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From confrontation to cooperation

A developed country perspective on the role of developing countries' contribution to technology development and transfer

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Contents

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Executive summary

The concept of *technology development and transfer* in the context of the United Nations Framework Convention on Climate Change (UNFCCC) has been around for several years. In the Bali Action Plan countries agreed on

"enhanced action on technology development and transfer to support action on mitigation and adaptation, including, inter alia, consideration of:

i. Effective mechanisms and enhanced means for the removal of obstacles to, and provision of financial and other incentives for, scaling up of the development and transfer of technology to developing country Parties in order to promote access to affordable environmentally sound technologies;

ii. Ways to accelerate deployment, diffusion and transfer of affordable environmentally sound technologies;

iii. Cooperation on research and development of current, new and innovative technology, including win-win solutions;

iv. The effectiveness of mechanisms and tools for technology cooperation in specific sectors."

It is expected that the Copenhagen COP15 meeting in December 2009 will elaborate on the agreement reached on Bali and decide on (principles for) a mechanism to implement technology development and transfer. Several countries have provided suggestions on elements of such a mechanism.

In the discussion of technology and transfer the emphasis has so far mostly been on the role of developed countries. The emphasis on developed countries is understandable since they are expected to provide the resources for the mechanism. Yet, on reflection it should be clear that a successful mechanism for technology development and transfer requires contributions by developing countries as well. For instance, one obvious requirement is that technology developed on behalf of, and/or transferred to developing countries at significant cost under such a mechanism, should actually be implemented by developing countries. This may sometimes be more difficult than it seems, say if implementation of a particular technology conflicts with domestic policy priorities.

In this report we discuss the role of developing countries within a mechanism for development and transfer of climate friendly technologies. In the course of the work we summarise suggestions (submissions) for the design of such a mechanism. Based on what we see as the role of developing countries, and in light of the thrust of the submissions, we identify design elements of the mechanism that India may take forward in the Copenhagen negotiations.

We identify contributions of developing countries during basic research, product development and post-development. During basic research into low carbon technologies we suggest, as do several submissions, to establish joint research centres into low carbon technologies. These should be internationally funded and located in both developed and developing countries. The model would be, e.g., MIT of the U.S., Tsinghua University of China and Indian Institute of Technology in India, but the mandate should be confined to low carbon technologies. The role of developing countries during this stage would be threefold:

- Make sure that the best scientific talent in developing countries is allocated to the centres

- Allow sharing responsibility for research programmes with other countries
- Practical host's obligations (setting aside land, physical infrastructure etc)

Following basic research come product development and manufacturing. During this stage research is commonly conducted in private companies. Funding is part private, part public. The aim is to profit from the new products that are developed. IPR and patent rights are protecting the profit stream. During this stage we argue that a mechanism for technology development and transfer contributes either by increasing the share of public funding in research, bringing down private costs; or the mechanism contributes by lifting demand for low carbon products, increasing potential income. Lifting demand will involve money transfers to developing countries, which use it for purchasing low carbon technologies. There are many practical ways of doing that. Bringing down costs will also mean money transfers to developing countries. Note that we do not recommend weakening the IPR or patent regimes. The role of developing countries during this stage would be threefold:

- Contribute to a consensus on what is the limit of technology development and when external funding should stop
- A willingness to have scrutinised that funds really are spent on stimulating demand and reducing costs of technologies
- A willingness to accept that this will be a mechanism with many similarities to tied aid

Assuming that technologies are developed to the point that they are cost-efficient the implicit assumption in the discussion over technology development and transfer is that developing (and developed) countries will deploy these technologies instead of polluting ones. Even this stage requires some contributions from developing countries. To accomodate the technologies they may have to adjust policy priorities and practices in some areas. For instance, the electrical grid in a large country may be owned by provincial governments that tend to impose tariffs on electricity transfers through their jurisdiction. The cumulative sum of these tariffs may render e.g., wind energy uncompetitive although the technology itself is cost-efficient. As far as we know both India and the U.S. Mid-West is currently struggling with this problem. Given that technologies are developed on behalf of developing countries such policies and regulations in developing countries will inevitably face greater scrutiny than today. Actually, some developing countries have invited developed countries to contribute to the policy infrasctructure for low carbon technologies and suggested a broad definition of the concept of the technology that goes far beyond the hardware itself. Developing countries may find this position to be quite demanding if followed through. Where one person sees a contribution another may see interference. In summary the role of developing countries during the post-development stage of technology development and transfer would be twofold:

- Clean technologies should be used
- Clean technologies should not be misused

We think it will be a useful and a substantial contribution to foster a more cooperative spirit in the negotiations if the developing countries could offer contributions along these lines in Copenhagen. India, in particular, may play an important role as

- India will have a global impact because of its size
- India have a relatively strong human capital basis
- India have large markets for demonstration purposes

Thus India could contribute significantly to the bridging the North-South divide in climate negotiations and hence turn confrontation into cooperation.

1 Introduction

Climate negotiations have been going on for close to two decades now, and a new important meeting is coming up in Copenhagen 2009 (COP15). The topic there is the prolongation or renewal of the protocol signed in Kyoto in 1997. A fair description of the process up till now is one of confrontation between developed (Annex I) countries and developing (non-Annex I) countries. Developing countries have (mostly correctly) pointed out that Annex I countries have not reduced their emissions according to expectations, and have also more or less failed when it comes to securing financial support for mitigation and adaptation in the developing countries. On the other hand, the developed countries point to the fact that meeting the climate challenge will entail large greenhouse gas (GHG) reductions from a business-as-usual (BAU) scenario from the developing countries, in particular the larger and faster growing countries like India and China. These countries object to even discussing target and time tables for binding commitments before the rich world has 'done its part'.

This stalemate has also reflected on the negotiations on technology transfer and financial support. How to break the stalemate? How to get from confrontation to cooperation?

There are several reasons for why a developing country should consider an early transition towards a low carbon economy.

1. It is increasingly likely that tomorrow's world will be carbon constrained. This creates opportunities for those economies that are willing to base their development of the industrial basis on clean and climate friendly technologies. The market for climate friendly technologies is likely to be a strongly growing segment of the world economy of tomorrow.

2. The relationship between a future world trade regime and climate restrictions is at present unclear. It may be that future trade in goods in particular may be regulated with respect to the production technologies' carbon footprint. Thus, establishing a production structure that is carbon lean may provide competitive advantages in a future world market.

3. Securing a low carbon production basis will normally imply an emphasis on energy efficiency. In a future world where non-renewable resources like fossil fuel are likely to become ever more scarce and their use more restricted and thus expensive, a strategy based on developing a low carbon economy may also be the economically efficient choice.

4. There is a strong link between energy use in most countries and local air and water pollution problems. Developing a low carbon economy is likely to promulgate a clean local environment.

5. In some regions and countries, concern about energy security may be a strong argument in favour of developing local, and often renewable, energy resources.

6. Finally, a global commitment to developing low carbon societies is a prerequisite to meeting the climate challenge. The cost of inaction may not always be obvious at a local level, but a climate disrupted global economy is likely to impose heavy economic costs in a steadily more globalised economic environment.

In conclusion, the arguments for basing an economic development strategy on the ideas of a low carbon economy are many and likely to be robust in the face of future uncertainties.

Technology is at the heart of this transition to a low carbon economy. We therefore in this report suggest that global cooperation on technological development and transfer could provide a way out of the confrontational stance of the negotiations. While the developed world will have to finance much of this development, it is, however, also the case that it requires something from the developing countries, and this is what we want to focus on this report.

2 What is Technology Development and Transfer?

A key concept in our report is *technology development and transfer*. The delineation of this concept is important for the roles and contributions of developed and developing countries. The concept has been part of the UNFCCC negotiations for a long time. However, we have not been able to find a precise definition of the term in official texts. Metz et al. (2000), in a special report to the IPCC, gives the following definition of technology transfer:

"The Report defines the term "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, NGOs and research/education institutions." (Metz et al., 2000)

The online encyclopaedia Wikipedia defines technology transfer as follows:

"Technology transfer is the process of sharing of skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among governments and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services."

These are definitions of *technology transfer* while *development* seems to have been inserted from Bali onwards. Development obviously refers to the stages prior to the actual transfer.

Metz et al. (2000) comment that "the treatment of technology transfer in this report is much broader than that in the UNFCCC or any particular Article of that Convention." The broadness probably refers to whether or not technology encompasses all of "know-how, experience and equipment". A narrow definition would focus on equipment and only include know-how and experience to the extent that those are necessary e.g., to make productive use of equipment. The transfer of know-how and experience is usually covered by *capacity building* or similar concepts. In our report it is fair to say that we have in mind a definition that is fairly broad and includes activities under the heading of capacity building. We shall see that submissions by several developing countries also use a broad definition, while developed countries are less broad.

3 Technology development and transfer in climate negotiations till now

Only gradually has the nature and scale of the climate challenge become clear. Today's ambition of limiting the global temperature increase to about 2 degree C above the pre-industrial level requires a massive retooling of the industrialised countries. In addition, economic growth in the developing world must be based on climate friendly technologies and a low carbon economy. Thus, technology development and implementation are crucial for

further human development and progress. How has the technology development challenge been met so far?

In the United Nation Framework Convention on Climate Change (UNFCCC) negotiated in Rio de Janeiro in 1992, it was determined to include the following text on technology development and implementation:

> "UNFCC article 4.1: All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall:
>
> …
>
> (c) Promote and cooperate in the development, application and diffusion, including transfer, of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors;
>
> UNFCCC article 4.5: 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 know-how 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. Other Parties and organizations in a position to do so may also assist in facilitating the transfer of such technologies.

Source: *http://unfccc.int/ttclear/jsp/Background.jsp*

Since then, most of the focus has been on negotiating reduction targets for the industrialised (Annex 1) countries. Technology transfer has been an issue, however not one that has attracted much attention or gained many successes at the negotiating table.

4 The Bali Action Plan and the "technological trail"

In 2007 the 13th conference of the parties to the United Nations Framework Convention on Climate Change (COP13) convened in Bali, Indonesia to discuss, e.g., the future of the international climate regime after 2012 (which is the end date for the Kyoto protocol). The Bali Action Plan (BAP), adopted as a COP13 Decision, was accompanied by a series of Decisions adopted by COP/MOP3 and established a two-track process (the Convention track and the Kyoto track) aiming at the identification of a post-2012 global climate regime to be adopted by COP15 and COP/MOP5 in Copenhagen in 2009.

The Bali Action Plan included the request for developed countries to contribute to the mitigation of global warming in the context of sustainable development. In addition, the Bali Action Plan envisaged enhanced actions on adaptation, technology development and on the provision of financial resources, as well as measures against deforestation. Paragraph 1 of the

Box 1: Recommendations in the Bali Action Plan for enhancing the implementation of the technological transfer framework of the Convention

(The recommendations presented here are reproduced as included in document FCCC/SBSTA/2006/5, annex II.)
Five main areas for enhancing the implementation of the framework are outlined in The Bali Action Plan:

*A. Technology needs and needs assessments (*FCCC/SBSTA/2006/INF.4*)*

- Technology Needs Assessments *(*TNAs) are important in order to get an overview of national technology needs and many have been completed. But the TNAs have in many cases been shown to be inefficient because of a lack of data. Several recommendations are made to enhance the implementation of this key theme, among others to encourage non-Annex I parties to complete their TNAs, and provide updated information on their technology needs.

B. Technology information (FCCC/SBSTA/2006/INF.4*)*

- The main goal here is to enhance communication between nations, regional centres, relevant international organizations and private sector.

C. Enabling environments for technology transfer

- Technical studies on barriers, good practices and recommendations for environmentally sound technologies are the focal points for activities under this paragraph, but information on nations' publicly funded research and development is not always available. Enhancing the interaction between government activity and private sector is important for the technology transfer process.

D. Capacity-building for technology transfer

- Capacity-building needs are to be identified by non-Annex I parties in their TNAs and national communications and other national reports.

E. Mechanisms for technology transfer

The mechanisms are aimed at enhancing the implementation of a technology transfer *framework:*

- Innovative options for financing the development and transfer of technologies
- Possible ways and means to enhance cooperation with relevant conventions and intergovernmental processes
- Promotion of endogenous development of technology through provision of financial resources and joint research and development
- Promotion of collaborative research and development on technologies
- The Expert Group on Technology Transfer

Bali Action plan1 describes the necessity to implement the Convention through a long-term cooperative action, by addressing the need for:

- Enhanced national/international action on mitigation of climate change,
- Enhanced action on adaptation,
- *Enhanced action on technology development and transfer to support action on mitigation and adaptation,*
- Enhanced action on the provision of financial resources and investment to support action on mitigation and adaptation and *technology cooperation*

Technology is here described as a key element in the implementation of this long-term action, and especially the third decision in the Bali action plan, makes this apparent.

[1] Decision 1/CP/13

4.1 The Expert Group on Technology Transfer

The Expert Group on Technology Transfer, is mentioned under E. Mechanisms for technology transfer in Box 1. As part of its future work program it is expected to develop a set of performance indicators that could be used by the Subsidiary Body for Implementation to regularly monitor and evaluate the effectiveness of the implementation.

The Bali Action Plan asked the Expert Group to consult with relevant international organizations in its work, and to report on its findings to both the subsidiary bodies, and relevant international organizations and initiatives should be closely coordinated with the relevant activities in work program of the Expert Group.

The Bali Action Plan also urged relevant intergovernmental organizations, international financial institutions, and other partnerships and initiatives (including the Climate Technology Initiative) to provide technical and financial support to Parties not included in Annex I to the Convention, and countries with economies in transition to help them conduct, identify and implement prioritized technology needs.

The Global Environment Facility, as an operating entity of the financial mechanism of the Convention, was requested to provide financial support for the technology transfer framework.

The Expert Group has an important role, but many parties, especially developing countries, do not see it as sufficiently competent or active to fulfil its purpose. Submissions to the negotiations both include suggestion to eliminate and to extend it's mandate.

4.2 The Ad Hoc Working Group for Long Term Cooperative Action under the Convention (AWG-LCA)[2]

An account of ideas and proposals contained in the most recent submissions from Parties (May 2009) was prepared for the Bonn conference by AWG-LCA. This negotiating text encompasses all aspects of the Bali Action Plan (decision 1/CP.13).[3]

As is customary in the practice of negotiation, it is envisaged that the text will be a "living document", with Parties modifying it and bringing new ideas to bear. In fact, several Parties have indicated their intention to bring forward additional proposals.

The depth of coverage of each element of the Bali Action Plan in this negotiating text varies according to the depth of consideration that each element has been elaborated on by the submitting parties. A particular case is that of the consideration of a shared vision for long-term cooperative action, in which Parties have yet to engage in clarifying how to integrate in their shared vision the essence of their agreed goals under the four building blocks of the Bali Action Plan (adaptation, mitigation, technology and financing).

5 The role of developed and developing countries in submissions on technology development and transfer

This chapter briefly reviews suggestions ("submissions") for a mechanism on technology development and transfer. The suggestions are put forward for the consideration of the COP15 meeting in Copenhagen. A large number of country alliances as well as individual countries have put forward suggestions. We have reviewed about 74 submissions from 41

[2] UNFCCC, 2009: Ad Hoc Working Group on Long-Term Cooperative Action under the Convention. FCCC/AWGLCA/2009/8. Bonn, 19th May 2009. http://unfccc.int/resource/docs/2009/awglca6/eng/08.pdf
[3] These submissions are contained in document FCCC/AWGLCA/2009/MISC.4.

parties[4], covering suggestions submitted in the period form the COP in Bali up to medio 2009. A working paper from World Resources Institute (2009), "Summary of UN Submissions", has also been useful in providing an overview with regards to trends and tendencies among parties, and contents of submissions. Section III concerning submissions on technology has been particularly useful. It contains references to 34 submissions, both joint initiatives and submissions from countries.

Key aspects of submissions are collected and presented in Appendix 1 of our report. The text of the chapter gives representative examples of what is stated in Appendix 1.

We are interested in describing what role, if any, the submissions ascribe to developed and developing countries. We find it useful to distinguish suggestions related to *finance*, *governance and regulation*, and *cooperation*. It is sometimes useful, as well, to distinguish suggestions related to *mitigation*, *adaption* and those having a *cross-purpose*.

5.1 Suggestions with respect to finance

Several developing countries have suggested that developed countries finance the incremental costs of technology development and transfer. For instance, India puts forward a suggestion that 0.5% of the GDP of the developed world should be set aside for funding adaptation and mitigation through resource transfers or grants. India suggests that this funding should cover the full cost of capacity building for research, development, and demonstration of new technologies, enhancing human capital and absorptive capacity. China has floated a figure of 0.7% (e.g., China Daily, 2008), which of course is equal to the unofficial target for development aid from developed countries. China suggests to pool the funding into a Multilateral Technology Acquisition Fund. This fund should finance technological R&D in a broad sense, including capacity building – with human resource development as a priority – and also including information service, monitoring and enforcement systems, and construction of policy infrastructure. Moreover, the fund should cover insurance, loan guarantees, or it should invest via stocks, bonds and other financial products.

5.2 Suggestions with respect to governance, regulation and institutions

Several countries have noted a need for new international bodies and systems of governance for organizing, overseeing and carrying out the research. For instance, Argentina suggests setting up national/regional/international collaborative R&D research centres, with North-South and South-South co-operation. The Alliance of Small Island States (AOSIS) wants the establishment and provision of support to national and regional academia and centres of excellence. The EU points out that for a number of specific key technologies, countries should agree on cooperative joint R&D and large scale demonstration and deployment projects.

These are suggestions for research cooperation. There are also ample suggestions on governance. India suggests to that an Executive Board of Technology, elected by COP and supported by a new branch of the UNFCCC Secretariat, should develop strategy and technology action plans, and monitor the implementation of specific operational policies, guidelines and administrative arrangements, including the disbursement of resources. China suggests to establish a subsidiary body under COP for development and transfer of technologies with panels for technology needs assessment, information clearinghouse, dialogue and coordination for enabling policies and measures and IPR, management of

[4] See report from UNFCCC, 2009: Ad Hoc Working Group on Long-Term Cooperative Action under the Convention. FCCC/AWGLCA/2009/8. Bonn, 19th May 2009.
http://unfccc.int/resource/docs/2009/awglca6/eng/08.pdf

financial resources for technology deployment, capacity building, and monitoring and assessment of performance. The EU suggests creating a consultative group that brings together government, the private sector, civil society and other stakeholders' expertise. This new body should provide strategic guidance for research and technology development and international cooperation, drawing on technology needs identified in national low carbon development strategies.

5.3 Suggestions with respect to cooperation

By the term cooperation parties have in mind international cooperation as well as domestic cooperation between the public and private sector. According to several submissions international cooperation will take place within the context of governance, regulation and institutions, i.e. the heading above.

The important topic of private-public cooperation is addressed by some submissions. For instance, China suggests supporting technology deployment through public-private partnerships by linking public finance with the carbon market, capital market and technology market, in order to leverage private finance with public finance. The EU suggests that public funds should leverage larger private finance flows and be employed in a variety of instruments, including pure grants, interest reduction, publicly supported loan facilities and venture capital funds. Support should include project-based programs such as the Global Energy Efficiency and Renewable Energy Fund (GEEREF).

6 Discussion of submissions on technology development and transfer

Any discussion of the role of developing (and developed) countries in technology development and transfer ought to measure submissions against an understanding of the R&D value chain. Hence we recall the main elements of the R&D value chain.

Theorists of innovation generally agree that the value chain in R&D runs from the general to the specific (Bresnahan and Trajtenberg, 1995). By general is meant (basic) research that has several potential applications. Maybe the most basic of all are the traditional sciences such as math, physics etc. Theorists also point to general purpose technologies (GTPs) such as nano technologies. These are one step more applied than e.g., pure math, but they also have several potential applications. At the other end of the scale are the applied innovations in the form of products that are brought to the market. At some point in the middle, the basic and applied research meet.

With this value chain in mind it is useful in the assessment of the submissions on technology development and transfer to distinguish basic research and general purpose technologies on the one hand, and product development and manufacturing on the other hand.

6.1 Basic research and general purpose technologies

Basic research and general purpose technologies are driven by science and technology research centres. Traditionally, most of them have been located in developed countries. In the context of a mechanism on technology development and transfer we imagine environmental science universities located in important developed *and* developing countries. The model would be MIT of the U.S., Tsinghua University of China and Indian Institute of Technology in India. Under a mechanism for technology development and transfer they would be generously funded and attract the best and the brightest heads. Individuals and institutions from participating countries should cooperate on science and technology initiatives within

clean technologies. The funding should come from developed countries either directly or through a fund. Research programmes and guidelines are necessary to secure a focused effort, and these should be drawn up jointly by developed countries as funders and developing countries as recipients.

We have seen above that parties like Argentina, AOSIS and the EU have provided suggestions for research cooperation along these lines. In our view the idea of setting up collaborative science and technology centres is good and a relatively unproblematic part of a technology mechanism.

It is unproblematic for two reasons. One is that the funding requirements are quite modest compared to applied research and demonstration. Hence it should be relatively easy to convince developed countries to mobilise the necessary funding. A second reason is that the research centres' emphasis on basic research implies that their output for the most part is recognised as a non-proprietary common good. Hence, conflicts over patents etc. should be manageable.

On the other hand, science and technology centres for basic research and general purpose technologies are not necessarily very helpful to the climate cause in the short run. That has to do with the assumption that they emphasise basic research and general purpose technologies. For basic research and technologies to contribute to lower emissions and efficient adaptation, applied research will have to turn basic knowledge into useful products. Nevertheless, general purpose research will increase the technical skills and competencies in the countries where it takes place. This is in itself a necessary prerequisite for meeting the climate challenge in developing countries, both with regard to mitigation and adaptation.

6.1.1 Role of developing countries in the science and technology centres

What would be the role of developing countries in the science and technology centres? One role would be for selected developing countries to host centres. Although funding for the centres would come from international sources there would in practice accrue some host's obligations: setting aside land for locating the centre, physical infrastructure, housing for (foreign and domestic) faculty etc. These are minor issues.

Assuming that funding is available and is scaled up fairly rapidly a challenge – maybe the main challenge – for the host countries would be to allocate sufficient domestic man-power to the centres. The idea is to attract the brightest professors and develop the brightest and best students into the next generation of professors in this field. Since funding is generous, these will be well paid jobs. In most countries there is competition for bright minds and representatives of other research fields might see their best and brightest disappear to the centres, attracted by high wages. Government and business couldface stiff competition for recruits. Some of these stakeholders from other sectors and fields could be expected to complain that the new centres "destroy the market" for academics. It must be expected of participating developing countries that they do not give in to these complaints. Over the longer term there will be more graduates in the field of (environmental) science and technology, and the pressures on the research labour market are likely to ease.

Technically the easy way to alleviate scarcity of man-power is to attract more foreign scholars than was planned at the outset. However, that would create problems of its own for some developing countries, and probably even for the technology mechanism itself. The mechanism depends on sufficient quantities of domestic knowledge and capacity for its product development and implementation stage.

Above we mentioned in passing that research programmes should be drawn up jointly between developed and developing countries. An alternative is that the host countries draw up these programmes, with centres in developing countries being subject to developing country priorities. However, we would argue that joint determination is the only feasible solution

given the nature of financing and the global nature of the problem we are facing. The Executive Board of Technology as suggested by India, might for instance have responsibility for drawing up research programmes. It is important to recognise that joint determination implies that a country hosting a research centre is not free to determine what it should do. This may be a practical challenge for hosts, both in developed and developing countries.

In summary the role of developing countries at the research stage is in our view related to the following issues:

- Allocation of the best scientific talent to this research despite a (temporary) scarcity of such talent
- Sharing responsibility for research programmes with other countries
- Practical obligations

6.2 Product development centres and product manufacturers

Product development is often driven by designated product development centres (but of course, the difference with the basic research centres just described is one of degree, not principle). Product development centres are usually organised as private R&D companies or as research laboratories of large companies. Automobile companies, for instance, have research labs that at the moment are working on non-fossil fuel cars. In the pharmaceutical industry many development firms are small and often backed by private equity, outside the big manufacturers. In many countries the product development centres cooperate with universities and receive public funding, but they also rely on private funding. Their motivation is the possibility of making a profit by selling the developed and patented product (and in the case of independent firms, selling the firm and the patents the firm owns. In this case it is the buyer who will profit from selling the patented product).

Product manufacturers bring the product to the marketplace. They purchase products and patents from the product development centres (which, as noted, may be an arm of their own company). They also do their own applied research, for which they cooperate with basic research and product development and receive co-funding from the public sector. Over time costs are reduced as a result of product modifications, organisational modifications, economics of scale etc. Some of this is the result of conscious research, but other improvements occur spontaneously. Collectively, the process is called learning by doing and it is sometimes summarised by a learning curve. Not only the manufacturers, but even the product development centres learn from seeing the product in action, and as a result, successive generations of a product are improved compared to the previous one. All users of Windows, iPhone etc. can attest this, but it is also what wind farm managers would say about the standard of turbines, rotor blades etc. developed by their product development centres.

An important motivation for innovation during product development and manufacturing is profit. Hence, a mechanism for technology development and transfer will have to intervene in product development and manufacturing by increasing the prospect for profit. There are two ways of doing that: reducing cost and stimulating demand.

6.2.1 Reducing cost

Lower cost amounts to governments in developed countries greatly increasing their funding for low-carbon technologies in all countries. So for instance, if a government finances 50% of a research project prior to the mechanism, the share would rise to e.g., 75% as part of the mechanism. From the perspective of the product development centre the cost of developing the product in question, falls. The practical details for making the transfer happen must of course be worked out. A fund is a possibility.

Governments may also contribute to lower costs during the learning-by-doing phase. For instance, several countries currently employ feed-in tariffs in the electricity sector. A feed-in tariff is a payment for the additional cost of employing new renewable energy. The cost is fed in with the average electricity tariff, hence the name. As part of a mechanism for technology development and transfer the governments of developed countries (or a fund that is designated this responsibility) may fund the feed-in tariff and hence the cost of deployment. There are many other forms of public contribution during the learning-by-doing phase, including subsidised infrastructure, input cost subsidies, purchasing obligations, guarantees or more directly through laws and regulations, etc.

We have seen above that China and the EU both address the need for public funding to bring down costs during the product development stage. China suggests supporting technology deployment through public-private partnerships by linking public finance with the carbon market, capital market and technology market, in order to leverage private finance with public finance. The country wants the Multilateral Technology Acquisition Fund that is the centerpiece of its submission to cover insurance, loan guarantees, or invest via stocks, bonds and other financial products. The EU suggests that public funds should leverage larger private finance flows and be employed in a variety of instruments, including pure grants, interest reduction, publicly supported loan facilities and venture capital funds. When it comes to the manufacturing stage, deployment and the like, India and other developing countries emphasize that the mechanism and developed country funding should include issues like deployment and demonstration of new technologies. Developed countries are generally more cautious here. This is an area where the definition of technology in the mechanism becomes important.

6.3 Role of developing countries

What is the role of developing countries in a process in which costs are reduced? One issue clearly relates to at what point inn the development cycle a technology is mature. Imagine that developed countries agree to fund the learning by doing phase and improvements during deployment of, say, the wind power technology. Improvements in wind power designs will in practice never stop, but funding must of course stop at some point. The guiding principle is to stop international funding when costs of wind power are competitive with thermal power, but when is that? Neither the cost of wind power nor the cost of thermal power is uniform across locations and the principle is open to interpretation. If the decision of when to stop is left solely to developing countries, the developed country funders may fear that they are hijacked into a never-ending stream of demands – to fund another innovation, and one more, and one more… One will need cut-off rules, and rules being what they are, it will happen that in some cases funding will stop too early, and in other cases too late compared to what is ideal.

Some technologies, maybe in particular carbon capture and storage (CCS), will never be brought down to zero cost. CCS is by nature an "end-of-pipe" technology that requires mortar, cement, steel and energy to work. The best one can hope for is to reach a flat portion of the learning curve in which the cost of CO_2 reduction has become fairly low. Should developed countries subsidize CCS in developing countries all the way into eternity? If not, when should one stop? This is also a question that requires a practical solution and participation of developing countries.

6.4 Stimulating demand

The second channel for stimulating product development and manufacturing is stimulation of demand. Here money must be transferred to developing countries in order to create a bigger demand for the products when they are brought to market. This increase in the research prize triggers private sector R&D. The suggestion by India that 0.5% of the GDP of the developed

world should be set aside for funding adaptation and mitigation through resource transfers or grants, is one example in this spirit, emphasizing that a transfer of money is a viable alternative to transfer of technologies.

One problem with the approach is to make sure that money really is spent on increasing demand. Consider a concerted effort to cut process emissions during cement production by e.g., 80% and assume that the main vehicle for this to happen is an increase in demand for "green cement". Assume, also, that in the future the main market for cement is in developing countries. For developing country manufacturers of cement the demand side is essential. By assumption there is no carbon price, or if there is, it is low. Hence there is no market incentive to purchase green cement. In this situation money must be transferred and a promise must be given by developing countries that the money is spent on purchasing green cement. The need for such a promise, i.e. a promise to use money received on green cement and other clean products and technologies, is on all accounts a vital part of what is expected of developing countries.

Actually the feed-in tariff that we mentioned above could be interpreted as a demand side measure, which goes to show that there is no water tight distinction between the two in practice.

In addition to funding increased demand, demand can also be encouraged by the introduction of standards, for instance with regard to energy efficiency, or even regulation. This is likely to incur additional costs, which then can be refunded by international funding.

6.5 Monitoring the funds

The problem that we referred to in terms of giving a promise is part of a larger monitoring problem: How can one make sure that money really is spent on the purposes it is designed for? Developing countries must be prepared for external scrutiny of funds that are transferred.

This may sound innocuous, but it is not. A parallel may be drawn with development aid: Developing countries have fought to make aid untied with respect to technology vendors and for the right to determine the purposes on which aid should be spent. Generally speaking, this fight has been successful. The principle of untied aid has been accepted, and the principle that the recipient decides the purpose of aid has also been accepted. They are, however, not always followed in practice.

According to proponents, the size of funds to be channelled to technology transfer should be on par with ordinary development aid. It is important to realise that this "technology aid" will be tied both in purpose and probably to some extent also with respect to technology vendors. Besides the research component, it should be spent on increasing demand for green technologies and for reducing the cost of developing such technologies. Developing countries will be held accountable for that. Also, it will in practice most probably involve active participation of companies from the developed world, especially those that have factories and research centres in developing countries.

Realistically the introduction of large scale tied funding will invite familiar problems of tied aid. It will be a joint responsibility of developed and developing countries to make clear that this is an unfortunate, but to some extent unavoidable consequence of a mechanism that is for the greater good.

In summary the role of developing countries at the product development and manufacturing stage is in our view related to the following issues:

- Agreement on what is the limit of technology development and when external funding should stop

- A willingness to have scrutinised that funds really are spent on stimulating demand and reducing costs of technologies
- A willingness to accept that this is a mechanism with many similarities to tied aid

7 Contributions after technologies are developed

So far we have discussed the role of developing countries *during* technology development and transfer. Here we wish to raise two issues that are relevant *after* development and transfer. We ask, when development of a technology has come to an end, what should be expected from developing countries from then on? The answer is simple: Technologies should be used, and not misused. This simple answer hides several difficult issues.

7.1 Technologies should be used

The premise of the mechanism for technology development and transfer is that *if* technologies are made available free of charge to developing countries, *then* the developing countries will use them. Is it really that simple?

7.1.1 Domestic policy priorities

A basic aspect of the mechanism has to be that developed and developing countries should jointly decide which technologies to go for. It cannot be the responsibility of developed countries only, since developing countries are the ones to make use of the technologies. On the other hand, making the decision cannot be the responsibility of developing countries only since the funders must have a say. Hence, both parties must decide. Of course, since most technologies will be used world-wide, there is all the more reason to decide on them jointly.

Imagine that off grid solar pv is a technology it is decided to go for, and assume that developed countries finance its development at great expense. Finally the development is finished according to some predefined standard. Everything is ready to employ the technology on a large scale. Then assume that a government in some country has decided to pursue on-grid electrification. Maybe the government views on-grid electrification as part of a general strategy for modernization. In this situation developed countries will expect the developing country to use solar pv anyway. After all, the technology has been developed by developed countries for the benefit of developing countries, and one must assume there has been an initial agreement between developed and developing countries to pursue this particular technology.

There are many other examples that the requirement to make use of the technologies that are developed actually can be quite demanding. Wind electricity, to take another example, puts requirements on the grid. The requirements are partly of a technical nature, but also organizational. Assume that the grid is owned by regional governments, who have decided to levy a fee on electricity that is transported through their region. Electricity transport becomes prohibitively expensive for purely organizational reasons, and this knocks out the competitiveness of wind. Assume that developed countries have developed wind energy on behalf of developing countries. Will they accept that organizational malfunctioning erects a barrier towards the use of wind power?

7.1.2 Technological protectionism

Any resentment to making use of new technologies may often be stronger if it is felt that technologies are transferred from abroad. By the same token, the attitude may be more positive if it is felt that the deployment of new technologies somehow benefits domestic manufacturers. There are for instance currently stories in the international press that China,

which has become the world's second largest market for wind energy, is making use of the occasion to develop a domestic industry (see, e.g., http://www.nytimes.com/2009/07/14/business/energy-environment/14energy.html). It seems clear to us that although basic research, deployment and manufacturing will take place in developing countries as well as developed ones, it is integral to the mechanism for technology development and transfer that firms located in developed countries play an important role. For the mechanism to work properly, developing countries will have to overcome any tendency to avoid foreign backed technologies.

7.1.3 Developing countries and developing country firms

So far we have discussed the question of making use of technologies as if developing countries are able to do so if only they decide as much. In reality it is not that simple. One difficulty is that local authorities often have a say. In the cases of wind power and solar pv, discussed above, that is probably an issue. However, from the point of view of the mechanism it must be expected that layers of government are able to sort out their differences and the national government speaks on behalf of all layers.

A similar, but perhaps more profound difficulty is that some of the technologies to be developed will be used by private firms and households. These are not readily controlled by governments. In many countries governments probably have a fair degree of control over large scale electricity generation and the problem is perhaps not pronounced there. But in other industries such as cement, iron & steel and agriculture (a big source of GHG-emissions worldwide), the level of control is less. The question is how to make sure that the carbon friendly technologies are taken up, e.g., among farmers or in cement works. In some countries environmental and energy regulation will have to be intensified.

In short, the assumption that developing countries will make use of the technologies that are developed is not innocuous. Developing countries have a role to play in making sure that technologies actually are put into use. Sometimes that may involve an adjustment of national policy priorities and a reigning in of the power of local governments. This is probably the most important, and difficult. It may also involve overcoming natural tendencies to emphasize technologies for which there is a strong national industry. Finally it may involve regulation of industries and households in order to make sure that the new technologies actually are deployed.

7.1.4 Technologies should not be misused

Firms in developing countries are already actively engaging in the manufacture of new technologies. With manufacture follows innovation and development of technologies to face new circumstances. This is clearly positive.

One worry that developed countries may have, however, is this: Suppose that a technology is developed as part of the mechanism. Per assumption its development is paid for by developed countries. Suppose, next, that a company in a developing country develops a new twist to the technology. The twist is based on the preexisting version of the technology. Maybe it even makes use of generous public support, organized by the developing country but paid for by developed countries in order to bring down costs, see above. The developing country firm then patents the new twist and sells it back to the developed world.

In this situation the developed world is paying twice for the same invention. First, it pays for its development. Second, it pays for a product in which perhaps 95% is technology that it has already paid for.

This is what we mean by misusing the technology. The way we have sketched the interventions by the technology mechanism into the innovation system, patents remain. Our sketch is consistent with the submissions by large countries such as China, India and the EU.

As long as the patent system remains, it is a universal property that someone will get rich off public money. Sometimes firms will sell to developed countries and sometimes they will sell to developing countries. The firms themselves are located in both sets of countries. Still, in terms of public support in developed countries for the mechanism it is a problem if developing country firms make large ventures into developed country markets on the back of the mechanism itself.

In summary the role of developing countries during the post-development stage may be condensed into two simple statements:

- Clean technologies should be used
- Clean technologies should not be misused

8 Concluding comments

Successful technology development and transfer offers positive and tangible rewards. Firms and countries possessing a technological advantage will profit in the marketplace. Their income will increase and pull along income's positive attributes: Consumption, status and power. He who wins the race for climate friendly technologies will benefit himself while also benefiting humankind.

These positive rewards stand in some contrast to the perceived rewards from carbon quotas (commitments). A carbon quota contributes to a better global climate, but it is the cost that is the most visible and both between and within countries the discussion is framed in terms of who should pay the cost. This tends to make the discussion confrontational. In contrast, the positive and tangible rewards from a mechanism for technology development and transfer, plus the fact it offers a fresh angle to climate negotiations, could mean that the mechanism will be discussed from the point of view of cooperation.

The task of this report has been to discuss the role that developing countries may play within a mechanism for technology development and transfer. Based on the submissions that have been put forward and our understanding of the research and development value chain we have identified contributions of developing countries during basic research, product development and post-development. Our findings may be summarised in following points:

During basic research into low carbon technologies:

- Allocation of the best scientific talent in developing countries to this research
- Sharing responsibility for research programmes with other countries
- Practical host's obligations (setting aside land, physical infrastructure etc)

During product development and manufacturing:

- Agreement on what is the limit of technology development and when external funding should stop
- A willingness to have scrutinised that funds really are spent on stimulating demand and reducing costs of technologies
- A willingness to accept that this is a mechanism with many similarities to tied aid

After development and manufacturing:

- Clean technologies should be used
- Clean technologies should not be misused

We think it will be a useful and a substantial contribution to foster a more cooperative spirit in the negotiations if the developing countries could offer contributions along these lines in Copenhagen. India, in particular, may play an important role as

- India will have a global impact because of its size
- India have a relatively strong human capital basis
- India have large markets for demonstration purposes

Thus India could contribute significantly to the bridging the North-South divide in climate negotiations and hence turn confrontation into cooperation.

Meanwhile, think tanks and research centres such as TERI and CICERO should collaboratively continue to explore the design of a mechanism for technology development and transfer. We submit that the next stage in such collaboration would be to discuss how a mechanism could be designed to concretely support technology development and transfer of some technology or technologies between the developed world (exemplified by Norway/Europe) and India.

In such a follow up endeavour the research question would be: pooling the (financial and human) resources of Norway/Europe on the one hand and the (human and market) resources of India on the other hand, how would one go about to foster the research, development and manufacture of one or two key low carbon technologies? The research would revisit the issues that are identified above during the stages of basic research, product development, and post-development. The value added would be to obtain a concrete understanding of the challenges and opportunities involved as well as the roles of Norway/Europe on the one hand, and India on the other hand. The research could amount to a tentative roadmap for technology development and transfer in a concrete case. Besides building on and extending the collaboration between TERI and CICERO under the auspices of the Royal Norwegian Embassy in New Delhi, a collaborative project on technology development and transfer would presumably be a most welcome initiative under the recent Norwegian strategy document for collaboration with India, *Opportunities in Diversity*.[5]

Bearing in mind that technology is a concept that includes capacity building and policy infrastructure, i.e. both "soft" and "hard" elements, we believe that *solar pv* and *carbon capture and storage* are two highly relevant case studies for technology development and transfer. In the case of solar pv a current cooperation project between Norway and India involving the company ScatecSolar has been given significant attention in Norwegian media and among Norwegian politicians.[6] It is however, so far extremely low scale with only two villages involved. In the case of carbon capture and storage Norway is one of the countries investing large sums in technology development. The explicit aim of the effort is that

[5] http://www.regjeringen.no/upload/UD/Vedlegg/Utvikling/Indiastrategi_Norsk_engelsk_endelig.pdf (Note that the English version is the second half of the document).

[6] See, e.g., http://www.scatecsolar.no/Global/News/090206_Solheim-visited-Scatec-Solar-Community-Solar-Power-Plants-India.aspx and http://www.scatecsolar.no/Global/News/~/media/ScatecSolar/pdf/Scatec%20Solar%20in%20rechargenews.ashx.

developing countries will have the opportunity to benefit.[7] However, this huge research endeavour is so far not seen in the context of technology development and transfer in the sense of UNFCCC. India is set to be a major source of coal fired power production, which like all other coal fired production in the world needs CCS in order to be sustainable.

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[7] See, e.g., the ambitions of the European CO_2 technology center Mongstad, http://www.tcmda.no/?language=UK.

Appendix: Overview of submissions on technology development and transfer

Submissions	Lower emissions/Mitigation		Cross purpose

Submissions	Lower emissions/Mitigation		Cross purpose
Finance and funding	An international fund to fasttrack development of renewable energy technologies and emphasize deployment and diffusion for RE and EE. (AOSIS). A new system to ensure technology and financial transfer wherein: Developed countries agree to a quota of technological and financial transfer to sustain voluntary mitigation actions in developing countries. Developing countries establish a list of mitigation options, with costs. Developed countries bid or select from the developing country proposals and pledge technological and financial support which will be independently verified (Costa Rica, El Salvador, Honduras, Nicaragua, Panama) Carbon market mechanisms to drive developed countries to fund full incremental costs. Joint ventures to accelerate deployment and diffusion. Elaboration of NAMAs (Nationally Appropriate Mitigation Actions) to include mitigation technology and finance support. New body on technology transfer/financing under the convention must fulfill the needs specified by NAMAs EGTT should further explore carbon market mechanisms that drive developed countries to finance the full incremental costs of technology application and deployment (Argentina) Multilateral Technology Acquisition Fund (MTAF), paid for from developed countries' fiscal budget for R&D. MTAF covers full cost of R&D, including via VC. MTAF would cover Incremental costs of ESTs to be calculated via BAU cost baselines. MTAF would cover insurance, loan guarantees, or invest via stocks, bonds and other potential financial products. (China) Developed countries must offer technologies affordable and suitable for the developing countries. Establish a mechanism to address means of technology implementation. Establish a joint SBSTA/SBI contact group on technology transfer and performance indicator (African Group +++) Technology Action Plan (by EB) will ensure financing for technology transfer. Guarantees on Foreign Direct Investment (FDI) Fund manufacturing capacity and cover costs of licensing. Venture capital, with public investment leveraging private capital markets for emerging technologies; Research, development, and demonstration of new technologies, financed by venture capitaland other sources; Joint technology development. (Antigua - G77 & China "A Technology Mechanism under the UNFCCC.") Low Carbon development Strategies (LCDSs) for describing NAMAs. Parties should identify barriers to the implementation of actions, including identifying technology needs and identify incremental costs which require financing, technology, or capacity building assistance for implementation, specifying the type of support.(EU) Full incremental costs of technology deployment (capital and lifetime) should be covered by A1s in full, by grants, while the base costs of economic and development can be funded by a range of current or new financial instruments offered by bilateral, multilateral or domestic/foreign market sources, including traditional equity and loan investments, concessional loans, loan guarantees or other risk mitigation structures, and a range of funds for acquisition, development, deployment and diffusion of technologies. Executive body work plan begins with Technology Action Plans supporting all stages of the technology cycle, including ensuring finance for technology transfer. (India)	International Adaptation centre (Bangladesh+++) Adap. Action programme (AAP) must provide scaled up financial, technological and capacity building support (African Group, +++) Urgent financial support for highly vulnerable countries. Risk reduction and insurance mechanisms for developing countries. Coordination of the finance mechanism under the Convection – market/non-market (Argentina) Financial need assessment to address adaptation needs (Bangladesh) Full costs of technology for stand alone adaptation projects should be covered (India)	Funding to support full cost of capacity building for research, development, and demonstration of new technologies, enhancing human capital and absorptive capacity. Request annual contributions equal to 0.5% of the total GDP of the developed world for funding adaptation and mitigation through resource transfers or grants (India) Financial resource to enhance financial architecture (Bangladesh) All NEW funds raised would be channeled through the FCCC and funds disbursed under the authority and governance of the COP. New governance required because existing IFIs put small states at disadvantage. Funding for TT should be managed in transparent regime. Developing countries should take voluntary, nationally appropriate mitigation actions (NAMAs) and any identified pledge to take NAMAs should be recorded in an international registry held by the UNFCCC Secretariat; There should be no mixing of support or credits from the KP with LCA (AOSIS). MTAF to fund full cost of capacity building - with human resource development as a priority, and also including information service, monitoring and enforcement systems, construction of policy infrastructure (China) Seek to double global energy related RD&D by 2012 and increase it to four times its current level by 2020, with a significant shift in emphasis towards sustainable, low-GHG technologies, especially renewable energy (EU).

Submissions	Lower emissions/Mitigation		Cross purpose
International governance & regulations	A coordinating mechanism to assess Low Carbon Development Strategies and NAMAs, match support. Create consultative group that brings together government, private sector, civil society and other stakeholders' expertise. This new body should provide strategic guidance for research and technology development and international cooperation drawing on technology needs identified in national low carbon development strategies . TNAs should be expanded, taking into account the findings of the 2006 TNA review; should be shared and publicly available to all relevant stakeholders within and outside the countries (e.g. through national communications); scope should be expanded to cover also more in-depth assessments of obstacles in the functioning of relevant technology innovation systems, including detailed assessment of technology capacity and markets. (EU) Mechanisms to address IPR would be promotion of joint R&D between developed and developing countries through research, academic and government institutions can secure joint IPRs (AOSIS)		R&D collaboration national/regional/ international research centres, North-South and South-South co.op. (Argentina) Enhance ownership of new technologies, in particular intellectual property rights, and to accelerate the deployment and diffusion of advanced technologies, e.g. through technology roadmaps. The IEA's 17 key energy technologies (demand and supply side) could serve as a starting point for discussing such roadmaps, as well as the technologies under the EU's Strategic Energy Technology (SET) Plan. Countries should explore options to strengthen IPR frameworks to protect and share technology and further strengthening incentives for innovation. (EU) Possibility of establishing new UNFCCC subsidiary body or expanding authorities of the Expert Group on Technology Transfer up to the level of the advisory centre at UNFCCC subsidiary bodies for development and transfer of technologies (mainly informational and advisory functions) (Belarus). The Technology Needs Assessment (TNA) process should be the basis for cooperation in technology related matters. Implementation of findings should be supported. Development of climate change adaptation and mitigation technologies must be kept outside the present IPR regime.(Bangladesh)
Regional cooperation	Supports sectoral approaches such as Asia Pacific Partnership (APP) to expedite the RD&D of low-carbon tech and sector-specific expertise between countries and regions. (Australia)	Regional partnership in technology assessment R&D and implementation (AOSIS) R&D collaboration national/regional/ international research centres, North-South and South-South co.op. (Argentina)	Considered how to strengthen Existing international and regional technology initiatives, such as the Carbon Sequestration Leadership Forum, International Hydrogen Partnership. Strengthen innovation and diffusion systems in developing countries, could be done through, for example, regional centres(EU) Identifies Asia Pacific Partnership (APP) as an excellent example of technology cooperation, specifically because it promotes voluntary public / private partnerships. Sectoral collaboration can help build capacity between Parties facing similar challenges. Parties should consider ways of improving the environment for technology diffusion, including enhanced regulatory frameworks, fostering positive environments for investment, and incentives for private sector, including strong IP protection. (Australia)

Submissions	Lower emissions/Mitigation		Cross purpose
Institutional suggestions	Create a Technology Mechanism under the COP - Executive Body (EB), functioning as a subsidiary body under FCCC, made up of government representatives and experts on technology transfer, with balanced regional representation. Supported by: 1) Strategic Planning Committee 2) Technical Panels - Verification Group - Secretariat - Multilateral Clean Technology Fund (MCTF) (Antigua - G77 & China ("A Technology Mechanism under the UNFCCC.") The MTAF shall be used as a catalyst to provide stakeholders with incentives to implement D&T&D of ESTs by means of proper policy instruments, financial instruments/products and investments, including supporting R&D, loan guarantees, direct investment as shareholders. The existing IPR system does not match the increasing needs for accelerating D&T&D of ESTs to meet challenges of climate change. Specific measures should be taken to overcome barriers of D&T&T related to IPR issues (China)		The establishment and provision of support to national and regional academia and Centres of Excellence; promotion of South - South cooperation. Reform to allow more incentives to private sectors addressing IPR and removal of barriers to D&D for both developed and developing countries. (Alliance of small Island states, AOSIS) Establish a subsidiary body under COP for Development and Transfer of Technologies with panels for technology needs assessment, information clearinghouse, dialogue and coordination for enabling policies and measures and IPR, management of financial resources for technology deployment, capacity building, and monitoring and assessment of performance (China) Executive Board of Technology, elected by COP and supported by a new branch of the UNFCCC Secretariat, shall develop strategy and technology action plans, and monitor the implementation of specific operational policies, guidelines and administrative arrangements, including the disbursement of resources (India) For a number of specific key technologies, countries should agree to cooperative joint R&D and large scale demonstration and deployment projects (EU).
Public-private sector cooperation	Differentiates between public/private technologies saying private should be made affordable by measures to resolve IPR barriers and "addressing compulsory licensing of patented technologies." (Antigua - G77 & China ("A Technology Mechanism under the UNFCCC.") Support technology deployment through public-private partnerships by linking public finance with carbon market, capital market and technology market, in order to leverage private finance with public. (China)		Recognizing the critical role of private sector investment, capacity and expertise, all Parties shall undertake national actions to support the development, demonstration, deployment and diffusion of environmentally sound technologies (Canada) Public funds should leverage larger private finance flows and be employed in a variety of instruments, including pure grants, interest reduction, publicly supported loan facilities and venture capital funds. Support shouldinclude project-based programs such as the Global Energy Efficiency and Renewable Energy Fund (GEEREF) (EU)