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Dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention
Third workshop
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Dialogue working paper 3 (2007)

Realizing the full potential of technology

Background paper by the secretariat

Summary

This paper has been prepared by the secretariat in consultation with the co-facilitators of the dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention (the Dialogue). It is intended to facilitate the exchange of views on realizing the full potential of technologies, during the third workshop under the Dialogue. It highlights elements for further consideration that are associated with different time frames (short-, medium- and long-term) for various technologies.

I. Introduction

1. Technology is an essential tool in achieving reductions in greenhouse gas (GHG) emissions and in enabling societies to adapt to future climatic conditions. In the context of the dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention (the Dialogue) (decision 1/CP.11), Parties agreed to exchange experiences and to analyse strategic approaches in four thematic areas, including ways to realize the full potential of technology. They have also agreed that:

(a) The Dialogue should enable Parties to continue to develop effective and appropriate national and international responses to climate change, and serve as a forum for identifying actions to promote research, development and deployment of, as well as investment in, cleaner technologies and infrastructure;

(b) The Dialogue should explore ways and means to promote access by developing countries to cleaner and climate-friendly technologies and technologies for adaptation through the creation of enabling environments, concrete actions and programmes.

A. The role of technologies in addressing climate change

2. The deployment, diffusion and transfer of existing climate-friendly technologies and the future development of new and more efficient technologies could contribute to the evolution of less carbon intensive economies without compromising economic growth. Technological solutions to climate change require substantial investment and capital to support the development of new technologies and the deployment of existing ones. However, investment in specific technologies is often dictated by national priorities that may not be associated with concerns over climate change; for example, access to energy and energy security are the overriding drivers for investment in the power generation sector. The combination of national priorities and the availability of a wide range of technological solutions add to the complexity in attempting to identify comprehensive solutions to the climate change challenge.

3. The most recent assessment by the Intergovernmental Panel on Climate Change regarding mitigation of climate change contained in its Fourth Assessment Report addresses a wide range of technologies and their mitigation potential for all economic sectors and for different regions. Examples of technological solutions for the reduction of GHG emissions in various sectors include: improved efficiency of the supply and distribution of electricity; fuel switching; renewable energy technologies; carbon capture and storage (CCS); hybrid vehicles; cleaner diesel engines; efficient lightning and more effective insulation and ventilation for dwellings; more efficient end-use electrical equipment; improved crop and grazing land management; reduced deforestation; and landfill methane recovery.

4. None of these technologies alone can provide all of the emission reductions needed to achieve stabilization of GHGs in the atmosphere; a portfolio of mitigation technological solutions and measures would be required. Some of the technologies that would be required during the next 20 years are currently on the market and have significant mitigation potential in the short- and medium-term, while others are at the demonstration stage and are expected to be deployed by 2030. Another group of technologies is expected to become available and to contribute to addressing the climate change challenge over a longer time period (after 2030).

5. The Stern Review on the economics of climate change considered in detail the potential for, and costs of, technologies and measures to cut emissions across different sectors. While noting that the results were subject to considerable uncertainties, the review highlighted the potential to reduce emissions in a cost-effective way through the implementation of technologies such as energy efficiency, renewable energy and CCS. It also noted that in some sectors, particularly electricity generation, policies to enhance the market for early-stage technologies would be a critical factor for their deployment.

B. Current international efforts on technology

6. Action on technology under the Convention has been guided by the framework for meaningful and effective actions to enhance the implementation of its Article 4, paragraph 5, adopted as part of the Marrakesh Accords (decision 4/CP.7). This framework includes a set of technology transfer activities, grouped under five thematic areas: technology needs and needs assessments; technology information; enabling environments; capacity-building; and mechanisms for technology transfer. The Expert Group on Technology Transfer (EGTT) has also been established with the objectives of facilitating and advancing technology transfer activities under the Convention and of implementing this framework. Over the last five years, the EGTT, in collaboration with the Global Environment Facility (GEF), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the Climate Technology Initiative and other international organizations, has carried out actions to implement this framework.

7. International financial support for development and transfer of technological solutions has been provided through various funding channels, including the GEF trust fund; bilateral activities such as Official Development Assistance (ODA), seed financing and green financing; multilateral sources like the World Bank, the European Union, UNEP, UNDP, the International Finance Corporation (IFC), The European Bank for Reconstruction and Development (EBRD) and The United Nations Conference on Trade and Development (UNCTAD); and the private sector. The GEF, through its trust fund, has

provided about USD 250 million dollars per year, allocated and disbursed to projects on energy efficiency and renewable energy.

8. Initiatives and partnerships have also been established as platforms for cooperation between governments, with the active participation of the private sector. These have been directed at removing barriers to the development, diffusion and deployment of technologies; the development of best practices on climate and energy; and establishing performance standards. Examples include the Gleneagles Plan of Action of the Group of Eight (G8), the Asia and Pacific Partnership on Clean Development and Climate Change, the Carbon Sequestration Leadership Forum, the International Partnership on Hydrogen Economy, EU–China Partnership, International Energy Agency Implementation Agreements.

9. Market mechanisms, such as the clean development mechanism (CDM), can foster the deployment of existing and near to market GHG mitigation technologies in developing countries. Financial incentives generated from the sales of certified emission reductions (CERs) have contributed to the deployment of new, environmentally sound or more efficient technologies. A study conducted in 2006[1] has indicated that roughly one third of all CDM projects accounting for almost two thirds of the total emission reductions involved technology transfer. The CDM can also contribute to the elimination of barriers associated with the introduction of a new technology such as technological risk and the stigma of being 'the first of a kind'.

II. Elements for further consideration

10. Differences in the characteristics of various technological solutions call, first, for the identification of particular impediments associated with their penetration into the market and, second, for the development of approaches and implementation of actions that ensure a higher market share for desired technologies. Specifically, removing barriers to diffusion and transfer is important for currently available technologies; technologies that will be available over the next 20–30 years may require incentives for demonstration or deployment; and future technologies would need support for research and development.

11. In general, two broad categories of policy approaches are available for realizing the full potential of technology. Technology-push approaches, such as publicly funded research and development (R&D) and R&D tax credits, aim to stimulate research and development of technologies that are generally far from penetrating the market. Market or demand-pull approaches aim to enhance the demand for lower-emissions technologies by increasing incentives to improve these technologies.[2] They include economic incentives such as adoption subsidies, direct public sector investments and carbon markets; market creation and transformation; public–private partnerships; regulatory approaches such as emission taxes and renewable portfolio standards; and legislative frameworks, codes, labels and standards.

12. No single policy can overcome all the barriers prevalent in developed and developing countries to the development, deployment, diffusion and transfer of climate-friendly technologies. To create the necessary enabling conditions, governments may need to establish regulatory frameworks that incorporate different approaches, such as policy tools, leveraging international financial support and promoting information sharing. In doing so, they may need to take into consideration national parameters and circumstances, including the possible need to build human and institutional capacities, the country's technology absorptive capacity and market penetration capability, as well as the existence (or lack) of the necessary infrastructure. Furthermore, for economic instruments to be successful, transparent governance structures and active support of the financial and industrial institutions and of the community organizations would be needed.

13. Intellectual property rights (IPRs) and trade policy have a potential role in realizing the full potential of technologies. In this context, efforts could be made to explore how policy on these two areas

[1] Haites E, Duan M and Seres S. 2006. Technology Transfer by CDM projects. *Climate Policy*. **6**: pp. 327–344.
[2] The terms 'push' and 'pull' are sometimes used in the context of enabling environments: "push"- measures in the country from which the technology originates; "pull"- measures in the recipient country.

can promote the diffusion and transfer of cleaner technologies. Protection of IPRs has been identified as a barrier to the transfer of climate-friendly technologies. In contrast, at the national level, lack of protection of IPRs could discourage the diffusion of those technologies. Finally, while protection of IPRs is a key requisite for investment in R&D, joint investment efforts allow for broader ownership of the results.

A. The short term: currently available technologies

14. The most frequently encountered impediments to diffusion and transfer of available technologies, particularly in developing countries, include economic, institutional, information and awareness barriers. Economic and institutional barriers are usually the result of market imperfections, and include restrictions to market entry, lack of financial resources or access to credit, high investment or up-front costs and incompatible retail prices, subsidies and tariffs and weak local currencies. Information barriers could include insufficient or complete lack of information on the technical performance of certain types of technologies and on means to acquire them; lack of information on costs of technologies, on their operation and maintenance and on vendors of various technologies. Awareness barriers include lack of awareness of stakeholders involved in energy conservation, energy efficiency and sustainable development issues.

15. Enhancing the deployment of low-GHG technologies is a multi-faceted process that requires the involvement of different stakeholders and a multitude of approaches. For example, multilateral development banks have an important role to play as they are able to provide long-term concessionary loans for the deployment of low-GHG technologies. Capacity-building activities and the creation of enabling environments are of paramount importance in developing countries and require financial support for their implementation. Transfer of publicly-owned and publicly-funded technologies, as well as easing access to commercial technologies while protecting property rights and other legal interests, could provide additional incentives for the wider deployment of technologies. Other approaches may include the provision of positive incentives for private sector transfers (e.g. provision of financial guarantees against risks in international transactions) and international partnerships, networks and joint R&D programmes. Furthermore, carbon pricing and the maintenance of a carbon market, including its expansion beyond a project-based approach to a sectoral one, has the potential to stimulate private sector investments in the short- and medium-term while providing additional predictability to the private sector on sustained demand for low-carbon technology products and on the return on investments in such technologies.

16. International cooperation on regulation, labels, product standards and public procurement could be a powerful tool, particularly for encouraging the diffusion of available technologies and promoting energy efficiency. It can strengthen incentives to innovate, improve transparency and promote international trade. For example, a global technology standard on standby power of electrical appliances, a large contributor to energy demand in office buildings and residential homes, could contribute to mitigation efforts while fostering product innovation in the marketplace. Other examples could include labelling programmes and standards for appliances such as refrigerators and air conditioners, or the exchange of experiences and know-how in the development of energy efficiency standards for new dwellings and service sector buildings.

B. The medium term: technologies that will be available over the next 20–30 years

17. The marketability of emerging technologies, which are either at a demonstration phase or are not ready for rapid deployment, could be deterred by high capital costs, lack of competitiveness, trade barriers and undefined property rights. The Stern Review has argued that the scale of existing deployment incentives worldwide should increase by two to five times, from the current level of around USD 34 billion per annum. Such investments would be a powerful motivation for innovation across the private sector to bring forward the range of technologies needed.

18. Private sector investment, both foreign and domestic, is and will probably remain the primary means of technology deployment and diffusion. Private flows could be directed towards lower-GHG

technologies through incentives such as capital allowances and depreciation schemes, taxation credits, certificates and tariffs and GHG reduction incentives. Public funds could be used effectively to leverage large private investments and to create a financial multiplier.

19. While at the international level funding will constitute an important means to stimulate the deployment of technologies, there are other alternatives such as technology-sharing agreements and partnerships between governments and the private sector to leverage private expertise and investment, and to provide support for demonstration projects, for disseminating best practices and for technologies that require further field-testing.

C. The longer term: technologies for the future

20. Addressing the climate change challenge in the longer term requires continuous improvement through innovation. Efforts on new technologies will primarily rely on R&D programmes. Given the long time required for R&D for some of these technologies, more investment in R&D is necessary to ensure their timely availability. In most cases, the development phase is too costly for the private sector alone and there is the danger that certain technologies may never enter the market and achieve their full potential. In other cases, advances in research and/or development may not happen due to the lack of clear guidance on the direction that such research should take.

21. The role of public funding is important at the beginning of the technology development cycle when technologies are not yet commercial and offer a low return on investment. Public investment in research, development and demonstration could encourage business commitments in the early stage of development cycles. Setting research priorities, risk management and large demonstration projects could also accelerate the R&D for future technologies.

22. International R&D cooperation can take many forms and can be embodied in formal multilateral agreements that allow countries to pool the risks and rewards for major investments in R&D, including demonstration projects and dedicated international programmes to accelerate key technologies. Future efforts could include agreements among groups of countries to better coordinate and substantially increase government investment in initiatives to develop long-term options such as hydrogen as a fuel, CCS, large-scale solar generation, biomass fuels, next generation nuclear reactors, or fuel cells. Establishing partnerships between governments and the private sector can help leverage private sector expertise and investment and provide support for large demonstration projects or projects that need extensive field-testing.

23. Managing long-term regulatory risk of new technology projects could be mitigated through the use of multilateral financing mechanisms or mechanisms that underwrite the long-term validity of GHG reduction units. For example, the World Business Council on Sustainable Development has proposed a special project mechanism allowing a limited number of large-scale demonstration projects to claim reductions up to 20 years into the future as current reduction units, issued once the project had started operating.

III. Summary

24. Climate change is global in its causes and consequences, and international collective action will be critical in driving an effective, efficient and equitable response on the scale required. There are a number of elements that could be considered further in order to realize the full potential of technology in addressing climate change. These include:

(a) Exploring the role of governments, the private sector and other stakeholders in technology research, development and deployment, including transfer;

(b) Identifying the key elements of an international or regional cooperation mechanism and/or arrangement as regards the realization of the full potential of technology;

(c) Identifying actions that may be needed for technologies at different development phases (currently available; to be available over the next 20–30 years; future technologies);

(d) Identifying potential sources of financial assistance, including financial mechanisms, to support technology research, development, and deployment, including transfer;

(e) Identifying needs for capacity-building and assistance (financial and technical) for developing countries;

(f) Collaborative R&D between developed and developing country institutions focussiing on technologies that are affordable, environment-friendly and suitable to the situation in developing countries;

(g) Exploring how to balance protection of IPRs to stimulate technology research, development and diffusion and the need for preferential access to technologies to address climate change.

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