
31 Meaningful technology development and transfer: A necessary condition for a viable climate regime

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Technology development and transfer, or ‘technology cooperation’, facilitating climate change mitigation and adaptation, is widely understood to be an integral part of the solution to human-induced climate change. It is embedded in the UNFCCC’s negotiating text, and has gained weight over the years as a necessary condition for a viable climate regime – especially with the establishment of the Technology Mechanism that emerged as part of the Cancun Agreements. The Technology Mechanism’s implementation, however, has seen mixed success so far, and is limited by resources and politics. This chapter explores necessary conditions and concrete options for a treaty in Paris (and beyond) that provides for successful technology development and transfer for climate change mitigation and adaptation. Conditions include (1) global and active recognition, in all UNFCCC bodies, that capabilities and innovation systems in the field of adaptation and mitigation technologies need to be strengthened before markets can be effective; (2) financial commitments that allow for the Technology Mechanism to fulfil its mandate as agreed in the Convention; and (3) a variety of practical arrangements, including a research and development cooperation body to be instituted within the Technology Mechanism.

1 Introduction: The transformational challenge

This chapter investigates whether and how meaningful provisions for technology development and transfer in a climate regime can contribute to broad participation from developed and developing countries. This translates into what individual countries stand to gain from the overall agreement, and from the technology part specifically (Barrett and Toman 2010), as well as what is needed for the availability of low-carbon technology in all countries. The most commonly used argument for technology development and transfer (sometimes summarised as ‘technology cooperation’) under the UNFCCC revolves around R&D for cost reduction; although we have heard for years now that deep emission reductions can be achieved by technologies that are available today (e.g. IPCC 2014, Pacala and Socolow 2004), reducing costs through research is thought to be key for successful implementation of those technologies (see the chapter by Toman in this book).

If only it were that simple. The problem of technology implementation goes well beyond cost reduction. Technology functions in a social and cultural context (Cherlet 2015), market failures are prominent (Grubb et al 2013), and the incumbent socio-technical regime is incredibly robust (Geels 2002). As an example, achieving a global low-carbon energy system requires bringing about change in every single aspect of energy demand and supply, involves many actors, is up against huge vested interests and technological lock-in, and hence requires a major intervention in economic and cultural systems. Such a complex, multi-level change to the fundamental attributes of a system is often characterised as transformational change (O’Brien 2011, IPCC 2014). As transformational change is essential for staying within a 2°C global mean temperature rise, the climate negotiations ought to place more emphasis on taking the conversation on transformational technological cooperation forward.

Transformation (in energy, but also in other mitigation and adaptation-relevant sectors) is an issue for every country, but in developing countries the challenges are compounded by lower capabilities, weak institutions and widespread poverty. The specific situation of developing countries needs to be taken into account in the UNFCCC, both in the area of mitigation and adaptation.

The UNFCCC allows for a conversation on transformations, notably in the specific circumstances of developing countries, in its discussions around technology development and transfer, which is where long-term challenges, enabling environments, national systems of innovation, and capabilities are discussed. Provisions for technology development and transfer are engrained in the Convention but have had cursory follow-up (Haselip et al. 2015). Recently, the Technology Mechanism has been set up as the first international body explicitly aimed at enhancing climate technology development and transfer in both adaptation and mitigation (see below for further discussion). Although it is too early to tell whether its efforts will bear fruit, and an overall estimate of the (monetary) size of the effort to bring about transformational change is definitely several orders of magnitude bigger, it is clear that the current funding (of around US\$30 million over five years) and the arrangements (based on one-off contributions from donor countries) provide too little to make a difference for a 2°C trajectory (Coninck and Puig 2015). Moreover, its mandate is not used to the full because of political barriers, including a hidden anxiety on the part of the current technology leaders to create their own competitors (Coninck and Sagar 2015). Therefore, this chapter indicates what key improvements can be made to the UNFCCC Technology Mechanism, and what the 2015 climate change deal, agreed at COP21, could include on technology.

2 What does ‘technology development and transfer’ mean?

As the word ‘technology’ is often misinterpreted, it is used with some hesitation in this chapter. Technology, to climate policy researchers and practitioners, evokes thoughts of renewable energy, electric vehicles and CO₂ capture installations. However, among scholars in innovation studies, and among a sizeable group of climate change negotiators, the word technology also incorporates the complex fabric of capabilities, institutions, connections, networks, policies and cultures that are an inalienable part of any strategy for renewable energy, electric vehicles or CO₂ capture installations. Many case studies support this view, for instance studies of the development of the solar and wind energy industry in India (Chaudhary et al. 2015) and the PV or battery industry in China (Gallagher 2014).

Technology development and transfer, as intended in the Convention, goes well beyond R&D agreements as discussed in Toman's chapter in this book – the Convention acknowledges that it is also about credible mechanisms that allow developing countries to 'catch up' technologically, to develop their own appropriate innovation capabilities, to make use of indigenous knowledge, and to become full participants in the global technological market place. Such mechanisms ought to enable developing countries to implement their own mitigation strategies and to benefit economically from other countries' mitigation strategies by becoming suppliers of the required knowledge and installations, much like China has managed for solar PV and other technologies. 'Catching up technologically', then, is very much a development question, relating to education systems, effective government interventions and entrepreneurial spirit. This is also indicated in Mekonnen's chapter in this book, specifically in relation to Africa.

The IPCC's definition for 'technology transfer' reflects this by comprising international transfer of installations and hardware, but also transferring and developing local capabilities, institutions and other non-hardware elements that are required for realisation of the hardware and the ability to improve on it (IPCC 2000). Therefore this chapter treats 'technology' in its manifestations as hardware (the installations), software (operational, manufacturing and innovation capabilities) and 'orgware' (institutional and policy capabilities). There are many documented examples of why this is relevant, from the implementation of energy-saving lightbulbs in Kenya and Ghana, which demonstrated the crucial role of local capabilities and manufacturing (Byrne 2013), to low-carbon and energy-efficient cement in sub-Saharan Africa, which relied on a range of factors, such as market liberalisation, government support for industrial development, activities of equipment suppliers, and OECD-based multinationals, local technical capacity and information and finance access (Ionita et al. 2013).

Consequentially, the question answered in this chapter is not limited to the hardware installation question of how do we get more solar PV and CCS installed globally, as discussed in the chapters in this book on CCS by Tavoni and on renewable energy by Bossetti. Rather, it answers the more political question of how participation and feasibility of an international climate regime can be improved by making technology part of the portfolio of agreements, and doing this in a meaningful way. The technology theme can thus also be seen as a building block or an enabler of mitigation and

adaptation strategies in development, as discussed in the chapter by Stewart, Rudyck and Oppenheimer.

3 Assessment of current provisions for technology within and outside the UNFCCC

3.1 Technology in the UNFCCC: 1992-2009

Technology has been an item in the UNFCCC since its inception in 1992; it is mentioned in Article 4.5, which states (UNFCCC 1992):

The developed country Parties and other developed Parties included in Annex II shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and knowhow to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention. In this process, the developed country Parties shall support the development and enhancement of endogenous capacities and technologies of developing country Parties. (...).

Clearly, the Convention obliges developed countries to assist in technology transfer, and it also explicitly mentions the relevance of building capabilities.

The technology development and transfer item under the UNFCCC went without much in terms of conclusions on actions in the field of technology development and transfer. This situation got worse over the years, as the developing countries continued to find evidence that developed countries were not compliant with the provisions of Article 4.5. In addition, discussions around intellectual property rights stalled progress in the negotiations, even up to the ministerial level (Abdel-Latif 2015).

The main activity that has been undertaken under the realm of the UNFCCC in the period until the Copenhagen Accord is the formulation of Technology Needs Assessments (TNAs), which aim to outline and prioritise activities around technology transfer under Article 4.5 in developing countries (and if appropriate, financed by Annex II countries). The first round of TNAs or similar activities in 60 countries was summarised in a synthesis report (UNFCCC 2006), which suggested that the technology and capacity needs, as well as barriers to technology transfer, are relatively clear but that actions to

address them are not pursued in most cases. Even after improvements in later rounds, it is unlikely that the TNAs significantly influenced decisions by developed countries for the allocation of assistance. Speculations about the reasons for this presumed lack of impact could include the appropriateness and user-friendliness of the documents, the often still far from ideal inclusiveness of the process of drafting the TNAs, and their insensitivity to matters of political timing.

3.2 Technology Mechanism: 2010 to present

One of the achievements of the Bali Action Plan (2007) and the Cancun Agreements (2010) (UNFCCC 2010) has been the development of a Technology Mechanism (TM) under the UNFCCC. After nearly two decades of painful and fruitless discussions on technology transfer, here was an outcome that developed and developing countries could accept and that helped cement the Cancun Agreements, an important package deal. Indeed, without the Technology Mechanism (in addition to discussions on loss and damage, the Green Climate Fund and the Adaptation Fund), developing countries would not have accepted the start of the breakdown of the firewall between Annex I and non-Annex I countries as agreed at COP 17 in Durban, and would not have committed to all countries submitting Intended Nationally Determined Contributions (INDCs). Technology is considered to be one of the mainstays of developing countries' negotiating points, and the Convention will have to deliver on it if it wants a balanced treaty that is agreeable to developing countries.

Moreover, as countries are submitting their INDCs, the emphasis on mechanisms to deliver technology development and transfer is even more evident. Several developing countries have put forward emissions reduction targets that are dependent on international support through technology transfer and cooperation, finance and capacity building. For example, as also noted by Kaudia in her chapter in this book, Kenya's INDC states plainly that its ambition to cut emissions by 30% by 2030 relative to the BAU scenario is "subject to international support in the form of finance, investment, technology development and transfer, and capacity building" (Republic of Kenya 2015). Mexico's INDC includes a commitment to lower its emissions by 40% by 2030 compared to BAU that is conditional on similar provisions (Republic of Mexico 2015).

The Technology Mechanism was designed to include a “policy arm” (the Technology Executive Committee, or TEC) and an “implementation arm” (the Climate Technology Centre and Network, or CTCN). The TEC was created with the intention of “providing an overview of needs for the development and transfer of technologies for mitigation and adaptation”, and to suggest policies and initiatives to encourage ‘technology cooperation’. The CTCN was expected to “facilitate national, regional, sectoral and international technology networks, organizations and initiatives to mobilize and enhance global clean technology capabilities, provide direct assistance to developing countries, and facilitate prompt action on the deployment of existing technologies” (UNFCCC 2010). It was envisaged that linkages between the Technology Mechanism and the Financial Mechanism would also be established, but so far no agreement could be reached on such a link.

The TEC has met over ten times since it started operations in 2011. It has produced a number of policy briefs on relevant topics, but it has not lived up to the hopes of being the go-to place for technological advice and a trusted source of information on technology development and transfer for developing countries. One of the issues seems to be lack of resources, and another the composition of the TEC – most members, both from developed and developing countries, are climate negotiators, which hampers practical discussions and replicates the same deadlocks and differences that can be observed in the climate negotiations (Coninck and Sagar 2015). If selection of TEC members could be based more on expertise, it might grow into the body that was envisaged when it was installed.

The CTCN is designed in such a way that it has more distance from the UNFCCC, as it operates mainly on its own account (although strategic guidance is given by a negotiator-populated Advisory Board). Its main activity so far is responding to requests by developing countries, through their newly instituted National Designated Entities, established especially for the CTCN. It is also supposed to develop a global network of organisations that are actors in the climate technology space – private, public, civil society and research actors. This Climate Technology Network is the hope of the developing countries – the diverse institutions (including companies, research organisations and NGOs) in the network are the places where capabilities for operation, maintenance, manufacturing and innovation on climate technology ought to be built.

Notably, although the mandate of the CTCN includes R&D cooperation (UNFCCC 2011), no activities have been facilitated in this space so far.

The CTCN started in February 2014, so is relatively young. Responding to requests, based on currently available information, seems to work properly. Requests vary from policy and technical assistance to research cooperation, and are so far evenly spread between adaptation and mitigation. The main weakness of the CTCN so far resides in the ‘N’, which non-Annex I Parties actually find the most important. There is no vision for what the Climate Technology Network will do, how it will be built up, and in particular how it will amount to relevant capabilities in developing countries, in particular least-developed countries. The CTCN director has also been calling for increased funding for the CTCN, which despite an earlier mandate in COP documents, does not enjoy structural funding and needs to fundraise from donors to be able to pursue its activities.

3.3 Non-UNFCCC technology interventions and financing

The vast majority of the activities around technology development and transfer, of course, take place outside of the UNFCCC. For instance, the private sector acts as an exporter and developer of technology, as a financier, and as a project developer. In order to address the barrier of accessing finance for riskier climate technologies, multilateral development banks have installed Climate Investment Funds that are funded by developed country development ministries. Numerous national, bilateral and international programmes that operate outside of the climate field contribute to global technology development and transfer, technology cooperation, green growth and the like (Hultman et al. 2012, Ockwell et al. 2015). It is hard to ascertain the level of technology cooperation (and the finance supporting it) outside of specific programmes. In addition, several authors have indicated that it is – probably unintentionally – even difficult to obtain an overview of just the public sector-initiated interventions on climate technology (Hultman et al. 2012, Coninck and Puig 2015, Ockwell et al. 2015).

4 Practical way forward for technology in the 2015 climate change agreement

No one believes that the UNFCCC will be the one and only institution for the global development and transfer of mitigation and adaptation technologies, or to facilitate grand transformative changes of the global energy system. However, many, in particular those based in developing countries, view the technology arrangements in the 2015 Paris climate change agreement as a condition for agreement as well as for implementing INDCs.

Moreover, developing countries value ‘technology’ as conditional to their right to development – specifically, fair access to technology, an opportunity to develop capabilities and the chance to play a role in the global technology market. Contrary to this, the behaviour of developed countries in the technology sphere is seen as protecting own technology interests. This can be understood in terms of an attempt to lower domestic political and social tensions in times of economic crisis and mounting international competition.

A balanced climate agreement would require provisions for technology cooperation to go forward. These could include the following elements:

- For technology cooperation on R&D, the Paris agreement should include provisions for an R&D cooperation body, possibly under the Technology Mechanism. Several authors have alluded to this in slightly different forms. We have argued earlier (UNEP 2010, Bhasin 2013) that the Technology Mechanism could facilitate setting up a multilateral single or distributed research body, similar to the CGIAR Research Programmes and Funds (established as the Consultative Group on International Agricultural Research). This could focus on R&D of low-carbon technologies cutting across national borders based on global public goods concerns relating to climate change. This would encourage scientific innovations and boost innovation capacities of developing countries. Similarly, in his chapter in this book, Toman argues for an international agreement to coordinate national RD&D programmes for low-carbon energy and to share the fruits of discoveries.
- As for improved innovation capabilities in developing countries, developed countries need to acknowledge that it is in their own interest to assist developing

countries in building these capabilities, as only when that happens will developing countries be able to achieve their INDCs and commit to further contributions to reducing emissions. The Technology Mechanism, in particular the CTCN through its network, could play a key role in this, but is not yet living up to expectations; more resources and an ambitious interpretation of its mandate are badly needed. In addition, the CTCN could encourage NDEs to submit requests that aim to increase capacity of a sector or the national innovation system.

- Climate technology development and transfer needs finance too. The Parties should elaborate on the provisions for financing technology development and deployment. They could decide in Paris to encourage partnerships between the Technology Mechanism bodies and multilateral development agencies, private sector associations, as well as specific climate-change financing bodies such as the Green Climate Fund. Until now, Parties in the UNFCCC have not agreed on a ‘technology window’ in the Green Climate Fund, or any other form of structural funding for technology activities. Without such provisions assuring financing, technology in the climate regime will not be able to play its envisioned role.

Since IPR remains a sticking point in the technology development and transfer negotiations, the TEC could attempt to bridge the gap between developing and developed countries by allowing discussion of a number of open licensing mechanisms (such as ‘patent pools’, open access, patent information databases, etc.) and supporting capacity building within developing country NDEs or other agencies. This should aim at contributing to developing countries’ understanding of the legal nuances of using these pools, technology management, and familiarising scientists and lawyers in developing countries with patent drafting. It should also support the identification of projects that can benefit open-access technologies (Bhasin 2013). At the very least, discussion based on case-by-case evidence of the role of IPR in technology cooperation would be helpful, as the current oversensitivity to the topic is blocking progress.

Technology is broadly viewed as a key building block in the climate regime and part of the package deal that will eventually be struck at COP21 in Paris. Despite sparse attention to the theme, the strength, financing, and design of the technology provisions in the Paris agreement will determine whether developing countries will accept the outcome of COP21. Ambitious yet realistic provisions around R&D cooperation,

innovation capabilities and finance is urgently needed, so that ‘technology’ can be the dealmaker it ought to be.

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