JIKO POLICY BRIEF

No. 01/2014

Technology Cooperation

Update on the Technology Mechanism and Options for Using Carbon Markets

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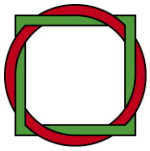

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The Wuppertal Institute is carrying out the "JIKO"-project on behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

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February 2014

Cover Photo: Siemens Press Picture

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Summary

This Policy Brief provides carbon market practitioners with a general overview on the setup of the UNFCCC's Technology Mechanism with the aim of exploring potential synergies between the mechanism and carbon market instruments such as the CDM.

There are two branches of the Technology Mechanism under the UNFCCC: the Technology Executive Committee (TEC), which is tasked to give political advice, and the Climate Technology Centre and Network (CTCN), providing support and fostering the operationalization of technology transfer. Both institutions strongly focus on capacity building.

The CDM, instead, has contributed to technology transfer in practice. However, the transfer has largely focused on equipment and basic operational knowledge. The transfer of knowledge to adapt, advance and innovate from the transferred hardware has been limited so far.

Therefore, the two mechanisms could well complement each other. In theory, Programmes of Activities and Standardized Baselines under the CDM could be a means for developing country governments to strategically address one of the most frequently mentioned barriers for technology transfer, namely financial barriers. However, under the current situation of international carbon markets the financial lever of the CDM is arguably not powerful enough to have a significant effect here.

Furthermore, potential synergies between the Technology Mechanism and the CDM are limited to the supply side of international carbon markets. Given that the current crisis is mainly a problem of insufficient demand, we do not see any realistic chance that synergies between the two mechanisms can relieve the crisis of international carbon markets.

1 Introduction

The development and transfer of environmentally sound technologies has been a prominent issue of the UNFCCC process from the beginning on. Articles 4.1c and 4.5 of the Convention as well as Article 10 of the Kyoto Protocol make provisions that developed countries shall assist developing countries in the development and transfer of technologies and know-how.

The Marrakech Accords established the Expert Group on Technology Transfer (EGTT) in 2001, which served as the main expert body of the Convention on the issue until the current Technology Mechanism was established by the Cancún Agreements in 2011.

The Technology Mechanism consists of two distinct, but interconnected institutions: The Technology Executive Committee serves as the "policy arm" of the Mechanism, whereas the Climate Technology Centre and Network forms its "operational arm". The former has been in operation for two years, whereas the latter is "brand new": It has just become fully operational with the adoption of its modalities and procedures at the COP in Warsaw.

The Marrakech Accords not only established the EGTT, but also defined the modalities and procedures of the CDM, which made the mechanism operational. One of the stated benefits of CDM projects is the transfer or diffusion of technology in the host country. With more than 7.000 registered projects, it remains the largest international carbon offset mechanism to date.

In spite of their common goal of technology transfer, the Technology Mechanism and the CDM have as yet not seen many collaborative action. With this Policy Brief, we provide carbon market practitioners with a general overview on the setup of the two institutions within the Technology Mechanism, and on the work within the Technology Expert Committee over the two years of its operation. We further provide some insights on technology transfer through the CDM. Lastly, we explore some potential synergies between the two mechanisms and challenges for their implementation.

2 Current Institutions

2.1 Technology Executive Committee

The Technology Executive Committee (TEC) was established at COP 16 in 2010 as the "policy arm" of the newly founded Technology Mechanism. It held its inaugural meeting in late 2011, and has been fully operational since 2012.

The TEC meets at least twice a year. Its 20 members are nominated by UNFCCC Parties and elected by the COP to serve in their personal capacity. The TEC is composed of nine members from Annex I countries, three from each non-Annex I region (Africa, Asia, and Latin America and the Caribbean), one from a Small Island Developing State and one from a Least Developed Country.

The TEC's functions closely mirror those of the Expert Group on Technology Transfer, which was closed down with the advent of the Technology Mechanism: a group of experts provides and synthesizes information on possible policies that enable or enhance technology cooperation and transfer. The TEC's modalities and procedures (UNFCCC 2011) list a number of key elements that form the basis for its work:

- **Analysis and synthesis**: The TEC is tasked with publishing technology outlooks and synthesized information on research and development as well as other technology-related activities, with a view to policy implications and opportunities for technology development and transfer. This includes information contained in National Communications, Technology Needs Assessments (TNAs), Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Plans (NAPs), and others.
- **Policy recommendations**: The TEC has to recommend actions for promoting technology development and transfer as well as for overcoming barriers to the COP and other relevant UNFCCC bodies. It should also recommend possible policies and programme priorities, with a special focus on developing countries.
- **Facilitating and catalysing**: The TEC is mandated to organize workshops and forums on technology-related activities. It should also make an inventory of existing collaboration activities and promote further collaboration. Especially for Technology Roadmaps and Action Plans, as well as TNAs, the TEC should take stock of existing practices, and provide recommendations on actions to further promote these activities.
- **Linkage with other institutional arrangements**: In order to enhance the coherence of activities, the TEC should seek to engage with other relevant institutions in- and outside the UNFCCC.[1]
- **Engagement with stakeholders**: The TEC should try to communicate with a broad set of stakeholders from the public sector, business, academia and NGOs. Stakeholders may participate in the TEC's meetings as observers or be called as expert advisers. The TEC can also organize other forms of participation, such as stakeholder forums or technical task forces.
- **Information and knowledge sharing**: The TEC's outputs and knowledge should be

[1] This point has proven rather controversial. It has led to the non-adoption by COP19 of the Joint Report of TEC and CTCN in 2013 because of an included recommendation to seek observer status within institutions dealing with intellectual property rights (IPR).

disseminated through an information platform that is responsive to its users' calls for information and other needs, and that can enhance collaboration between the various relevant actors. The existing platform TT:CLEAR (ttclear.unfccc.int/) was overhauled and expanded to match these requirements.

2.2 Climate Technology Centre and Network

The Climate Technology Centre and Network (CTCN) was also established at COP 16 in 2010 to be the operational arm of the Technology Mechanism. Due to its more complicated organizational and operational structure, it has not progressed as far as the TEC yet. In early 2013, a consortium led by UNEP was tasked with the implementation of the CTCN. At COP 19 in late 2013, the CTCN's modalities and procedures were approved, and the CTCN entered its operational phase. During the CTCN side event at COP 19, UNEP announced that it is now open for requests for assistance by developing countries.

The CTCN is hosted and managed by UNEP in collaboration with the United Nations Industrial Development Organisation (UNIDO), and supported by eleven further organizations from various developing and developed countries. The Climate Technology Centre is located in the United Nations City building in Copenhagen, Denmark. Requests to the CTCN are channelled through Nationally Designated Entities (NDEs), which serve as focal points within the partner countries. The Network, consisting of international, regional and national institutions will handle responses to countries' requests for assistance (www.unep.org/climatechange/ctcn).

An Advisory Board guides the CTCN in its activities. It is comprised of 16 government representatives elected by the COP (eight each from Annex I and Non-Annex I countries), the Chair and Vice-Chair of the TEC, a Co-Chair of the Green Climate Fund and of the Standing Committee on Climate Finance, a Chair or Co-Chair of the Adaptation Committee, the Director of the CTCN, and one representative each from environmental, business and research NGOs (UNFCCC 2012).

While funding for the CTCN's start-up phase has been secured, there is no regular funding structure for the CTCN. UNEP is planning on establishing a CTCN trust fund; moreover, the CTCN may also be eligible for the technology transfer tranche under the Global Environment Facility's sixth replenishment phase.

The CTCN will assist developing countries in their choice of technologies for adaptation and mitigation best suited for their individual situation, and promote acceleration, diversification and up-scaling of technology transfer. To do so, three core functions are identified in its modalities and procedures (UNFCCC 2013):

1. **Manage requests from developing country national designated entities and deliver responses**: On request of the NDEs, the CTCN will support developing countries in developing proposals for projects and actions, e.g. in the form of NAMAs and NAPS. It will further provide technical support for TNAs and technology roadmap development, as well as support and advise on tools to identify, plan and implement climate-friendly technologies.
2. **Foster collaboration and access to information and knowledge to accelerate climate technology transfer**: The CTCN will gather and catalyse knowledge on climate technologies. This may include technology needs, human resources development, best practices, research, development and demonstration (RD&D) programmes and others. It will also assess existing support options for the identification of gaps and opportunities for enhanced access to various support measures provided by donors, as well as technology cooperation needs

and opportunities of developing countries. It will recommend possible policies and programme priorities to the Advisory Board, with a special focus on Least Developed Countries.

3. **Strengthen networks, partnerships and capacity-building for climate technology transfer**: The CTCN will work towards strengthening institutions and institutional capacities in developing countries. It will also catalyse the development of training programmes on various needs, including financing. It will work on capacity building programmes with the aim to form technology centres and institutes in developing countries. Further work includes forums to promote public-private and other partnerships for technology RD&D, for leveraging resources, and for the promotion of public and private investment in technology development and demonstration.

3 Current Work under the TEC

In its work over the last two years, the TEC put a special focus on technology needs of developing countries, barriers to and enabling environments for technology-related activities resulting from technology needs, and the development of technology roadmaps. It further held a thematic dialogue on research, development and demonstration of environmentally sound technologies. Linking its work to other institutions, it fed some findings into a submission to the UNFCCC's Work Programme on Long-Term Finance.

3.1 Technology Needs Assessments

Under the Poznan Strategic Programme on Technology Transfer supported by the Global Environment Facility, 31 Non-Annex I countries have prepared or updated their TNAs. The TEC has compiled a synthesis report containing the main findings (TEC 2013a).

Most countries identified their main emission sources in the energy sector (including energy industries and transport). Other high emission sources mentioned were the agriculture, forestry and land use sectors. Countries also included information on their vulnerability to climate change. Many countries also reported on existing policies and measures for mitigation and adaptation, and on their development priorities, such as food security, reduction of air pollution or infrastructure development.

Most TNAs named priority sectors for their technology needs. For mitigation, the main factors for prioritization were greenhouse gas emissions and development priorities, whereas for adaptation vulnerability and development were factored in.

The strongest need for mitigation technologies was identified for energy industries and transport. Within these sectors, renewable energy technologies, energy efficiency technologies, modal shift in transport, fuel switch and infrastructure improvement technologies were named most. For adaptation, the agriculture and water sectors were commonly named priority sectors.

In order to assist implementing TNA results, and identifying linkages between TNAs and NAMAs and NAPs, the TEC also organised a workshop to discuss needs and actions. Resulting from the discussions, the TEC published the following two short policy documents (TEC briefs):

"The results and success factors of TNAs" (TEC 2013b) presents a short overview of the TNA development process and the results of the current round of TNAs. It also contains some lessons learned for success factors and challenges for the TNA process (see next section).

"The possible integration of the TNA process with the NAMA and NAP processes" (TEC 2013c) discusses interlinkages between the TNA and NAMA/NAP processes for policy development. It finds that several steps in the development of these processes can be integrated, including development goals, identification of priority areas and sectors, and prioritization of the identified needs and actions in the planning phase. Identified technology needs can be used

to elaborate concrete project proposals as NAMAs or NAPs.

3.2 Barriers and Enabling Environments

As part of the TNA process, countries also identified the most common barriers to a successful deployment of technologies within their national context, and possible enabling environments to overcome them. Already in 2012, the TEC had organized two thematic dialogues on the topic. The results of both the dialogues and the information provided by the TNAs are closely aligned.

Economic and financial barriers remain the strongest impediment to technology deployment in most countries. Inappropriate financial incentive schemes and lack of or inadequate access to financial resources were named as the main barriers to both mitigation and adaptation technologies.

Apart from financial barriers, insufficient legal and regulatory frameworks also hinder implementation of mitigation and adaptation technologies.

Measures proposed to overcome these barriers include the expansion of financial incentives and a strengthening of regulatory systems in order to attract private investors for mitigation technologies. For adaptation technologies, the creation of national financial mechanisms, and the expansion of national budgetary spending may help removing existing hindrances. Capacity building and awareness building can address barriers for both mitigation and adaptation technologies.

Also resulting from the findings, the TEC has synthesized key success factors and challenges for the implementation of concrete project proposals from the TNAs in a TEC Brief (TEC 2013b).

Success factors for implementation include the availability of funding, but also involvement and commitment to the process of the administration of the country, and a strong promoter of the project concerned.

Conversely, a lack of government involvement in project proposals can prove challenging for implementation, especially if environmental issues are not prioritized within the government. Financially, high investments and low rates of return as well as high costs of some technologies have proved daunting.

The TEC will further consider the issue over the course of 2014. Activities may include a call for inputs and one or more workshops on the issue. The first workshop will discuss national systems for innovation in developing countries.

3.3 Technology Roadmaps

A major part of the TEC's work over the past two years was to analyse and compile information on roadmapping approaches as a planning tool for the development and implementation of technology related policies and measures. In the TEC's background paper, Technology Roadmaps (TRM) are defined as

> "*a coherent basis for specific technology development and transfer activities, providing a common (preferably quantifiable) objective, time-specific milestones and a consistent set of concrete actions; developed jointly with relevant stakeholders, who commit to their roles in the TRM implementation"* (Londo et al. 2013).

TRMs can be used to provide input to research and development policies and as a basis for policies aimed at technology diffusion. They may help to adapt existing technologies to new markets and to foster interest of the private sector. For funding purposes, they can act as a common ground for international support and

to align funding initiatives of different donors and the national government.

The TEC has compiled the main findings of its work on TRMs in a third TEC brief: **"Using roadmapping to facilitate the planning and implementation of technologies for mitigation and adaptation"** (TEC 2013d) gives an overview over the roadmapping process, existing TRMs that were analysed by the TEC, good planning processes, inter-relations with other institutions and processes such as markets, policies and political frameworks.

It finds that good planning is essential in order to attract funding for and implementation of technology-related projects. TRMs can help to demonstrate clear objectives, engage stakeholders including the private sector, and provide milestones for the implementation of the targeted technologies. Approaches such as TRMs can also assist in the development of NAMAs and NAPs. However, practice shows that roadmapping is currently not commonly used for adaptation technologies, possibly because their effects may be harder to quantify than with technologies for mitigation of greenhouse gases.

3.4 Other Work

The TEC further held a thematic dialogue on research, development and demonstration (RD&D) of environmentally sound technologies in developing countries, and prepared a summary report (TEC 2013e). Its main messages include:

- National capacities should be strengthened and resources allocated accordingly for a facilitation of international collaborative RD&D.
- A special focus should lie on multi-stakeholder engagement on regional and national levels for successful and effective RD&D.

As part of the TEC's work on interlinkages with other institutional arrangements, the TEC also submitted its views on long-term finance (TEC 2013f). The submission reiterated the financial barriers to technology transfer identified in the TNAs, and the corresponding financial needs of developing countries in the prioritized sectors. Finance and business communities as well as funding sources in- and outside the UNFCCC need to be engaged in order to ensure the implementation of the projects resulting from the TNA process. The financial and business community should be engaged early in the process to ensure successful financing for technology development and transfer.

The TEC further stressed that technology-related activities, policies, regulations and financing should be considered in an integrated manner. Alignment of the Technology Mechanism with enabling frameworks for private and public sector investment is needed.

4 The CDM and Technology Transfer

International carbon markets have to some extent contributed to transferring technology to developing countries. The issue of technology transfer in the CDM has been studied quite extensively. Research shows that roughly one third of CDM projects specify technology transfer through transfer either of equipment or knowledge in the Project Design Documents (PDD) (Murphy et al. 2013). The PDD is, however, a planning document and only contains information about what was planned before starting the project. Thus, the PDD is not more than an indicator about the technology that is actually used in the CDM projects. Furthermore, the question of technology transfer entails a notion of reciprocity, i.e. if and how a technology has been embraced by the host country. A PDD analysis can hardly answer this question.

The only study that tries to go deeper into the question of what the term 'technlogy transfer' entails is the one of Kasturi Das (2011). Referring to the definitions of technology transfer as applied by UNCTAD and the IPCC, Das deducts that

> *"if it is found that a CDM project involves technology and/or equipment import only, it is not considered to be a case of technology transfer (...). Only when such import is found to contribute towards technological learning and capability building in the host country, in some form or the other, is it regarded as a case of technology transfer."* (Das 2011: p5)

Based on this definition, she has developed three categories of types of technology transfer. In descending order of their contribution to technological learning and capability learning these are:

Study	Type of Study	Rating
Spalding-Fecher et al. (2012)	PDD analysis (Sample size: 202)	27% of projects specify technology transfer. Small scale projects report higher technology transfer levels than large scale projects
Murphy et al. (2012)	PDD analysis (complete set of 3949 registered projects as of March 2012)	39% of projects specify technology transfer. Technology transfer by CDM projects has varied significantly by host country and project type and that it has declined as the number of projects of the same type in a country has increased.
Seres et al. (2010)	PDD analysis (complete set of 4984 projects in the CDM pipeline as of June 2010)	>30% of projects technology transfer Technology transfer is generally more strongly associated with larger projects of almost all project types. Technology transfer was more common during the early years of the CDM than it is today.
Das (2011)	PDD analysis of the first 1000 registered projects	27% of projects specify tech transfer. However, only for a marginal number of projects this goes beyond import of technology and basic operational training.

Table 1: Overview of major empirical studies investigating technology transfer in the CDM. *Source: Wuppertal Institute.*

1. A new technology is being developed in collaboration with a foreign entity.
2. Technology import is accompanied by domestic technological efforts towards adapting/improving the technology.
3. Technology import is accompanied by training for operation and maintenance of the technology only.

The study has scrutinized Project Design Documents in depth. To apply the above definitions it was necessary to go beyond the mere statement that a given project contributes to technology transfer and also analyse the technical descriptions as specified in the PDD. The study finds that by far the most projects feature technology transfer of the third type. Only six out of 1000 reviewed projects entail technology transfer of type one or two.

Similarly, Byrne et al. (2011: p18) state that the CDM has not significantly contributed "to develop low-carbon innovative capabilities". Instead, they opine that the CDM follows a pathway that focuses on financial and technological flows rather than the development of capabilities to use, adapt and improve these technologies.

Byrne et al. base their evaluation on two arguments: [1] There is a strong bias in the CDM's project distribution towards economically efficient carbon reductions, i.e. a bias towards more advanced developing countries and a bias towards a limited number of mainly large-scale technologies. [2] The CDM largely follows a narrow understanding of technology as hardware. This is for example reflected in the approach used in most of the above mentioned studies that have evaluated technology transfer (or transactions in most cases). Those studies that have looked in more detail into the evaluation of CDM projects with respect to technology transfer support the hypothesis that learning associated with transfer of technologies in the CDM is relatively low in process improvement capabilities and even lower in design and development capabilities (ibid., p24).

In sum, the literature on technology transfer through the CDM suggests that the CDM has contributed to technology diffusion in that it has helped to spread climate friendly technological appliances on the globe. However, technology transfer may be described as a much more comprehensive process, containing not only technological hardware and the necessary knowledge to operate and maintain it, but also to building capacities and knowledge to optimize the technology according to local circumstances, to adapt it to alternative uses or even to design and develop new technologies building on them, i.e. innovate from them. Following this broader definition of technology transfer, the CDM's effect is likely much smaller.

Numerous CDM projects have introduced technologies in their respective host countries for the first time. However, the transfer of technology has been limited to equipment and basic operational knowledge. The transfer of embedded know-how necessary to adapt the imported technologies to the respective circumstances, to advance them to make more efficient use over time or even to innovate starting from the level of the imported technology, continues to fall short of what would be necessary to achieve sustainable development in the project host countries.

In this, the CDM could well complement with the Technology Mechanism, particularly with the CTCN. As the CTCN has just started operating, it is still unclear how and to what detail capacity building can be provided through it. However, at least theoretically there is some room that capacity building through the CTCN can fill in the CDM's above-mentioned gaps in transferring deep knowledge and the ability to adapt technologies. Correspondingly, the CDM could complement the Technology Mechanism by financing the deployment of promoted technologies.

5 Synergies and Challenges

The institutions that form the Technology Mechanism under the UNFCCC, namely the TEC and the CTCN, are focused on knowledge management, policy support and capacity building for technology development and transfer.

While the TEC was created to give general expert advice on possible policies for technology development and transfer, the CTCN aims at giving concrete advice and capacity development upon request by developing country governments. A special focus lies on support for the development of strategies, policies and measures, and to provide information technological options.

The Technology Mechanism has no mandate to finance the deployment of environmentally sound technologies, or to implement projects under its operational arm, the CTCN.

Nevertheless, there is potentially some room for synergies between the technology mechanism and market-based instruments such as the CDM. Economic and financial barriers are among the most important hurdles that hamper the diffusion of sustainable technologies in the developing world. The synopsis of the current round of TNAs finds that all countries that have conducted a TNA have identified economic and/or financial barriers. If carbon prices recover to a more healthy level in the future, international carbon markets could play a central role in overcoming these barriers:

- Additional revenues from the carbon market could shift financial incentives.
- The prospect of additional sources of revenue could lower the cost of capital to project developers.
- In some cases, carbon market revenues could make projects financially viable.

Traditionally, the CDM has been characterized as a bottom-up process, which relied on the private sector's initiative to develop projects and methodologies to carry them into execution. The promotion of standardization in the CDM in recent years has created a space for institutional actors and regulators to also make (strategic) use of the mechanism.

In the case of standardized baselines, the role of host country institutions is even more distinct: Standardized baselines must be submitted through the host countries designated national authority (DNA). Although the route is in principal open for private actors to develop standardized baselines proactively, this has not happened so far. In fact, thus far all proposed and approved standardized baselines have been developed on the initiative of the respective national governments in close collaboration with various international development agencies and donors.

Standardized baselines in the CDM potentially provide host countries with a tool to more flexibly support specific types of projects. If for example a given country's TNA has found that renewable energy is a core technological need, the government could initiate the development of a standardized baseline which covers renewable energies.

Under a standardised baseline a positive list of technologies (including those that have been identified in the TNAs) and a standardized crediting threshold would be developed. This would drastically cut the necessary effort in terms of transaction cost for project developers. For individual CDM projects, the demonstrating additionality and calculating a crediting baseline in most cases constitute the most cumbersome part of the development of the PDD.

In that, TEC and especially the CTCN could complement well the CDM:

- Linking the DNAs and NDEs in the respective host countries could help align developing countries' technological needs with opportunities identified by CDM project developers.
- Standardized baselines could be developed that specifically target the most commonly identified technology needs of developing countries.
- Programmes of Activities may help to deploy these technologies in a broad fashion.
- The necessity of private sector engagement has been specifically addressed for technology roadmapping exercises. Options for co-financing through carbon markets can provide stimuli for a greater uptake of medium to high investment projects by private investors.
- The Network part of the CTCN may also play a connecting role between a country's demand for technologies and a provision by a mechanism such as the CDM, and foster new possibilities for public-private partnerships.
- The Regional Collaboration Centres established by UNFCCC in partnership with regional development organisations could built on TNAs to proactively promote development of Standardised Baselines and / or Programmes of Activities.

The usefulness of the current round of TNAs for concrete projects will depend largely on the swiftness of governments and project developers in conducting follow-up activities, such as detailed roadmapping exercises (top-down), and concrete project proposals (bottom-up). The vintage of data on needs and barriers in the first TNA round already limits its applicability for more current activities.

But even if developing country administrations and project developers act fast on barriers and opportunities identified in TNAs, the attractiveness of carbon market finance options will finally depend on a solution to the current crisis of low demand for and resulting very low prices of carbon offset certificates.

Any opportunities for synergies between the elements of the Technology Mechanism and the CDM or other market mechanisms will depend on the revenues private investors can gain through carbon finance with environmentally sound technology projects. Without raising demand, project developers and countries seeking to implement technology development and transfer projects will likely look elsewhere for needed funding.

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