

# Innovation and Technology Transfer: Supporting Low Carbon Development with Climate Finance

Letha Tawney and Lutz Weischer

**International Innovation System** - the web of relationships between individuals, institutions, companies and governments where new ideas and improvements emerge, are tested and if successful, spread. This system is both the source of improvements and the channels through which they spread to other practitioners.

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## OVERVIEW

Meeting the ambitious goal of limiting global warming to 2° Celsius or less will require significant innovation - the improvement of technologies and processes to drive down their cost and improve their performance. Public climate finance is essential to spurring innovation and creating the conditions that attract private investment. Investing in innovation also makes the most efficient use of the limited financial resources available and takes advantage of the developing world's growth to improve technologies. Countries like the UAE have an opportunity to play a pioneering role in this expanded international innovation system.

Innovation will be underpinned by international cooperation that supports:

- priority setting and coordination,
- joint research, development and demonstration,
- sharing information and knowledge,
- capacity building,
- provision of finance and
- supporting hubs and networks.

Several international forums can fulfill portions of these functions, but each faces its own limitations and risks. In this context the UAE could uncover opportunities to be an innovation leader. For example:

- How can IRENA and Masdar develop into a world-class innovation hub and then effectively link into the international innovation system?
- How can the UNFCCC's Climate Technology Center and Network function effectively?
- How can other forums such as the Clean Energy Ministerial develop to support the international innovation effort?
- How can public climate finance be used to support innovation while deploying clean technology in the developing world?

## INTRODUCTION

Support for and investment in clean energy technologies will be one of the main uses of public climate finance. In Cancun, the international community confirmed that global warming needs to be limited to 2° Celsius above pre-industrial levels.<sup>1</sup> For this to be possible, continuous innovation, the development and dissemination of improved technologies and processes, will be necessary in all countries. Developed countries will have to deeply reduce their emissions. The poorest and least developed countries will have to increase energy access in a climate-friendly way. Finally, the major emerging economies will have to shift to a low carbon development path, which enables further rapid economic development while slowing and eventually stopping the growth in emissions. None of these shifts will be possible without technology transfer and innovation. Countries with strong technology assets, like the United Arab Emirates, have the opportunity to participate in and even expand the international innovation system in an unprecedented way.

Climate finance, the \$10 billion a year through 2012 and \$100 billion a year by 2020 that governments have pledged, is necessary to support technologies because, while several of the mitigation technologies required for low-carbon development are available, most are more expensive than the higher-polluting options. For the time being, these technologies need additional support in order to be deployed in developing countries. However, pledged climate finance is insufficient to address the entire challenge and should therefore be used in a way that reduces the cost for clean technologies over time; to drive wide deployment that encourages improvement in both cost and performance. In the power sector, for instance, the cost to produce a low carbon kWh of electricity must fall so that scarce funds meant to address energy poverty and enable economic development through access to modern energy can go farther.<sup>a</sup>

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<sup>a</sup> This paper focuses on mitigation technology transfer and draws examples from the electricity sector, but many of the recommendations apply equally to technology transfer in sectors beyond electricity and in adaptation.

This change in price will come through improved performance (e.g. larger wind turbines that have a higher capacity factor) and lower input costs (e.g. the declining price of PV solar panels) as well as improved processes to produce, install and operate low-carbon power technologies. Energy efficiency technologies will also need to be widely deployed to dampen the growth in energy demand; again addressing energy access by ensuring new low carbon generation meets more customers' needs. Finally, entirely new technologies that are still in labs around the world need to be developed and widely diffused. These changes in the energy infrastructure that will enable cost-effective, low carbon development will be driven by innovation which has been supported and catalyzed by climate finance.

So far, countries such as Japan, Germany and the United States have dominated innovation in nearly every industry, including low carbon technologies. Analysis by Chatham House in 2009 highlighted how slowly patented innovations diffuse throughout the global power sector specifically, taking decades to become the new standard practice.<sup>2</sup> This glacial pace of change has many causes: slow capital stock turnover, risk aversion when financing large capital projects, private sector business strategies and a high degree of complexity in the energy system. However, the truly massive energy build-out already underway in the emerging economies presents opportunities to overcome these barriers, for example through designing demonstration projects to reduce technological risk over time, rapidly iterating through design cycles, improving manufacturing processes and optimizing the operations and maintenance of facilities. Emerging economies can play a new role in this wave of innovation and climate finance, as pledged in Copenhagen and Cancun, can provide the means to take advantage of this opportunity.

This paper reviews the functions of international cooperation that support innovation. Then it turns to the international forums that could undertake these functions, focusing on the UNFCCC technology negotiations but also discussing some of the other arenas of activity. Finally, the paper outlines the key decision points approaching in 2011 and the opportunities these may present to emerging economies such as the UAE.

## SUPPORTING INNOVATION AND TECHNOLOGY TRANSFER

It has long been clear that a simple model of ‘transferring’ technologies<sup>b</sup> from developed to developing countries is insufficient to meet the climate challenge.<sup>3</sup> The technologies as they exist today cannot cost-effectively replace the polluting energy infrastructure and the slow rate of growth in developed economies does not offer the opportunity to rapidly improve them. Developing and dispersing the innovations required to transform the global energy infrastructure will require international cooperation as opposed to simple transfers. This cooperation must fulfill the following array of functions in order to effectively support innovation.



### Priority-setting and coordination

There are limited resources to apply to a massive transition so some priority setting and coordination of efforts internationally is useful to ensure efficiency. Coordination of policy, such as international efficiency standards, is also a powerful innovation driver.



### Joint research, development and demonstration

This is the most familiar function, conjuring visions of laboratories and test results. Research cooperation between countries is already common in other areas. China for example has invested in collaborative RD&D, signing 103 collaboration agreements by 2009.<sup>4</sup> Another example is the demonstration of carbon capture and storage technology, which is so expensive that working jointly offers important efficiencies.

<sup>b</sup> The Intergovernmental Panel on Climate Change 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 such as governments, private sector entities, financial institutions, non-governmental organizations (NGOs) and research/education institutions." This definition explicitly goes beyond the narrow discussion of the developed countries handing technology off to developing countries and captures the full breadth of work needed to meet the challenge.



### Sharing of information and knowledge

Innovations come almost entirely on the shoulders of prior knowledge. Learning about prior successes and failures, for example in policy design, allows innovators to find new paths to success with less duplication of effort. Information sharing is also critical to the spread of successful innovations as decision makers are rarely willing to take risks on innovations in the absence of trusted information, such as how technologies perform in the field.



### Capacity building

Innovations are by definition a new way of operating. Institutions and individuals need the capacity to absorb new ways of working. Developing countries may have a particular need to build capacity to work with (develop, manufacture, install, operate, improve on) clean energy technologies. Developing countries may also need to build capacity in order to implement policies to remove barriers or create markets and demand for clean energy.



### Provision of finance

International development aid and climate finance are two sources that can support the international innovation system directly, can be invested in helping developing countries build capacity to innovate, can support domestic enabling environments and policies or can simply cover the incremental cost of a cleaner technology option.



### Supporting hubs and innovation networks

The success of informal hubs such as Silicon Valley in California has led to a range of published studies on how proximity and personal interaction encourages the rise and spread of innovations.<sup>5</sup> This has, in turn, led to efforts to create hubs, both physical and virtual; to bring smart people together so new ideas can emerge and quickly spread. Hubs and networks may also be where information sharing, capacity building or joint RD&D happen - but they are not the only place for these functions to take place. Hubs and networks go beyond these functions, providing an important incubator for innovation.

## MATCHING INNOVATION FUNCTIONS TO INTERNATIONAL INSTITUTIONS

The outline of necessary functions of a good international innovation system listed above begs the question, “Who will do all of this?” This question has been central to the United Nations Framework Convention on Climate Change (UNFCCC) negotiations around technology transfer as well as discussions in the G20, the Major Economies Forum and other major international processes. Fortunately there are a wealth of options in existing institutions and new initiatives being announced regularly. Table 1 summarizes the functions and some of the key forums undertaking them.

### THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

Technology transfer to address climate change, including for both mitigation and adaptation solutions, was first addressed in the United Nations Framework Convention on Climate Change<sup>6</sup> and was one of the pillars in the 2007 Bali Action Plan.<sup>7</sup> A Technology Mechanism was established in the December 2010 Cancun Agreements.<sup>8</sup> The mechanism has a Technology Executive Committee (TEC), which will do strategic planning, identify barriers and facilitate collaboration. It also has a Climate Technology Centre and Network (CTCN) where the center will facilitate a network of those institutions, networks and initiatives that are already working on climate technology.

Under the Cancun Agreements the new technology mechanism has no explicit relationship with the new Green Climate Fund. The Green Climate Fund (GCF) will have its own board that will make funding decisions in accordance with strategic guidance provided by a Standing Committee (SC) under the Conference of the Parties (COP) to the UNFCCC. This committee has several functions including “improving coherence and coordination in delivery of climate finance”<sup>9</sup> but nothing in the Agreements specifically addresses how the GCF will drive innovation and technology transfer. Given the TEC’s mandate, together with the SC, it could support the COP in developing strategic guidance on program prioritization and resource allocation, funding criteria and

country eligibility to the GCF Board. However, this relationship remains to be defined.

The Cancun Agreements also describe the CTCN but lack specificity on which institutions can be part of the network, how they are selected and how they will interact effectively. The role of the Center in relationship to the network also needs to be defined further.

Given the strengths of the UNFCCC technology mechanism it is best suited to fulfilling the following functions:

- Priority setting and coordination: Recommending priorities and providing loose coordination of activities within the UNFCCC and beyond.
- Supporting hubs and innovation networks: Coordinating existing efforts and institutions working on climate technologies and providing a ‘one-stop shop’ for countries seeking solutions.
- Capacity building: The mandate of the CTCN includes providing capacity building at the Parties’ request but its ability to deliver will heavily depend on funding.

The UNFCCC technology mechanism faces some challenges unique to its makeup. Operating within the UNFCCC has the benefit of ensuring very wide participation and broad agreement with any decisions that can be reached. However, decisions that influence resources like finance can become political and therefore more difficult to reach. The UNFCCC Nairobi Work Programme on adaptation, for example, has not been able to issue recommendations on best practices because the Parties cannot find agreement. Though, the Expert Group on Technology Transfer (EGTT), which the TEC is replacing, has had some success in negotiating recommendations.

It can also be difficult to bring deep technical expertise to the TEC’s work. It is critical that TEC members have extensive experience in innovation and technology policy issues in order for the TEC’s mandate to be successful. Finally, there is little discussion of how the mechanism will be funded. It does not currently have access to the Green Climate Fund so, like much of the UNFCCC secretariat, it will have to raise money from Parties to fulfill its mandate.

## OTHER FORUMS FOR INNOVATION AND TECHNOLOGY

Technology transfer and innovation happen within a complex system of relationships between governments, companies, financiers, regulators and others. The UNFCCC cannot fulfill all of the functions necessary for an effective international system of innovation. Many other forums are important to incubating innovation and ensuring successes spread widely and quickly. The following section presents some selected examples that the UAE has experience with, but a recent survey by infoDev found at least 67 organizations supporting climate innovation globally.<sup>10</sup>

The **Clean Energy Ministerial (CEM)** is an example of ‘opt-in’ technology initiatives.<sup>11</sup> Unlike the UNFCCC, where more than 190 countries must agree, the Clean Energy Ministerial launches initiatives involving just those countries that are interested in participating. This process has a great deal of flexibility to take up several functions. The focus on operational efforts means it lends itself to:

- **Information sharing:** The Clean Energy Solutions Center is collecting experiences with policy to drive clean energy innovation in many member countries and disseminating the lessons learned broadly. Through the Multilateral Solar and Wind Working Group, an international atlas of solar and wind resources is under development.
- **Priority setting and coordination:** The Carbon Capture, Utilization and Storage Action Group is creating an international, strategic plan to overcome the barriers to CCUS demonstration at the commercial scale.

The nascent **International Renewable Energy Agency (IRENA)** is intended to fulfill the information sharing and capacity building functions.<sup>12</sup> It will perhaps become one of the hubs within the UNFCCC CTCN. IRENA represents a multilateral approach to tapping expertise and collecting information. Where the Clean Energy Ministerial initiatives are geared towards middle income and emerging economies, IRENA has very broad participation, like the UNFCCC. It is intended to permanently house expertise on renewable energy development and implementation, though with a heavy focus on the latter. While it is a new organization so growing pains

are to be expected, it remains to be seen how quickly IRENA can begin to fulfill its mandate. In particular, it will need to grow beyond being a counterpoint to the International Energy Agency and become a center of innovation in its own right.

The **Global Carbon Capture and Storage Initiative (GCCSI)** is an example of public and private cooperation to coordinate and share information on demonstrations.<sup>13</sup> While this effort was launched by the Australian government and is supported by funds from the United States, it is not a formal inter-governmental organization. It is instead a membership organization, bringing governments, industry and civil society together to consider how CCS can move to commercial deployment.

**Bilateral cooperation**, through development aid or technology cooperation, can be an effective tool to provide finance and participate in joint RD&D. For example, development aid or bi-lateral climate finance can be invested in enabling environments that must be in place before debt finance, even from the multilateral development banks, is available to clean energy projects. For example, transmission companies have to have the technical capacity to absorb intermittent electricity from renewable resources. Transmission infrastructure is not specifically a low carbon technology but is a pre-requisite to low carbon development.

Cooperative research and development is often done bi-laterally, outside the multilateral institutions. The US / China Clean Energy Research Centers that were announced in 2009 are just one example of this model. These agreements can be highly tailored to the countries’ needs and often are structured to encourage relationship building between researchers and long-term cross-pollination of information, ideas and lines of inquiry.

**Table 1 Innovation Functions and the Institutions Undertaking Them**

Functions	Institutions
Priority setting and coordination	UNFCCC – Technology Executive Committee, CEM – CCUS Action Group
Joint RD&D	Bi-lateral efforts - e.g. US/China Clean Energy Research Centers
Information sharing	CEM – Clean Energy Solution Center, IRENA, GCCSI
Capacity building	UNFCCC, IRENA, Bi-lateral efforts
Provision of finance	Bi-lateral efforts, The Green Climate Fund
Supporting hubs and networks	UNFCCC – Climate Technology Centre and Network, IRENA

**LOOKING FORWARD TO 2011 AND BEYOND**

The Cancun Agreements set out a rough work-plan for elaboration of the technology mechanism by COP 17. In particular, the Ad-hoc Working Group on Long-term Cooperative Action (AWG-LCA) is directed to convene an expert workshop to discuss open issues – including the relationship between the technology mechanism and the Green Climate Fund and the makeup of the CTCN.<sup>14</sup> The workshop will provide input to the ongoing negotiations under the AWG-LCA with an eye towards a decision at COP 17 that would make the mechanism operational in 2012. The members of the TEC will also be elected shortly to begin to negotiate its specific modalities.

While the mandate and makeup of the TEC was contentious, the remaining issues, particularly the relationship with the finance mechanism, are even more difficult to resolve. Any discussion that influences climate finance is a controversial issue. However, the TEC's influence on the Green Climate Fund strategic guidance will be a key indicator of its potential to fulfill its mandate and add value to the international innovation system.

As seen above though, the UNFCCC is hardly the only player. Countries that have pledged climate finance, such as Germany, the United States and Norway are now establishing strategies for how that climate finance will be allocated. They are weighing how to fund developing countries’ nationally appropriate mitigation actions (NAMAs) as well as the larger technology cooperation infrastructure that can help ensure those NAMAs are successful. Their choices will have a strong

impact on the level of support international innovation receives.

As the Clean Energy Ministerial enters its second year there is an opportunity for the initiatives to grow in ambition and on the ground impact. Being an ad hoc organization however, it could also lose momentum and direction over time. Similarly, IRENA has an opportunity to fill important gaps in renewable energy innovation though building an institution from scratch has proved difficult.

**UNCOVERING OPPORTUNITIES FOR THE UAE**

As a technically advanced developing country and member of the G77, the United Arab Emirates may have some unique opportunities to shape the intersection of climate finance and global innovation and technology transfer.

- IRENA and Masdar represent an opportunity to build an important clean technology hub. Integrating with the international innovation system could further leverage this investment. Could the UAE develop a proposal for how institutions like IRENA can effectively function as a part of the UNFCCC CTCN?
- Is there an opportunity, as the host for the 2011 CEM meeting, to shape the individual initiatives and the larger meeting to encourage ambition and a focus on implementation for maximum impact on the ground?
- In the very near term, the makeup of the UNFCCC TEC will be an important ingredient to its long-term success. Could the UAE work with its G77 partners to ensure highly qualified candidates are elected in early 2011?

- As a participant in global discussions about how climate finance might be best allocated, could the UAE champion the vision of a global innovation system as roughly outlined above and ensure financial support for the multilateral institutions that will implement it?
- The UAE has one of the largest sovereign wealth funds in the world today. Is there an opportunity for the investment strategy to prioritize clean energy deployment and minimize investments in high carbon energy sources? Similarly, could the UAE's own overseas development investments support building enabling environments in developing countries?



## REFERENCES

<sup>1</sup> "Outcome of the work of the Ad Hoc Working Group on long-term Cooperative Action under the Convention" (United Nations Framework Convention on Climate Change Secretariat, December 12, 2010), para 4, [http://unfccc.int/files/meetings/cop\\_16/application/pdf/cop16\\_lca.pdf](http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf).

<sup>2</sup> Bernice Lee, "Who Owns Our Low Carbon Future? Intellectual Property and Energy Technologies" (Chatham House, September 2009), <http://www.chathamhouse.org.uk/research/eedp/papers/view/-/id/775>.

<sup>3</sup> "Methodological and Technological Issues in Technology Transfer. Summary for Policymakers, A Special Report of IPCC Working Group III" (Intergovernmental Panel on Climate Change, 2000), p. 3.

<sup>4</sup> Xiaomei Tan, "An Emerging Revolution: Clean Technology Research, Development and Innovation in China" (World Resources Institute, December 2009), 5, <http://www.wri.org/publication/an-emerging-revolution>.

<sup>5</sup> James Duderstadt and Gary Was, "Energy Discovery-Innovation Institutes: A step toward America's Energy Sustainability" (The Brookings Institute, February 2009).

<sup>6</sup> "United Nations Framework Convention on Climate Change" (United Nations Framework Convention on Climate Change Secretariat, 1992), article 4, <http://unfccc.int/resource/docs/convkp/conveng.pdf>.

<sup>7</sup> "1/CP.13 Bali Action Plan" (UNFCCC Secretariat, March 14, 2008), clause 1d, <http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf#page=3>.

<sup>8</sup> "Outcome of the work of the Ad Hoc Working Group on long-term Cooperative Action under the Convention" (United Nations Framework Convention on Climate Change Secretariat, December 12, 2010), chapter IVB, [http://unfccc.int/files/meetings/cop\\_16/application/pdf/cop16\\_lca.pdf](http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf).

<sup>9</sup> "Outcome of the work of the Ad Hoc Working Group on long-term Cooperative Action under the Convention" (United Nations Framework Convention on Climate Change

Secretariat, December 12, 2010), para 112, [http://unfccc.int/files/meetings/cop\\_16/application/pdf/cop16\\_lca.pdf](http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf).

<sup>10</sup> Ambuj Sagar, Bloomberg New Energy Finance, "Climate Innovation Centres: A new way to foster climate technologies in the developing world?" (infoDev, November 2010), <http://www.infodev.org/en/Article.645.html>.

<sup>11</sup> "Clean Energy Ministerial," <http://www.cleanenergyministerial.org/>.

<sup>12</sup> "IRENA - International Renewable Energy Agency," <http://www.irena.org/home/index.aspx?mnu=hom>.

<sup>13</sup> "Global CCS Institute," <http://www.globalccsinstitute.com/>.

<sup>14</sup> "Outcome of the work of the Ad Hoc Working Group on long-term Cooperative Action under the Convention" (United Nations Framework Convention on Climate Change Secretariat, December 12, 2010), para 129 [http://unfccc.int/files/meetings/cop\\_16/application/pdf/cop16\\_lca.pdf](http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf).

## ABOUT THE AUTHORS

**Letha Tawney** is a Senior Associate leading the International Innovation Ecosystem project at WRI. She has written on innovation, clean energy and transmission policy and bioenergy. Letha has a Master in Public Administration from the Harvard Kennedy School. She can be reached at [letha.tawney@wri.org](mailto:letha.tawney@wri.org).

**Lutz Weischer** is a Research Analyst at WRI, leading the Climate and Trade project. He has written on clean energy markets, trade in a carbon constrained economy and competitiveness. Lutz has a Master in International Affairs with a specialization in Sustainable Development from the Paris Institute of Political Studies. He can be reached at [lutz.weischer@wri.org](mailto:lutz.weischer@wri.org).



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