I. INTRODUCTION

## A. Overview

A number of countries, including Bolivia, Brazil, China, Egypt, Ghana, Kazakhstan, Korea Mexico, the Philippines, the fourteen countries comprising the Southern African Development Community, and other countries have undertaken climate change technology needs assessments and implemented technology transfer activities in cooperation with various bilateral and multilateral assistance programs. This document presents methods and step-by-step approaches based on the experiences of these countries. Technology needs assessment and implementation have also been the focus of considerable discussion by experts involved with the climate change negotiations and this report also draws on those discussions.

Drawing on these experiences, this report presents the various elements of an integrated framework to promote technology transfer. In order to present a methodology that is more robust than a series of steps, each major implementation step is discussed in depth, including fundamental elements, recommended steps, variations that can adapt the methods to country-specific considerations, case studies from different countries, and schematic representations of various processes.

The document is structured as follows: The introduction provides background on the technology transfer provisions of the United Nations Framework Convention on Climate Change (UNFCCC). Section II presents an overview of the technology transfer process. Section III begins the methodological discussion by introducing approaches and frameworks for technology transfer; it provides a detailed look at institutional arrangements that engage all relevant stakeholders; the technology needs assessments process; implementing follow-on technology transfer actions; and reviewing and refining these actions. The final section considers the role of technology information in these technology transfer activities. An Appendix lists additional resources and reference materials on technology transfer under the UNFCCC.

## B. Background on Technology Transfer under the UNFCCC

Article 4.5 of the UNFCCC states that developed countries “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.” In this context, technology transfer is designed to assist developing countries with responding to climate change through the diffusion and use of appropriate climate change mitigation and adaptation technologies. The Intergovernmental Panel on Climate Change (IPCC) *Special Report on Methodological and Technological Issues in Technology Transfer* defines technology transfer as “a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders...”

Based on a request made by the Parties to the UNFCCC at the Fourth Conference of the Parties (COP-4), the UNFCCC Secretariat conducted a consultative process to help Parties identify and define key elements of a framework for technology transfer under the UNFCCC. This consultative process included input from regional workshops in Africa, Asia and Latin America, the aforementioned IPCC special report, submissions by Parties, as well as the negotiations themselves. (The Appendix to this report contains additional information and documentation on these workshops, reports and negotiating decisions). This consultative process and the negotiations under the UNFCCC subsequently produced a draft decision incorporating a framework to enhance technology transfer, which the Parties agreed to at the resumed session of COP-6 in July 2001 (Please see Appendix for documentation).<sup>2</sup> The five elements of this framework are:

- Technology needs and needs assessment
- Technology information
- Enabling environments
- Capacity building
- Mechanisms for technology transfer

This framework to facilitate and enhance technology transfer activities under the UNFCCC is based in large part on examination of the experience gained through existing technology transfer initiatives between developing countries and donor organizations. A wide range of material, literature, and experience on technology transfer and technology transfer programs is currently available. For example, the IPCC *Special Report on Methodological and Technological Issues in Technology Transfer* discusses several types of programs that could facilitate technology transfer. These programs include comprehensive approaches to technology transfer that integrate technology needs assessment, capacity building, information and enabling environment activities (referred to in the IPCC special report as "national systems of innovation"). Vehicles for technology transfer programs include Official Development Assistance programs, GEF projects, and Multilateral Development Bank activities, the private sector and other institutions. The IPCC special report also mentions the potential contribution that the Kyoto Mechanisms could make to enhance technology transfer.

In recent years, a variety of activities have advanced common understanding of practical methods to assess technology transfer needs and implement technology transfer activities. First among these are the experiences of the countries that have undertaken technology needs assessments and the international donors who have supported this work. These countries include: Ghana, Bolivia, Mexico, China, Korea, the Philippines, Brazil, Egypt, Kazakhstan, and the 14 member countries of the Southern African Development Community, among others. Beyond these national and regional initiatives, a number of workshops and other fora have considered technology transfer processes and methodologies for technology needs assessments. In addition to UNFCCC negotiations and consultative processes on technology transfer, these

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<sup>2</sup> This decision (FCCC/CP/2001/L.10) was forwarded to the 7<sup>th</sup> Conference of the Parties (COP-7) in November 2001, and was adopted there as FCCC/CP/2001/13/Add.1.

activities include workshops and seminars convened by the United Nations Development Program (UNDP), the Climate Technology Initiative (CTI), and various bilateral and multilateral aid programs. Such fora recognize that further development of practical methods, through exchange of information and experience, will benefit both countries conducting needs assessments and implementing technology transfer activities as well as the donors that are supporting this work. These discussions have in turn contributed to the development of the technology transfer framework under the UNFCCC.

Recognizing that the critical first step to facilitating technology transfer involves identification and communication of prioritized technology needs, the COP requested the GEF to help Parties “identify and submit to the Conference of the Parties their prioritized technology needs, especially as concerns key technologies needed in particular sectors of their national economies conducive to addressing climate change and minimizing its adverse effects.”<sup>3</sup> The GEF has responded to this request by providing assistance through Additional Financing for Capacity Building in Priority Areas (Phase II top ups) of up to \$US100,000 per country. Of the 54 countries that have requested this funding, most are focusing on technology transfer activities.

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<sup>3</sup> Paragraph 1(b) Decision 2 CP/4

## **II. APPROACHES AND FRAMEWORKS FOR TECHNOLOGY TRANSFER: AN OVERVIEW OF THE PROCESS**

*This section reviews countries' experiences and summarizes practical steps to undertake technology transfer needs assessments and implement technology transfer activities. Experience has shown that technology needs assessments are most effective when undertaken in a framework that integrates all the elements of technology transfer activities. Although more than one possible framework is included in this discussion, the fundamental elements, such as the basic steps, the stakeholders, and key interactions, remain the same. The following sections address each of these elements in more detail.*

The IPCC *Special Report on Methodological and Technical Issues in Technology Transfer* identifies key stages in the technology transfer process, while acknowledging that the process of technology transfer is complex and intertwined. These stages include identification of needs, choice of technology, assessment of conditions of transfer, agreement, implementation, evaluation, adjustment to local conditions, and replication. For each of these stages or implementation steps, the stakeholders, technology transfer pathways, and barriers to implementation will vary. The challenge of the UNFCCC technology transfer process is to reach understanding and agreement on a broad and flexible framework for facilitating technology transfer using a country-driven process.

While some aspects of climate change-driven policy are unique, many components of a successful climate change technology transfer program provide benefits toward a broad range of development objectives. Lessons learned through the needs assessment process can be applied to a range of development challenges. Furthermore, although the primary model for technology transfer under the UNFCCC is to encourage technology flows from developed to developing countries, it is important to recognize that the process can work in both directions. A successful technology transfer initiative will make the developing country a working partner in the RD&D process. Indeed, one of the fruits of successful technology transfer is the enhancement of indigenous capacities in developing countries to develop, deploy and transfer technologies.

### **A. Possible Steps for Implementation of Technology Transfer Activities**

Experience from multilateral and bilateral climate change technology transfer programs provides valuable insight into the key ingredients of successful technology transfer. Successful technology transfer programs have included variations of the following 5 steps or components:

- 1. Establishment of collaborative partnerships between key stakeholders with the common purpose of enhancing technology transfer;*
- 2. Implementation of technology transfer needs assessments (including both evaluation of alternative technologies and definition of technology transfer priorities);*
- 3. Design and implementation of technology transfer plans and specific actions;*

4. *Evaluation and refinement of the actions and plans (an ongoing process); and*
5. *Dissemination of technology information.*

The first four of these activities are country-driven and have been lead by developing and transition country teams with assistance from bilateral and multilateral donors and international technical experts and engagement of the business community and other key stakeholders. The fifth activity, dissemination of technology information has occurred, and will probably continue to occur, both through global and regional activities (e.g. technology clearinghouses) and through country-specific activities (e.g. technology assessments, technology training, study tours, etc.)

When considering possible frameworks for establishing country-based technology transfer programs, several alternative models can be effective. In any model, , it is important that the structure and process of technology transfer need to be open, not restrictive in nature. The process needs to be country driven and country guided to take into account the special circumstances and preferences of each country, particularly with respect to stakeholder participation. The model must recognize that role of government is crucial. However, the role appropriate government role in facilitating and guiding the process depends strongly on national circumstances.

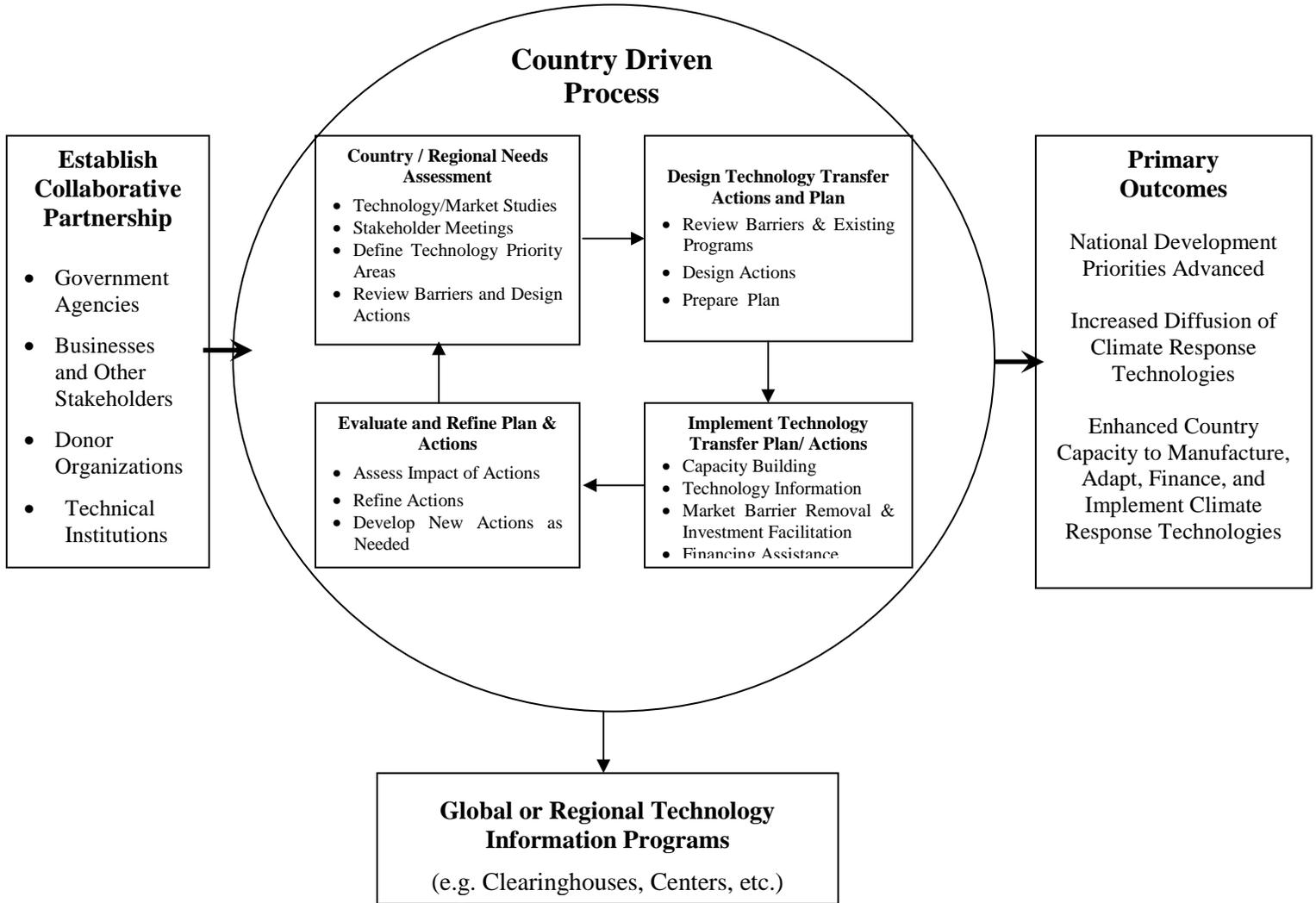
All these issues point to the need for a flexible, country-driven, integrated model that establishes a transparent process for linking the above key components of a technology transfer process together. The diagrams below illustrate two models that could form the basis for undertaking a technology needs assessment within an overall strategic framework for promoting technology transfer.

The first four activities are country-driven and led by national country teams with assistance from bilateral and multilateral donors and international technical experts, along with engagement of the business community and other key stakeholders. The fifth activity, dissemination of technology information has occurred, and will probably continue to occur, both through global and regional activities (e.g. technology clearinghouses) and through country-specific activities (e.g. technology assessments, technology training, study tours, etc.)

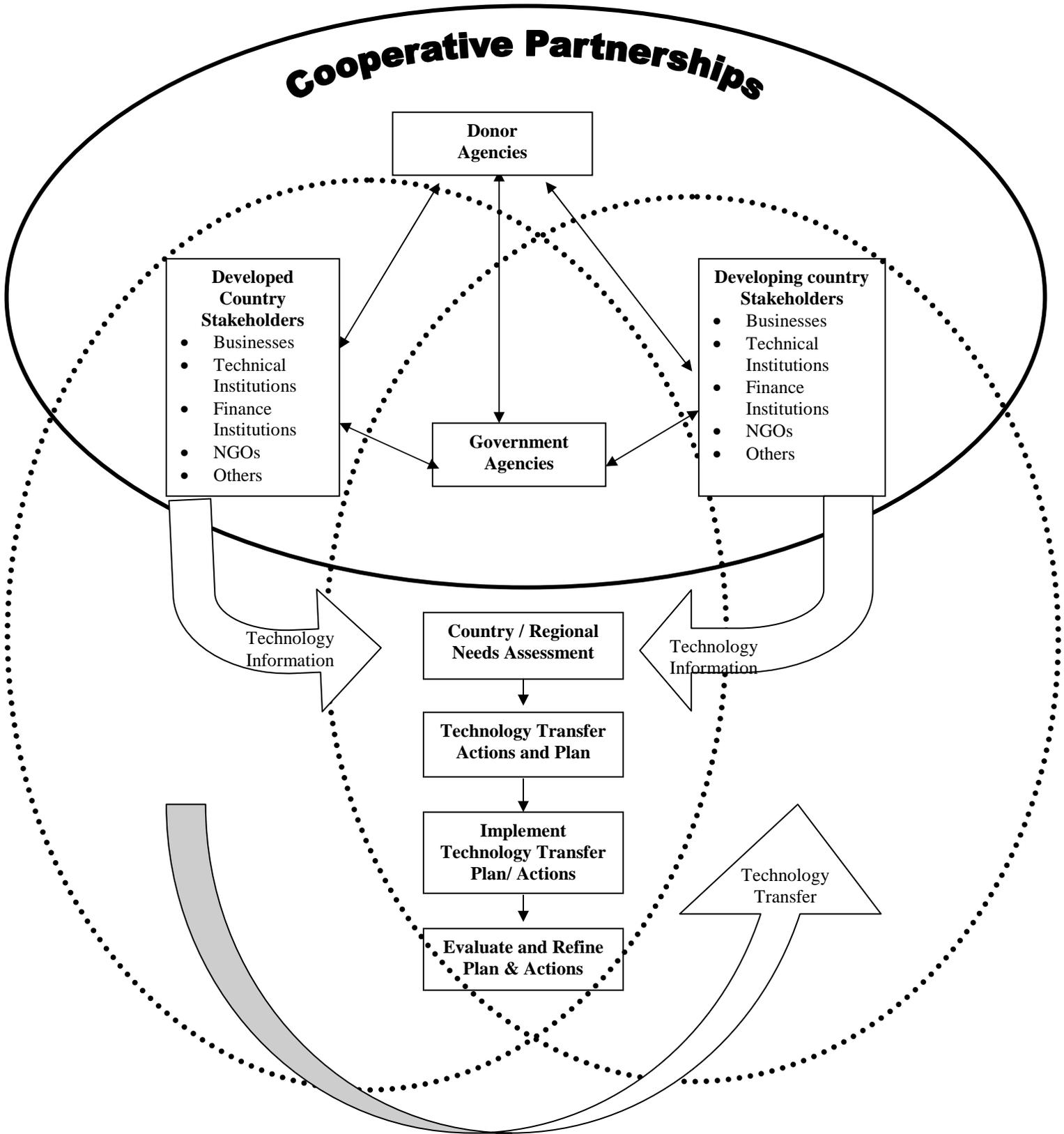
When considering possible frameworks for country-based technology transfer programs, a variety of models can be effective, as long as the structure and process of technology transfer is open and transparent. Above all, the process must be country-driven and country-guided to take into account national circumstances and preferences, particularly with respect to stakeholder participation. The model must acknowledge the crucial role of government in implementing successful technology transfer, while also recognizing that the appropriate government role in facilitating and guiding the process depends strongly on national circumstances.

These issues all point to the need for an integrated yet flexible, country-driven model that establishes a transparent process to link the key components of technology transfer described above. The following diagrams illustrate two models that could form the basis for undertaking a technology needs assessment within an overall strategic framework to promote technology transfer.

## Example Model 1: Key Elements of an Approach to Technology Transfer Implementation



## Example Model 2: Key Elements of an Approach to Technology Transfer Implementation



## **B. Key Considerations in Design of Technology Transfer Approaches and Frameworks**

Based on individual country experiences, the UNFCCC Consultative Process, technology transfer discussions at the climate change negotiations and other fora, several key considerations have been identified to help guide the design of technology transfer approaches. The most often-cited considerations are listed below:

- The technology transfer process should be country-driven and should support sustainable development objectives of the host country;
- All stakeholders (including government agencies, businesses, donors, technical institutions, and other NGOs) must be actively engaged in the technology transfer process;
- The role of governments is crucial, even though the transfer of technology usually involves many stakeholders, and is a complex process;
- There should be firm linkage of overall development plans with commitments under the UNFCCC and strategies to promote technology transfer;
- The technology transfer process should be flexible so that it can be adapted to the specific needs and circumstances of individual countries or regions;
- Technology transfer should enhance the endogenous capacity of developing and transition countries to develop and implement climate change response technologies;
- Technology transfer should include the transfer of “soft” as well as “hard” technologies;
- Technology transfer should address both climate change adaptation and mitigation;
- Climate change technology transfer activities should supplement and complement current activities that promote technology transfer of environmentally sound technologies;
- The donor community should assist countries in conducting technology transfer needs assessments and must be ready to respond in a coordinated manner to the needs identified through these assessments;
- Technology transfer is a “two-way” process where developed countries not only support technology transfer to developing and transition countries but also partner with them to promote the common use of both soft and hard technologies;
- Some parties and stakeholders have noted that technology transfer activities should help leverage and facilitate private investment where such investment will support a developing or transition country’s technology transfer and development goals, while others have highlighted the need for technology transfer under the UNFCCC to go beyond facilitating market-driven transactions.

Many of these fundamental considerations are included in the following case study of a technology transfer program conducted in the Philippines.

## **Example of Comprehensive Approach to Technology Transfer: the Philippines**

Through the U.S. Cooperative Technology Partnership, (CTP)<sup>4</sup>, the Philippines is addressing national sustainable development priorities, including energy services to support economic development in rural areas.

The Philippines' approach to climate change technology transfer is guided by the overall objectives of the Philippines National Action Plan on Climate Change:

- ❖ 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" in character (i.e., can be justified for other reasons besides mitigating GHG emissions).

The Government of the Philippines defined specific goals for this effort:

- ❖ Addressing national sustainable economic development priorities by improving energy services to support economic development in rural areas;
- ❖ Using clean energy technologies to improve energy services in light of climate change concerns;
- ❖ Reviewing possible technology transfer models.

### **Institutional Arrangements to Involve Relevant Stakeholders**

To identify country-driven priorities and establish its implementation approach, several Philippines government agencies provided technical and policy direction for CTP efforts, including contacts in the Office of the President – National Anti-Poverty Commission, the Department of Energy, and the Department of Environment and Natural Resources. The Department of Energy, through its Energy Utilization and Management Bureau, serves as the lead coordinating and implementing institution. The country-driven process for priority technology selection featured strong public participation to ensure the local relevance of CTP priorities. Previous stakeholder meetings on renewable energy and energy efficiency opportunities, as well as previous analytic work, laid the groundwork for this process. Building on these efforts, CTP developed the following selection criteria:

CTP priorities 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;

Based on the priority selection process, criteria, and government agency input, the CTP team selected renewable energy for rural development, along with associated support activities, as the central focus of Philippines CTP. Energy efficiency and cross-cutting support activities were also identified as important priority areas for future action.

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<sup>4</sup> The program in the Philippines was initiated under the Technology Cooperation Agreement Pilot Program (TCAPP), and continued under CTP when the TCAPP program was concluded. For simplicity, we refer to all of these activities collectively as CTP.

*Example of Comprehensive Approach to Technology Transfer: the Philippines Continued...*

**Technology Cooperation Actions**

CTP initially focused on investment actions to research and recommend policy reforms that would facilitate private investment in clean energy technologies. These recommendations were developed in partnership with the policy reform initiatives of USAID/Manila, the World Bank, and Preferred Energy Incorporated. These efforts led to the following “Fast Track” modifications of energy regulations to enhance the policy environment for clean energy technologies:

- ❖ Streamline the corporate track-record requirement for new and renewable energy power projects;
- ❖ Establish a case-by-case evaluation for a spinning reserve requirement on new and renewable electric generation projects for the backbone grid, and clarify that spinning reserve requirements do not apply to new and renewable energy on small grids;
- ❖ Remove the thermal energy requirement for cogeneration facilities using new and renewable energy;
- ❖ Eliminate the requirement for a power purchase agreement for new and renewable electricity generation projects, and instead require demonstration of foreign exchange savings;
- ❖ For projects that supply electricity to a designated utility or end-user, remove DOE power development plan review and approval requirements.

The resulting streamlined accreditation process and removal of unnecessary requirements that inhibit efficient projects provide an opportunity for more private sector participation and investment in renewable energy development and deployment. This will ultimately lead to stronger competitive forces and lower costs for renewable energy products and services, particularly in small-grid areas.

Beyond these policy reforms, CTP is engaged in a number of rural energy projects, including renewable-based hybrid systems in remote areas and solar-powered water pumping for agriculture. CTP provided training to help electric cooperatives evaluate the benefits of diesel-wind hybrid project, and the team is now working with BreezElectric Philippines and international organizations to explore opportunities to finance such projects. CTP is working with the Bureau of Soil and Water Management, Central Luzon State University, and WorldWater Inc., a U.S. solar company, to develop a pilot program for Solar Energy-Powered Agricultural Water Pumping that will ensure solar pumps are considered on an equal basis with diesel systems when agricultural subsidies are rationalized. In the area of hydropower, CTP is working with the Philippine Department of Energy and international organizations to build markets by distributing project data via the internet and exploring potential commercial retrofits. CTP is also supporting work to clarify legal and policy issues related to cooperative-owned hydro projects. At a more general level, CTP is identifying island and isolated grids with the greatest potential for renewable energy development, gathering information on current and projected loads, conditions of the current diesel systems, and the financial condition of electricity cooperatives.

The Philippines CTP program was formulated to support overall government policy objectives such as climate change mitigation, poverty alleviation, rural development and sustainable development. Activities under CTP have been geared toward stimulating private sector participation in the development and widespread utilization of new and renewable energy systems as viable, clean options to provide energy services in rural communities. The Fast Track Action initiative has produced several policy and regulatory reforms that removed provisions of existing laws disadvantageous to new and renewable energy projects. The Hydropower Market Development activity has successfully informed the government and the energy sector of the potential for international investment in local hydro projects. These and other initiatives are expected to result in the implementation of a variety of projects that are largely financed and implemented by the private sector.

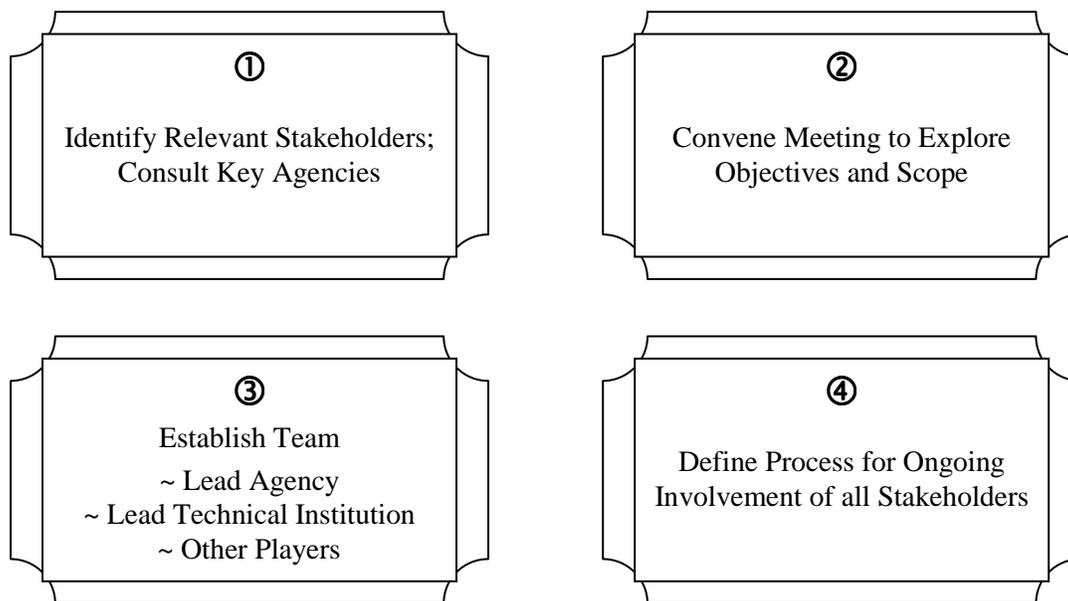
### III. A METHODOLOGY FOR TECHNOLOGY TRANSFER ACTIVITIES BUILDING UPON ASSESSMENTS OF NEEDS AND PRIORITIES

*The first two sections of the following methodological guidelines address the process of conducting an effective technology needs assessment. The third section discusses follow-on actions to implement the priorities identified in the needs assessment, and the last section discusses the role of technology information, which contributes to all stages of the technology transfer process.*

#### A. Institutional Arrangements to Engage Relevant Stakeholders

One of the most important steps in the technology transfer process is creating a team that provides a foundation for the needs assessment and all other technology transfer activities. There are a number of options for countries to go about establishing a team; each option incorporates the fundamental elements illustrated below.

##### STEPS IN FORMING INSTITUTIONAL ARRANGEMENTS



Successful technology cooperation requires collaboration at many different levels. Partnerships between different stakeholders build on their common interests and create an important pathway for successful technology transfer. Key stakeholders may include developers, owners, suppliers, buyers, recipients and users of a technology; financiers and donors; governments; international institutions; NGOs and community groups. Governments can often play a key role in facilitating these partnerships. Experience with successful technology cooperation programs has highlighted

the importance of encouraging and facilitating working partnerships among the following groups of key stakeholders:

- Among host country government agencies, businesses, NGOs, and technical experts. Cooperation among these stakeholders is needed to define and implement technology cooperation actions;
- Between developing country and developed country technical experts and government officials to exchange technology information and experiences and to design technology cooperation actions involving both countries. Regional efforts that share and build on the capabilities of national governments and regional institutions can be especially important for smaller countries;
- Between developing countries and international businesses and investors. Engagement of host country and international companies and investors is essential for promoting sustainable technology development and implementation;
- Between developing countries and international donors to attract donor support for financial and technical assistance;
- Among developing and transition countries ("south-south") to facilitate exchange of both soft and hard technologies.

One successful model for effective cooperation among relevant stakeholders has been the establishment of a technology transfer collaborative team. The composition of such a team depends on an individual country's circumstances. However, one common element of these teams has been the central role of government in coordinating and focusing the team's activities toward achievement of national development and economic goals.

The technology transfer team is responsible for designing and implementing technology transfer activities. Broad stakeholder representation on the technology transfer team provides several important benefits: It helps to ensure that planning for technology transfer activities is consistent with the country's broader development objectives and sustainable development policies, that there will be both business and consumer interest in the technologies identified, and that selected policies will receive sustained support from stakeholders. Technology transfer collaborative teams should generally include:

- Government officials responsible for climate change;
- Government officials responsible for sectoral development programs that either contribute to greenhouse gas emissions (e.g. energy, forestry, agriculture, waste management, etc.) or are vulnerable to the impacts of climate change (e.g. water resources, coastal management, agriculture, forestry, health, etc.);
- Businesses and business associations interested in participating in technology transfer activities in each sector of interest or potential priority area;
- Non-government organizations and community organizations with an interest in technology transfer activities and/or experience working with those who will be using the priority technologies;
- Technical institutions with expertise in technology assessments, technology implementation, market analysis, and business project development and financing for each sector of interest;

- Representatives from donor agencies and other international organizations. Donor agencies and international organizations can provide countries with technical assistance to implement their technology transfer activities, can help link these activities with other development programs, and can facilitate participation of international businesses and investors.

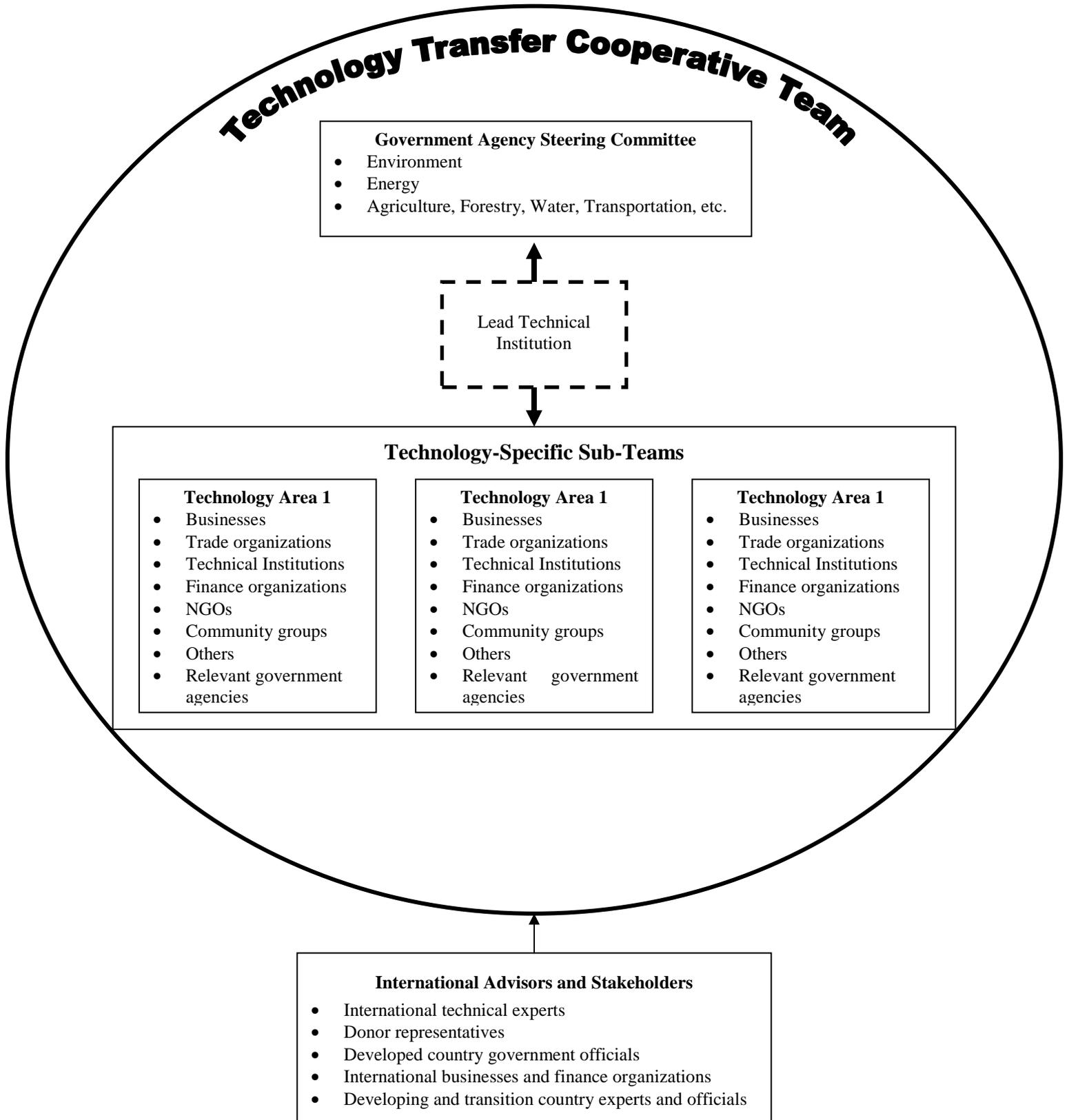
A national collaborative technology transfer team should represent a broad range of interests, including sectoral ministries--such as energy, transportation, agriculture, forestry, and water resources--environmental agencies, climate change delegates, private companies and trade associations, technical institutions, and non-government organizations. The ministries that implement energy and other sectoral programs and policies are particularly important because they often have the controlling or regulatory authority necessary to implement technology transfer actions. Climate officials should be involved as well, even if they do not have implementation responsibilities, so that they can integrate the work of the team with key climate change issues and identify opportunities to build on other climate change work. Governments can often play a key role in facilitating these partnerships. In particular, effective inter-ministry cooperation can help maximize synergies between various programs and avoid conflicts with other government programs and objectives.

A second model entails a collection of technology transfer “teams.” Multiple teams allow for specialization of expertise or interest and can be formed or disbanded as interest in specific technology sectors grows or wanes. This provides the opportunity for focused, technical interaction on issues associated with technology transfer in specific sectors. A team of stakeholders, including in-country businesses, investment organizations, and non-government organizations, could be formed to provide focused input and advice to an interagency government group charged with providing overall direction and coordination of the various specialized teams. A group of technical teams, comprised of organizations with expertise or interests in each area, could be formed to address the issues associated with each of the main priority technology transfer areas.

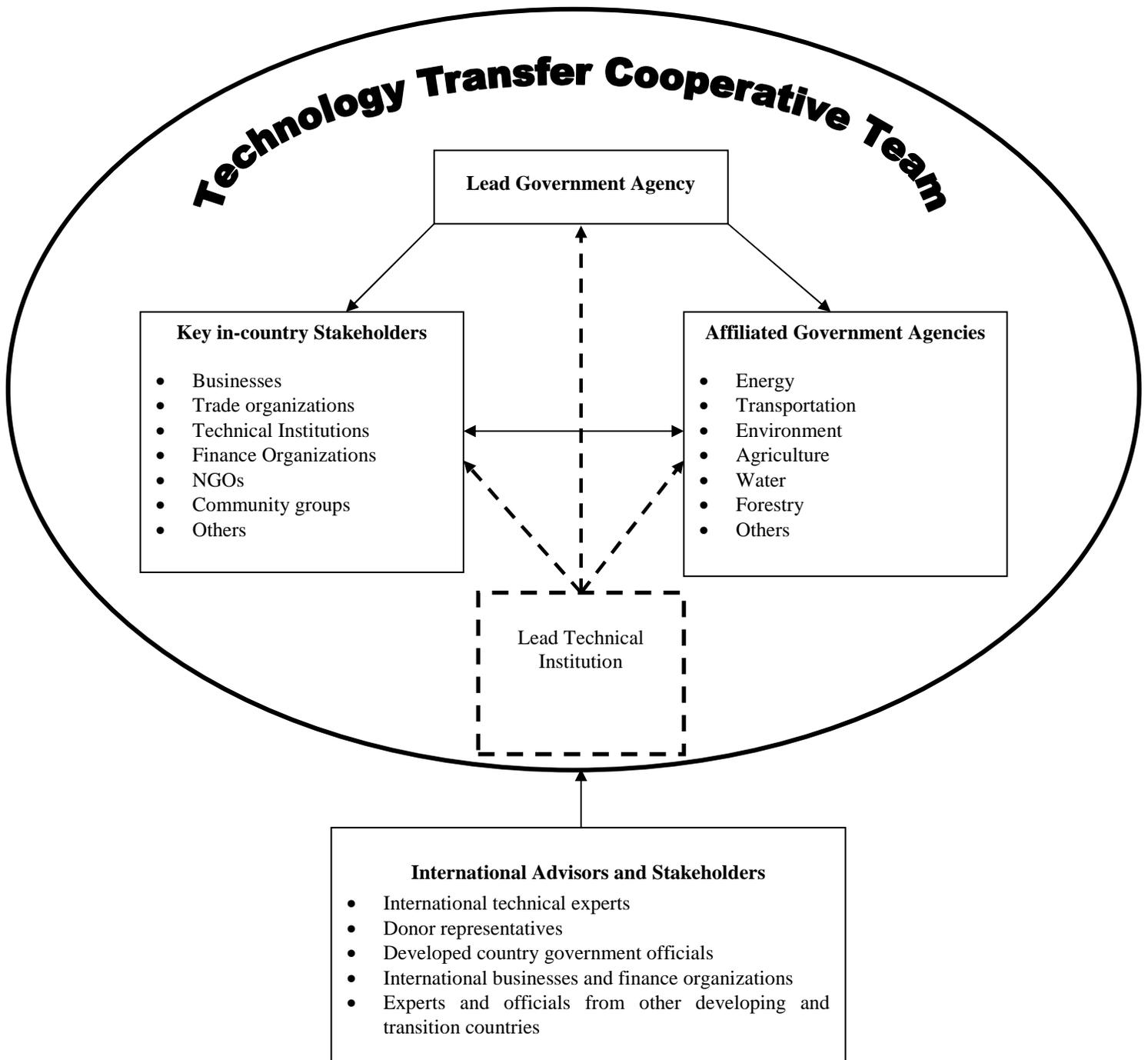
Regardless of which model is chosen, a critical element of the collaborative team is the identification of a country coordinator and support organization. Many different organizations, including technical institutions or other NGOs, private firms, and government agencies could play this role. However, the organization filling this role must have the full support and backing of the in-country government and the technical expertise to maintain the respect of other important stakeholders. Coordinating institutions perform a wide variety of duties, depending on the needs of the team. The primary function is to coordinate the involvement of all of the in-country participants. They may also compile information on technologies, conduct market research, and design technology actions.

The following diagrams illustrate these two possible models that countries might wish to consider when establishing their national teams to promote successful technology transfer.

# Example Model 1: Technology Transfer Cooperative Team

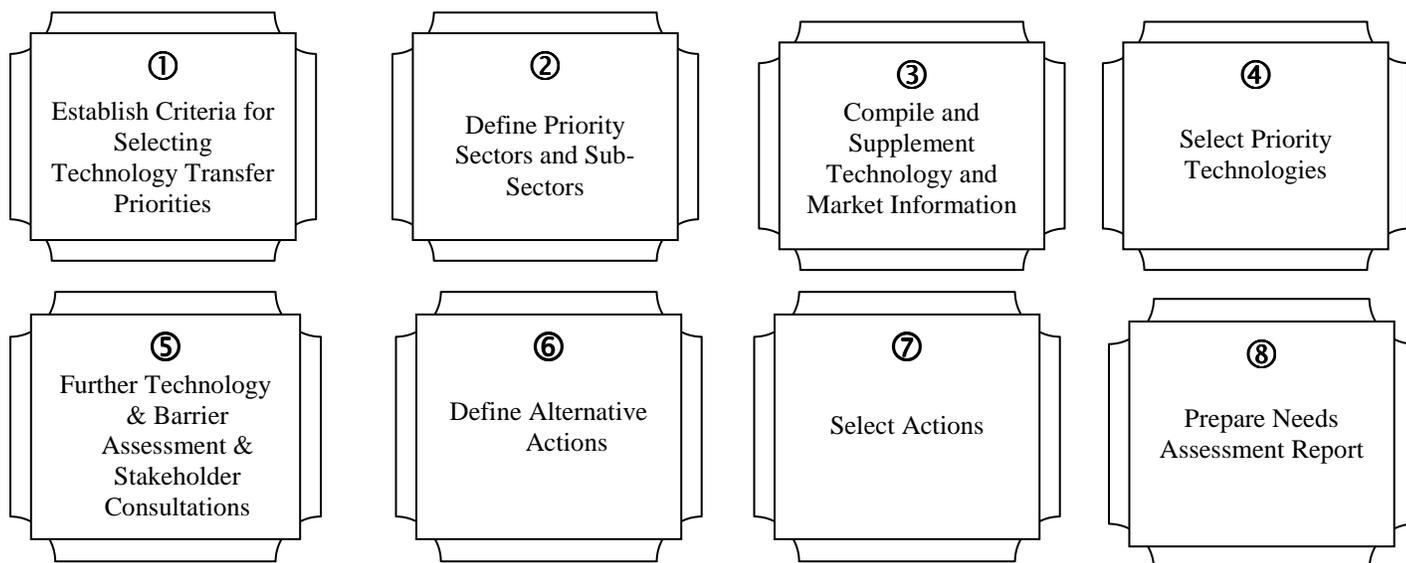


## Example Model 2: Technology Transfer Cooperative Team



## B. The Needs Assessments Process

Once the technology transfer team is established, a country (or region) can begin to define its technology transfer priorities. The technology transfer needs assessment process, which includes both definition of technology transfer priorities and evaluation of alternative technologies and their penetration potential, generally involves several steps, including those shown below:



Every country will want to design their own process and might want to pick and choose from these steps depending on their national circumstances. Each of these steps is described in detail below.

### Establishing Criteria

Establishing selection criteria for technology transfer priorities creates a common framework to identify the highest priority technologies and technology transfer activities. In technology transfer needs assessments conducted to date, many countries have used three basic criteria:

- ❖ Development benefits – Which climate change mitigation and adaptation technologies offer the greatest value to the country in meeting current national development priorities?
- ❖ Implementation potential – What scale of implementation and diffusion of the technology can be realistically achieved if key barriers are addressed?
- ❖ Contribution to climate change response goals – Which technologies will make the biggest contributions to the country's efforts for mitigating greenhouse gas emissions and/or facilitating adaptation to climate change?

### **Defining Priority Sectors and Sub-Sectors**

Once established, the criteria can then be applied to select sectors of interest. Countries can use these criteria to determine which sectors (e.g. energy, forestry, agriculture, water resources, etc.) should be the primary focus of their technology transfer activities. This selection process will help focus the detailed technology assessment work to follow. Countries may find it helpful to focus initially on just 1 or 2 sectors since significant effort will be required to define and implement technology transfer activities for each sector. Additional sectors can then be added over time. In some cases, it may be appropriate to identify preliminary sectors of interest to initiate technology assessment work, while leaving open the possibility of revisiting the selection of sectors after the technology assessment is complete.

It may also be helpful to identify the sub-sectors of interest, at least in a preliminary fashion. For example, in the energy sector, sub-sectors might include use of renewable energy for rural electrification, increased industrial energy efficiency, power plant efficiency, use of alternative fuels for transportation, etc. This can help focus the technology assessment work. However, these choices may need to be revisited once additional technology and market information is available to confirm that these sectors are indeed the most appropriate areas of interest.

### **Compiling and Supplementing Technology Information**

After identifying the sectors of interest, country teams together with international experts can then collect information on alternative climate change response technologies and related market information for those sectors. This includes soliciting input from key stakeholders on the prospective priority technologies, such as:

- A summary of alternative climate change response technologies for each sector and sub-sector that could best meet (or be adapted to meet) local needs and circumstances and a summary of possible applications of the technology in the country;
- Development benefits of the alternative technologies, including information on the contribution of the technologies to economic development, social, and environmental goals;
- Implementation and investment potential for alternative technologies, including characterization of the potential scale of implementation and market penetration for the technology and identification of the applications that hold the greatest potential for near-term success;
- Contribution to climate change response goals, including a summary of the potential impact that the technology could have on reducing greenhouse gas emissions or facilitating adaptation to climate change;
- Information on technology performance and costs, including descriptions of the technical performance, and capital and operating costs of various technology applications. It may be helpful to compare this information to that of technologies already in use for similar applications;
- Policy, regulatory, investment and financing, institutional, and business capacity barriers to widespread use and investment in the technology. Identification of implementation barriers is of critical importance since technology transfer activities will be structured to overcome these barriers, regardless of which technologies are selected. Therefore, countries may want

to focus on technology priorities where they feel they can make real progress in addressing the critical implementation barriers;

- Summary of existing and planned programs designed to promote technology implementation and opportunities to complement these programs through technology transfer activities;
- Identification of key organizations active in facilitating implementation of the prospective priority technologies, including in-country businesses and government agencies, and international private sector suppliers and investors.

Much of the above information may be available from existing studies and development plans for the sectors of interest. This report's final chapter on "Technology Information" also provides valuable resources for collecting this information. Countries may want first to compile existing information and then decide if this information needs to be supplemented with additional analysis. Since this stage of the process is designed to select priority technologies for which more in-depth analysis will be conducted, it may not be necessary to conduct any new assessments at this stage.

In addition to reviewing existing studies, country teams and international experts should also consult with key stakeholders working in the sector (e.g. government program managers, businesses, technical institutions, and community groups) to solicit their input on the above topics as they relate to the prospective priority technologies. Early input from stakeholders is of vital importance for an effective priority setting process.

### **Selecting Priority Technologies and Sectors**

After compiling information on alternative technologies for the priority sectors, country teams can then select their priority technologies and service needs. While countries may wish to develop a list of up to 15-20 priority technologies, it is recommended they focus on identifying 3-4 high priority technologies for immediate attention. Experience has indicated that it is not practical to act on more than 3-4 priority technologies at a time. Indeed, initially focusing on 1-2 priority areas appears to increase the chances of success in achieving technology transfer goals.

This selection of priority technologies has most often occurred through convening a meeting (or series of meetings) of all key stakeholders to rank the priority technologies according to the criteria established in Step 1 and based on the information compiled in Step 3. Broad stakeholder participation is essential to ensure that there is strong support for these priorities and that they reflect the best near-term opportunities for implementation. It is recommended that countries include government officials from all agencies with an interest in these technologies, business representatives, technical institutions, and key NGOs. Many countries have found it helpful to have international technical experts, international businesses active in the markets under consideration, and donor representatives participate in these meetings as advisors, though these groups will not necessarily participate in the actual technology ranking process. That said, efforts to include all relevant experts and stakeholders should be balanced with the need to move toward implementation.

While some countries have ranked priorities in one meeting that addresses all priority sectors or sub-sectors, other countries have convened meetings to identify priority technologies for each sector or subsector and then held a cross-sectoral meeting to select priorities across all the sectors. Please note, technology assessment and selection should not be conducted in isolation from the implementation process. In other words, the prospects for success of a given implementation step should be considered early on as part of the technology selection process.

***In-Depth Technology and Barrier Assessment, including Evaluation of Availability of and Barriers to Financing, and Stakeholder Consultations***

Following the selection of priority technologies, countries can then proceed with more in-depth analysis of these technologies. This analysis tends to address topics similar to those addressed in the initial compilation of information in Step 3 (e.g. technical performance, costs, benefits, market potential, implementation barriers, existing programs, etc.) but in much greater detail. At this stage the group should also consider the financial requirements of their proposed actions, e.g. implementation of pilot projects or expansion of existing programs. They should closely examine the probability of securing adequate financing from in-country sources, foreign equity investors, or international donor institutions since the availability of financing is critical to project success. At this stage, the purpose of the technology assessments is to support decisions on the actions that will be pursued to overcome key technology transfer and diffusion barriers.

These technology assessment and stakeholder consultation activities generally include the following:

- a. *A detailed technology assessment for each priority technology.* This assessment should be conducted in consultation with business and investment organizations, government agencies, technical institutions, and donor and international institutions.

A detailed technology assessment should include:

- Identification of the specific applications for the technology (by use and by location within the country);
- Estimation of the scale of implementation and market penetration that can be achieved for each of these applications;
- Analysis of the costs and development benefits (including contribution to climate change response goals) of each of these technology applications;
- Identification of in-country businesses, government representatives, and other stakeholders, and international businesses and institutions that can be partners in increasing investment and use of the technology.

- b. *Identification and analysis of specific barriers (e.g. policy, regulatory, information, financing, capacity building, etc.) that would need to be overcome to achieve the full implementation potential.* This review might define the primary reasons why the technology is not currently in widespread use and why neither the private nor public sectors have invested significantly in it. The review could consider, for instance, any critical policy or other barriers that prevent companies from investing in the technology.

- c. Evaluate effectiveness of existing country and donor programs and anticipated impact of planned programs. Country teams can determine how current and planned programs are addressing the barriers defined in the prior step and identify possible refinements to these programs and new initiatives that would help to address these barriers. This step involves a more detailed assessment of existing programs than conducted previously.
- d. Identification of specific opportunities to accelerate implementation of these technologies through private and public investment in these technologies. This step could include helping in-country businesses expand their operations, promoting partnerships between in-country and international businesses and financial institutions, and promoting public investment in selected technologies.
- e. Initial identification of potential actions to address critical implementation barriers while building on existing or planned programs and taking advantage of opportunities for additional business development and investment. These actions might include capacity building, commercial pilot projects, technology education and outreach programs, policy and program reforms, investment conferences and competitive solicitations, business financing, government procurement, product standards and labeling, and related initiatives.

Building endogenous country capacity to adapt and develop climate change response technologies is one benefit of successful technology transfer; it can be an important means for countries to accomplish development goals such as supporting local industries and building human capital. Some countries have focused their assessments on defining specific business projects in need of support, which saves time and ensures that the private sector is fully engaged in the implementation step. These actions ideally are designed to complement existing and planned programs. Selecting actions that enjoy the strong support of government program managers, the business community, and other key stakeholders increases the likelihood of their effectiveness.

As in the previous steps, consultations with stakeholders (including in-country and international businesses) are of vital importance in addressing these issues. Early engagement of businesses is essential since companies play a critical role in the long-term success of technology transfer projects and are usually the only pathway to full market transformation. When businesses engage in technology needs assessment and implementation actions, they offer the perspective of profit-driven companies with practical experience of market barriers and a realistic sense of market potential. Governments play an equally vital role in identifying and removing market barriers to entry and dissemination of technologies

Many countries have prepared reports that summarize their analysis of each priority technology, identify key implementation barriers, describe opportunities to build on existing or planned programs and opportunities to support business development and investment partnerships, and propose alternative actions for consideration. These reports can form the basis for further evaluation and selection of priority actions to promote technology transfer and implementation. Some countries have developed individual reports on each priority technology while others have

developed comprehensive technology cooperation frameworks summarizing technology information, barriers, and potential actions for all the priority technologies.

### **Further Define Alternative Actions**

While the previous step usually includes identification of alternative actions to address key barriers to technology transfer and diffusion, countries have often found it helpful to refine these actions before making final decisions. This process can include working with key government program managers, businesses, and technical institutions to define in more detail the scope of alternative actions and how they will impact the most important barriers in order to have a near-term impact on technology transfer and implementation. Countries may want to prepare short descriptions of alternative actions and their expected impacts in addressing barriers in light of the criteria established for the needs assessment. These descriptions can then be integrated with the technology reports or frameworks that were prepared in the earlier step.

### **Selection of High Priority Actions for Further Development and Implementation**

Following more in-depth analysis of priority technologies, stakeholder consultations, and definition of alternative actions, country teams can then select priority actions for detailed development and implementation for each priority technology. Countries have generally selected 1-3 high priority actions for each priority technology. Most countries have convened meetings of all key stakeholders to select the highest priority actions based on the criteria established in Step 1 and utilizing the results of the analysis of the technologies and alternative actions and results of the stakeholder consultations in Steps 2-6.

### **Prepare Needs Assessment Report**

Countries may want to prepare a summary report that describes the process they used to select their priority actions, the results of each stage of this process, and a description of the priority technologies and proposed implementation actions. In describing the actions, it will be helpful to document how these actions will address key implementation barriers and be integrated with existing development programs. It is also helpful to provide information on the impact of these actions in light of the established selection criteria. In addition, countries may want to describe the proposed roles of key stakeholders in implementation of these actions and ideas on needs for technical and/or financial assistance to support their implementation. Such reports can provide the basis for securing technical and financial assistance from donors as well as the necessary domestic resources to implement priority actions.

## **Example of a Regional Participatory Needs Assessment Process: Cooperative Technology Implementation Plan for Southern Africa (CTIP SA)**

In a March 1999 conference in Victoria Falls, Zimbabwe, Southern African ministers and senior government officials requested assistance from the Climate Technology Initiative to accelerate investment in clean energy technologies. In response to this request, the Climate Technology Initiative (CTI) launched the Cooperative Technology Implementation Plan for Southern Africa (CTIP SA). Countries participating in CTIP SA include South Africa, Zimbabwe, Tanzania, Zambia, Botswana, Swaziland, Angola, the Democratic Republic of the Congo, Mozambique, Namibia, Seychelles, Mauritius, Malawi, and Lesotho.

CTIP stakeholders, including government officials, businesses, and technical experts, have identified clean energy technology priorities that have the greatest potential across the Southern African region to meet sustainable development needs while reducing greenhouse gas emissions through accelerated private investment. In September 2000, six technologies were identified as regional priorities: biomass power generation, solar crop drying, efficient and solar-powered home systems, natural gas development, green house design, and efficient motors and boilers. In August 2001, project stakeholders agreed to implement actions to promote investment in bagasse cogeneration (a technology identified under biomass power generation) and solar water heating. At present, CTIP SA is finalizing actions to promote more efficient bagasse cogeneration in Mauritius and increase consumer interest in solar water heaters in South Africa. Stakeholders from other countries in the region will be kept apprised of these two projects in order to facilitate replication elsewhere in the region as appropriate and feasible.

The National Renewable Energy Lab coordinates this effort on behalf of the Climate Technology Initiative and the Department of Energy. The Zimbabwe-based Southern Centre for Energy and the Environment leads regional outreach and communications. Solar Engineering Services and Winrock International are partners in the solar water heating effort in South Africa, and partners are still being identified for the bagasse cogeneration work in Mauritius

### ***Objectives:***

The Southern African countries began this process by establishing a set of shared objectives for the program:

- ❖ Identify shared priorities within the region for attracting investment in clean energy technologies that will meet sustainable development priorities and reduce greenhouse gas emissions;
- ❖ Develop a cooperative technology implementation plan that identifies actions that Southern African countries and regional institutions can undertake in partnership with international donors and the private sector to accelerate investment in these technologies;
- ❖ Assist the region in securing international donor support and private sector participation in implementation of actions to attract private investment;
- ❖ Enhance the technical and institutional capacity of Southern African countries and regional institutions to attract international investment in clean energy technologies.

## ***Cooperative Technology Implementation Plan for Southern Africa (CTIP SA) Continued...***

### ***Technology Priorities***

During a workshop in September 1999, SADC members reviewed and refined the project workplan and established the following criteria for selecting priority technologies:

- ❖ Development benefits the technology will provide;
- ❖ The technology's market readiness;
- ❖ Greenhouse gas (GHG) avoidance potential;
- ❖ Appropriateness of the technology for the region as a whole; and
- ❖ Local environmental benefits (beyond GHG avoidance) the technology will offer.

Once these criteria were defined, the participating countries conducted national consultations to identify specific technology priorities, define market barriers to these priorities, and propose regional actions to address those barriers and accelerate investment and implementation. Representatives from key government agencies met with businesses, technical experts and other stakeholders to identify specific technologies within the six broad priority areas based on the selection criteria described above. Following these consultations, a report was prepared synthesizing the results of the consultations, and outlining the priority areas and actions that could be taken to promote investment in each technology:

### ***Efficient and PV (Photovoltaic) Lighting***

- Develop regional standards and ratings
- Establish revolving loan fund

### ***Efficient Motors and Boilers***

- Implement industry training program and develop guidelines
- Establish low-cost financing mechanisms

### ***Efficient Housing Design***

- Organize regional seminar to develop standards and guidelines
- Implement training program for architects, developers, etc.

### ***Solar Crop Drying***

- Conduct public education campaign
- Create business network for manufacturing and distribution

### ***Biomass Electricity Generation***

- Develop regional model independent power purchase agreements (PPAs)
- Organize investment workshop

### ***Natural Gas***

- Assist with gas development plans, legal frameworks and guidelines
- Create Regional loan fund for capital investments

### *Cooperative Technology Implementation Plan for Southern Africa (CTIP SA) Continued....*

At present, CTIP SA is finalizing workplans for three priority technologies. The actions to promote private investment are outlined below:

***Biomass Power Generation:*** CTIP SA is developing a proposal to help sugar mills in Mauritius increase their power output by adopting more efficient technologies. Japan, a Climate Technology Initiative partner, has expressed interest in supporting this work. A pre-feasibility report is underway, and CTI is planning a visit to Mauritius to meet prospective partners.

***Solar Home Systems:*** In Durban, South Africa, tariff restructuring is making solar water heaters cost competitive with conventional technologies. CTIP SA is supporting efforts to better understand low and middle-income consumers' concerns about solar water heating technology and to carry out a consumer awareness campaign in response to those concerns. The project is supported by USAID and carried out in collaboration with Winrock International and the Durban-based Solar Engineering Services.

CTIP SA is complementary to regional development objectives and approaches, including many Southern African countries' national energy policies to provide sustainable energy to trigger economic efficiency. The integration of a wide range of stakeholders and countries ensures that the priority needs and actions are integrated with other development objectives in the region and will receive sustained support from a broad constituency. While helping countries in the region prepare for investment in the energy sector, the CTI process is also supporting related development goals, including environmental and natural resource protection, social development, housing and transportation planning.

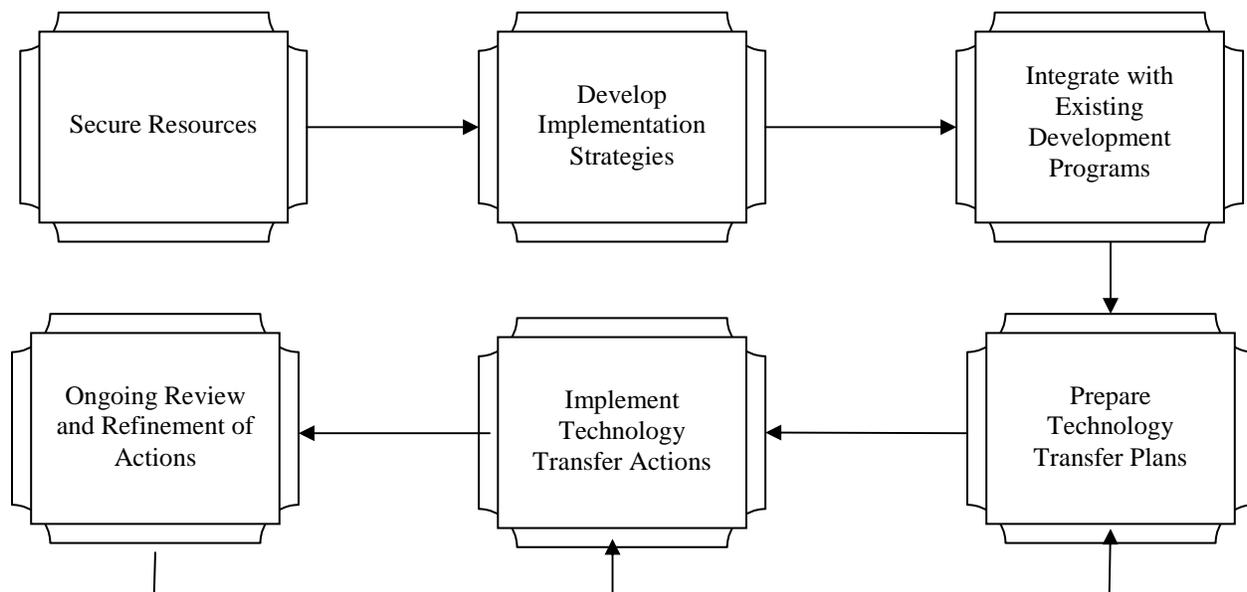
Although a regional-level needs assessment is necessarily more ambitious and complex than one performed at the national level, the Southern African experience has shown that these challenges can be met and that regional efforts can usefully pool limited resources to attract international donors and potential investors.

### C. Preparing and Implementing Technology Transfer Actions and Plans

*Note: The following activities build upon the foundation laid in the establishment of institutional arrangements and the needs assessment process (sections A and B of this chapter).*

The preparation and implementation of technology transfer actions and plans can involve several steps, including:

- Secure resources to support further design and implementation of high priority actions;
- Develop implementation strategies for high priority actions;
- Integrate of these implementation strategies with existing development programs and stakeholder activities;
- Prepare of technology transfer action plans;
- Implement the actions;
- Evaluate and refine the actions (ongoing).



Each of these steps is described briefly below.

#### **Secure Resources for Action Design and Implementation**

After country teams complete their needs assessments and define their priority technology transfer actions, they will be ready to work with donor organizations and domestic agencies to secure the technical and financial assistance necessary for detailed design and implementation of these actions. In existing climate change technology transfer programs, the process of securing resources has occurred through a matching of the proposed actions with the availability of resources from donor organizations and consideration of the availability of resources within the country to support implementation. This process has also sought to leverage new resources with existing country, donor, and stakeholder programs in order to integrate new technology transfer activities into these programs and maximize their effectiveness. Such integration also helps avoid overburdening in-country staff with new activities that are not connected to existing

programs. The process of securing resources may occur in tandem with the development of detailed implementation strategies since such strategies may be required before resources are provided. The financial mechanisms of the UNFCCC may ultimately be an important resource to support implementation of actions. The next chapter presents information that may be helpful in securing resources for technology transfer activities.

### **Develop Implementation Strategies**

Once resources have been secured, country teams in collaboration with international experts and donors can then develop detailed implementation strategies for each action. These implementation strategies should include information on:

- Objectives and scope of the action;
- Barriers to be addressed;
- Activities to be implemented;
- How the action would complement existing and planned development programs;
- Expected impact on development goals and on climate change response goals;
- Summary of a long-term market development goal (e.g. 5-10 year target for level of deployment and investment) and key elements of the strategy to achieve that goal;
- Lead institution and roles of other institutions engaged in implementation, including identifying the lead government officials responsible for each action and technical institutions, businesses, and other stakeholders that will be engaged;
- Key deliverables;
- Schedule of activities;
- Detailed budget showing how domestic and international resources will be allocated to support implementation of the action.

Countries may want to prepare draft implementation strategies to circulate for broad stakeholder review before they finalize them.

### **Integration with Existing Development Programs**

It is important for countries to effectively integrate implementation of their technology transfer actions with other national, local, and international development programs and related stakeholder activities. Such integration reduces or eliminates redundancy among programs, ensures that technology transfer actions complement and support existing programs, and avoids unnecessary burdens on the government program managers who will be responsible for implementing technology transfer actions. When government agencies and stakeholders work together to plan technology transfer activities, this coordination can also leverage other activities and resources to support them. Such integration can best occur through discussion of the implementation strategies with government program managers, businesses, technical institutions, other in-country NGOs, and donor officials responsible for implementation of related programs. As countries develop their implementation plans, communicating them through various technology information vehicles, including the networks listed in Chapter IV, can both attract donor and private sector interest, and provide information to help other organizations that may want to design technology transfer activities that complement these plans.

### **Preparation of Technology Transfer Plans**

Following development of detailed implementation strategies for each priority action, countries may want to present these strategies together in one integrated technology transfer plan. This will provide key decision-makers and stakeholders with one document that provides detailed information on the implementation approach for each action. Such a document will be valuable for stakeholder review and engagement and building domestic awareness and support for these actions and for engaging active stakeholder participation. It can also help secure donor support for the actions and facilitate integration of these actions with current programs. Such a plan can also be used to report internationally on the country's technology transfer activities. This can be particularly effective if the plan is an overall multi-year strategy for development and transfer of technologies, indicating specific needs that donors can address. In addition, countries can choose to include such plans, or summaries of them, in their national communications.

### **Implementation of Technology Transfer Actions**

Implementation of the technology transfer plan, or high priority actions, can begin once they are approved or adopted by the key decision-makers, and resources and stakeholder support have been secured. In many cases, it will not be possible to implement all actions immediately, so countries may want to focus initial efforts on a few of their highest priority actions. Active participation of all key stakeholders, including in-country and international businesses that are an important source of sustained investment resources, will be critical to success. Countries will likely need to create separate teams, with participation of government and non-government officials and technical experts, to lead implementation of each action. As noted earlier, implementation should be coordinated with related development programs and initiatives.

While UNFCCC discussions have yet to clarify the process for funding the implementation phase of technology transfer, it is clear that, whatever the final process, the needs assessment report will be key to attracting international interest and resources for technology transfer efforts. Key to that success will be the clarity with which the report specifies the development and environmental benefits of each action, a plausible path for achieving the plan's overall objectives, and the opportunities it provides for the international participation in the process.

### **Ongoing Review and Refinement of Actions**

In order to identify areas for improvement so as to refine and replicate this process, countries are advised to establish systems for ongoing evaluation and revision of technology transfer actions.

These can include:

- ❖ Ongoing assessment of the climate change technology transfer and development impacts of actions;
- ❖ Identifying and implementing refinements to the actions to improve the effectiveness;
- ❖ Developing new actions and refining the plan to respond to initial implementation experiences.

## **Example of Technology Transfer Implementation: Korea's Energy Management Program**

In 1999 the Republic of Korea initiated work with the U.S. through the Cooperative Technology Partnership (CTP – formally known as TCAPP) to prioritize climate change technology needs and implement follow-on activities to promote the transfer of selected technologies. The Ministry of Commerce, Industry and Energy (MOCIE) of the Republic of Korea chairs a CTP steering committee and has designated Korea Energy Management Corporation (KEMCO) to lead the implementation of CTP activities in Korea.

### ***Technology Priorities***

The Korean team held scoping meetings among relevant stakeholders in March 1999 to select priority technologies for climate change technology cooperation. In addition to greenhouse gas mitigation potential and energy development benefits, the team used four criteria to select priority technologies:

- 1) The technology must hold near-term market potential;
- 2) Successful widespread implementation of the technology requires intervention by public institutions to overcome market barriers;
- 3) There is a need for demonstrating new technologies or energy management systems to open up new markets for advanced technologies;
- 4) Soft technologies (e.g., new management systems and other tools for use of advanced technologies) should be given consideration along with hardware.

Based on these criteria, the following three priority technologies were selected:

- ❖ Energy management, i.e. energy management “know-how,” advanced energy auditing, and energy service companies or “ESCOs”;
- ❖ Methane recovery from organic waste;
- ❖ Waste energy recovery using heat pumps.

### ***Implementing Actions***

For the initial Energy Management project, KEMCO, working with the U.S. National Renewable Energy Laboratory (NREL), facilitated meetings between U.S. and Korean companies interested in partnering on future energy efficiency projects. One Korean company (EPS Korea) and one U.S. company (Sempra Energy Services) were selected to work with KEMCO and Hyundai to perform an energy audit of the Hyundai company facility in Ulsan. The team developed a proposal prioritizing the plant's greatest potential priorities for energy savings.

Following this energy audit, Honeywell Korea (US-Korean company) took on the project and is working with Hyundai to finalize the energy conservation measures chosen from the alternatives proposed by Sempra. Honeywell is expected to coordinate the technical support for the project, while KEMCO's role, in addition to providing technical assistance, will include review of the proposal, barrier reduction, and financing assistance. This project, if successful, should open the door for other energy service projects at this plant and others. To build capacity to implement additional projects, Korea CTP is supplementing this pilot project with training and certification programs to improve energy auditing techniques in Korea.

***Example of Technology Transfer Implementation: Korea's Energy Management Program Continued...***

KEMCO identified two projects at LG refineries, which were considered for implementation under CTP. A U.S. ESCO, Trane, considered participating in those projects, but decided not to due to a strong relationship between LG and a Trane competitor. CTP is seeking other private companies that may be interested in the project, but has yet to find a suitable match.

In the meantime, Trane has developed a relationship with SK Corporation. The SK-Trane team identified two potential projects. One at Ulsan Hospital has been put on hold due to the facility's reluctance to go forward with energy efficient improvements. The other at the Korean Advanced Institute of Science and Technology looks very promising. Trane did an initial survey of the facility and submitted an initial proposal. The Institute is now trying to get approval to move forward with the project. The drawback is that the project must be competed, which discourages ESCOs from being proactive in identifying sites.

***Korea's Methane Gas Use Program***

Korea's second priority technology, methane gas recovery, has been highly successful. KEMCO, NREL, and the U.S. EPA Landfill Methane Outreach Program (LMOP) partnered to identify potential sites, conducted a landfill gas workshop in Korea, and are now working with developers and municipalities to advance projects.

Two landfills are currently pursuing projects that received assistance from CTP. The Ulsan city landfill has competed and awarded a contract to a team led by SK's Landfill Gas Team working with the Danish firm, LGF Consult Aps. Construction is underway and expected to be completed by August 2002. A chemical company adjacent to the landfill will use the gas from the project to fire an industrial boiler.

The second project, also supported by CTP, is at the Teagu landfill. A feasibility study has been conducted at the site, and the city is expected to issue a solicitation for the project in March 2002. Several end-uses have been considered for the gas generated from this project, including on-site power generation, gas purification and inclusion in a nearby natural gas pipeline, and using the gas in a nearby local cloth dying plant.

According to Korea's implementers, the CTP project has been effective because the host country has played a pivotal role in identifying and prioritizing technologies. In the process of identifying and addressing barriers to technology dissemination, the participation of a wide range of stakeholders has been particularly important. It is also notable that, in selecting its technology transfer priorities, Korea has chosen to focus not just on hard technologies but "soft" technologies, i.e. energy services, as well.

The Korean experience provides an example of how a successful technology transfer program can bring together government and a variety of stakeholders, including research institutions and both domestic and international private companies to promote technology transfer. Korea has designed the prioritization of technology needs within an overall strategic approach that incorporates follow-on actions, including training, certification, and coordinated steps to develop pilot projects. Through the design and implementation of such projects, the experience and capacity of the host country institutions will be enhanced so as to attract additional projects. Indeed, Korea does not consider the pilot projects to be the objective of the program, but rather tools for developing technology transfer models that can be replicated elsewhere.

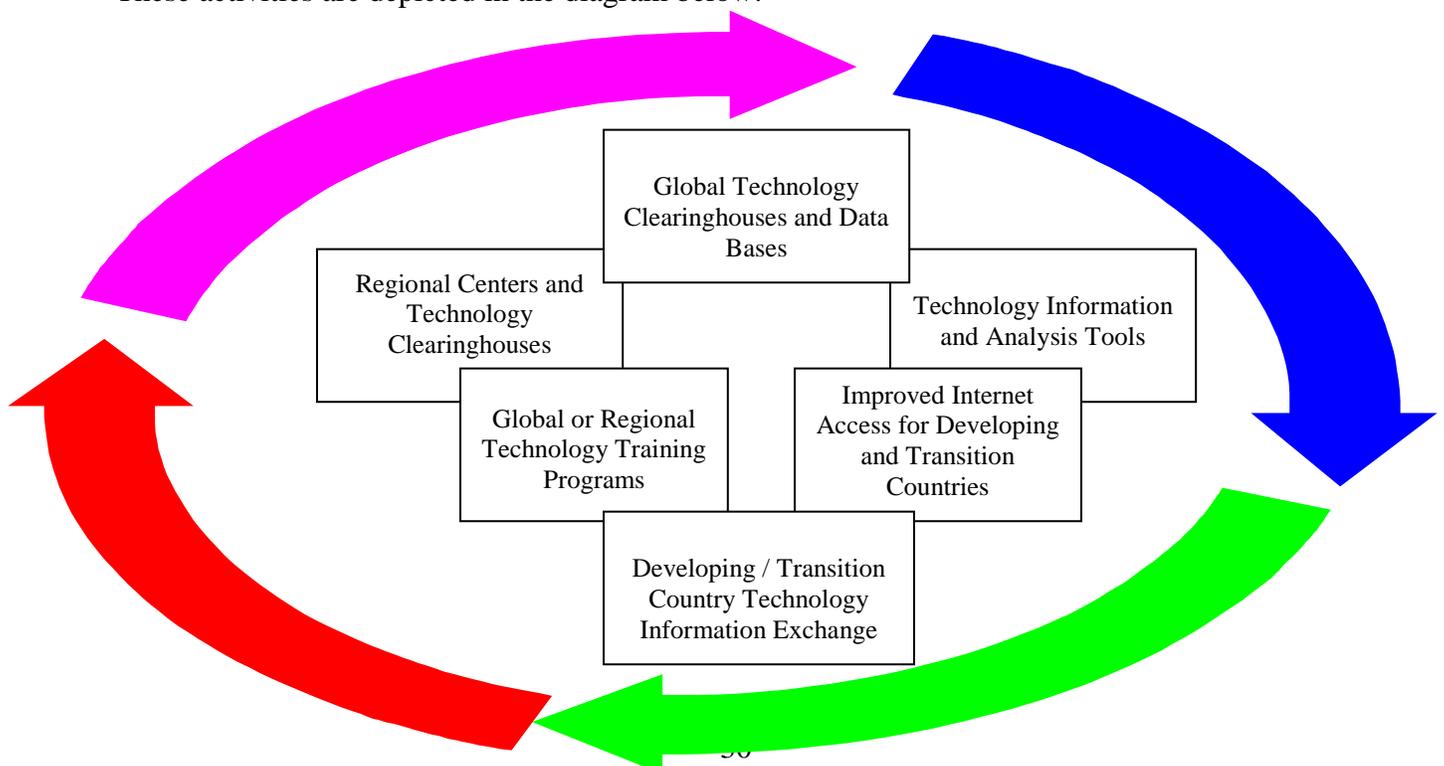
## IV. THE ROLE OF TECHNOLOGY INFORMATION

The availability of accurate and comprehensive information on alternative technologies and technology transfer resources is a cornerstone for successful technology transfer. Developing and transition countries will require a broad range of information on climate change response technologies, including data on technology performance, costs, benefits, availability, suppliers, financing, non-climate environmental and sustainable development considerations, project case studies, and related topics. Countries not only require accurate and timely information on technologies, but must also have efficient mechanisms for disseminating this information to all key stakeholders (e.g. government agencies at all levels, businesses, technical institutions, and NGOs) engaged in technology development and implementation. Countries also can benefit from improved access to tools for compiling and analyzing information on technologies. Likewise, the broad dissemination of information on technology needs can guide technology suppliers, both foreign and domestic, to respond to those needs.

While countries can access some technology information through the support provided for needs assessment and technology transfer implementation actions, there is still a need for global and regional activities to disseminate technology information. Several approaches have been identified for dissemination of this information, including:

- Establishment of global technology clearinghouses and data bases available through the internet and other means;
- Diffusion of technology information through regional centers;
- Improving internet access for developing and transition countries so that key actors in those countries can access up-to-date technology information;
- Exchange of technology information and experiences between developing and transition countries (e.g. workshops, electronic networks and web sites);
- Global or regional technology training programs;
- Improved access to information and analytic tools that developing and transition countries can use to help manipulate and analyze technology information.

These activities are depicted in the diagram below:



Several global and regional activities have been initiated to support the diffusion of technology information to developing and transition countries, while a number of others are under consideration.

Examples of existing information resources include

- The prototype technology transfer information system/clearinghouse developed by the UNFCCC Secretariat: <http://ttclear.unfccc.com/ttclear/Jsp>
- The GREENTIE/CADET technology data bases: <http://www.greentie.org>
- UNEP's Sustainable Technology Alternative Network: [www.sustainablealternatives.net](http://www.sustainablealternatives.net)
- Energy Efficiency and Renewable Energy Network (EREN), sponsored by the U.S Department of Energy: <http://www.eren.doe.gov>
- The Climate Technology Initiative website: <http://www.climatetech.net>.
- The UN Industrial Development Organization's technology information website and database: <http://www.tbiip-unido.org>
- The work of the United Nations Information and Communication Technologies Task Force to close the digital divide through improved access to information and communication technologies: <http://www.unicttaskforce.org>

## **APPENDIX**

### **Additional Documentation and Reference Material on Technology Transfer Issues and the Technology Transfer Negotiations under the UNFCCC**

#### **The Intergovernmental Panel on Climate Change (IPCC) Special Report on Methodological and Technological Issues in Technology Transfer**

(available at: [www.ipcc.org](http://www.ipcc.org)).

**Decision on Development and Transfer of Technologies, agreed to at the 7th Conference of the Parties, July 2001, in Marrakesh, Morocco** (Decision 4/CP.7, Included in Document FCCC/CP/2001/13/Add.1, available at [www.unfccc.int](http://www.unfccc.int))

#### **UNFCCC Consultative Process:**

**Workshop Reports** (available at [www.unfccc.int](http://www.unfccc.int))

Africa Workshop (August 1999, Arusha, Tanzania) (FCCC/SBSTA/1999/11)

Asia and the Pacific workshop (January, 2000, Cebu, Philippines)  
(FCCC/SBSTA/2000/INF.2)

Latin America and the Caribbean Workshop (March 2000, San Salvador, El Salvador)  
(FCCC/SBSTA/2000/INF.6)

**Submissions by Parties** (available at [www.unfccc.int](http://www.unfccc.int))

Submissions by Parties on issues and questions listed in the annex to decision 4/CP.4  
(FCCC/CP/1998/16/Add.1):

(contained in FCCC/SBSTA/1999/MISC.5)

Submissions by Parties on programs and experiences incorporating cooperative approaches to the transfer of technologies (contained in documents  
FCCC/SBSTA/1999/MISC.5,

FCCC/SBSTA/1999/MISC.5/Add.1, and

FCCC/SBSTA/1999/MISC.5/Add.2)

**The Climate Technology Initiative Web Site – [www.climatetech.net](http://www.climatetech.net)**