Intellectual Property Rights Series 14

Intellectual Property and Technology Transfer Issues in the Context of Climate Change

Sangeeta Shashikant
and Martin Khor

TWN
Third World Network

Intellectual Property and Technology Transfer Issues in the Context of Climate Change

Sangeeta Shashikant
and Martin Khor

TWN
Third World Network

Intellectual Property and Technology Transfer Issues in the Context of Climate Change

is published by
Third World Network
131 Jalan Macalister
10400 Penang, Malaysia.
Website: www.twnside.org.sg

Printed by Jutaprint
2 Solok Sungei Pinang 3, Sg. Pinang
11600 Penang, Malaysia.

ISBN: 978-967-5412-37-0

CONTENTS

NOTE

This paper was prepared for the United Nations Department of Economic and Social Affairs as a background paper for the *World Economic and Social Survey 2009*.

1 Introduction

CLIMATE change is now recognized as a major, if not the most important, global environmental problem. Now that the scientific battle to have this problem recognized as a potential catastrophe seems to have been won (with a few exceptions), attention is turning to solutions. A major area in the search for solutions is the design and spread of more energy-efficient technologies that reduce or eliminate climate-change-inducing emissions. In the next few years, it can be expected that these technologies will be increasingly introduced in both developed and developing countries.

However, intellectual property rights (IPRs) over such technologies may pose a hindrance to their dissemination and use. In particular, developing countries may be expected to face such obstacles to the transfer of technology that is aimed at reducing the sources of climate change. This paper looks at some of the issues relating to IPRs and the transfer of climate-friendly technologies (also referred to in this paper as climate technologies).

2 IPRs and Technology Transfer

The General Relationship between IPRs and Technology Transfer

A CENTRAL aspect of technology transfer is the building of local capacity so that local people, farmers, firms and governments can design and make technologies which can be diffused in the domestic economy.

Commonly, however, the predominant type of technology supply to developing countries has tended to be capital goods and equipment.[1] For example, one study showed that 80% of aid to China's energy sector was focused on funding construction of new thermal and hydro-power plants wherein the aid was to finance the export of equipment supplied by foreign firms.[2] Studies have also pointed out that the transfer of plant and equipment to developing countries has often been based on "turnkey" and "product-in-hand" contracts and that restrictive contract terms between transnational companies and developing countries' firms have limited scope for fostering innovation through "reverse engineering".[3] Often technology transfer between technology suppliers and importers precludes knowledge sharing across the economic spectrum.

A comprehensive definition of technology transfer,[4] however, involves not only the purchase and acquisition of equipment but includes the transfer of skills and know-how to use, operate, maintain as well as to understand the technology hardware so that further independent innovation is possible by recipient firms.[5] It also includes the ability to make the technology through "imitation" or reverse engineering; to adapt it to local conditions; and eventually to design and manufacture original products.[6] The process of technology transfer involves progressively climbing through all these aspects.

There are many barriers to effective transfer of technology to developing countries. Among the barriers that are normally listed are poor infrastructure, inadequate laws and regulations, lack of absorptive capacity, shortage of skilled personnel, lack of finance, ignorance of technological issues, high cost of certain technology agreements, problems created by equipment suppliers, and intellectual property rights (particularly patents and trade secrets). This paper addresses the barrier of intellectual property rights.

While some of the abovementioned barriers are linked to conditions in the recipient countries, a central problem surrounding technology transfer is that firms that possess technology often have little incentive to transfer it to developing countries.[7] Reasons for this include: (a) liberalization of markets often means technology owners can directly export the products without resorting to foreign direct investment (FDI) or licensing; (b) licensing technologies would assist a licensee to become a potential competitor in a global market or could be seen as subject to "leakages" which lead to imitation; and (c) for licensing to be a viable and attractive option, the expected profit should compensate the licensor for his transaction costs and risks.

It is often argued that availability of effective IPR protection provides foreign companies an incentive to transfer protected technologies to developing countries and will encourage the inflow of FDI, which in turn will bring about technology transfer to the host country.

However, evidence that strengthened IPRs (patents, trademarks and trade secrets) will increase FDI and expand technology transfer flows is limited, ambiguous[8] and thus inconclusive.[9] The availability (and enforceability) of IPRs is by no means a sufficient condition for an increase in FDI or for transfer of technology to occur. Countries with "weak" IPR regimes have been among the major technology borrowers (e.g., South Korea, Taiwan, Brazil in the years preceding the coming into force of the World Trade Organization (WTO)'s Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)). Meanwhile, many countries (including many African countries) with IPR regimes comparable to those of developed countries have a poor record of being technology importers.

A similar scenario is observed in the context of the IPRs-FDI relationship.[10] For example, despite Canada and Italy's lack of patent protection at various times, they had no trouble attracting FDI.[11] Evidence on a clear cause-effect relationship

between strengthened intellectual property (IP) protection and FDI is inconclusive. According to Gerster (2001), "Economic history does not support this view" (that strengthened IPRs will increase FDI) and "Other factors are far more decisive".[12] He also adds that "Foreign investors are particularly attracted by market size – in countries such as India, China or Brazil, for example – even when conditions do not correspond to textbook descriptions of a market economy. Small countries, on the other hand, are frequently regarded as marginal and unattractive, even when they have created admirable market conditions". A United Nations study on IPRs and FDI has also found that there is an insufficient linkage between patents and FDI.[13]

In fact, strong IP protection can make access to technology more problematic. Generally, having IPR-protected technology means that the IP holder can control the use of his technology, and decide when, where and how to use it and whether to transfer it and the ways in which the technology can be utilized, if at all, in those countries where protection has been obtained.[14] In some cases, increased IP protection may lead foreign firms to close down manufacturing facilities in developing countries since the products can be safely exported from other locations. This effect was notably seen in the area of pharmaceuticals in some Latin American countries after the introduction of product patent protection for pharmaceuticals.

There are also numerous situations where weak IP regimes have actually facilitated access to foreign technologies and allowed reverse engineering to take place, resulting in strengthened indigenous technological capacity. For example, prior to 1970, when India allowed patent protection for pharmaceuticals, multinational corporations dominated the supply of medicines and the Indian manufacturers supplied only 32% of the Indian market.[15] In 1970, the Indian law was amended and patents on pharmaceutical products were not allowed anymore. Over the years the share of the Indian pharmaceutical market supplied by domestic companies increased to 77%. India also moved from being a net importer of medicines to a net exporter, with exports worth $3,177 million in 2003-04. It exports to 65 countries, including developed regions such as the United States and Europe and developing countries. India has the most US Food and Drug Administration-approved manufacturing facilities outside the US, which indicates the high technology and quality standards achieved by Indian manufacturers when IP protection was lowered. It should also be noted that between 1970 and 1995 India received significant amounts of FDI. Likewise, in Switzerland in the 1880s

two of Switzerland's most important industries, chemicals and textiles, were strongly opposed to the introduction of patents as it would restrict their use of processes developed abroad.[16]

IPRs increase the leverage technology suppliers have to charge royalties higher than those they would have obtained in the absence of protection.[17] Many firms in developing countries may not be able to afford this higher cost and it reduces the resources available for local research and development (R&D). Even if they could afford it, the additional cost would increase the costs of production, making their products unviable, particularly in an open globalized market. Moreover, there could be a large drain on a developing country's foreign exchange as a result of having to pay foreign IPRs holders for the use of their technology.[18] Many developing countries with serious debt problems will be unable to afford the cost of using the technologies.

IPRs also deepen negotiating imbalances and lead to the imposition of abusive practices that restrain competition.[19] For example, even if a local firm is willing to pay the commercial rate for the use of the technology, the patent holder can withhold permission to the firm or impose onerous conditions, thus making it impossible or extremely difficult for the technology to be used by the firm.[20]

Technology Transfer in the TRIPS Agreement

The WTO's TRIPS Agreement reflects the technological protectionist agenda of the US and other developed countries. At the time the Agreement was being negotiated, as well as now, developed countries account for most of the global resources spent on R&D annually, control most of the patented technology and, as a result, receive most of the global cross-border royalties and technology licensing fees. According to Kumar (2002), 10 developed countries account for 84% of resources spent on R&D globally, control 94% of the technological output in terms of patents taken out in the US between 1977-2000 and received 91% of global cross-border royalties and technology licensing fees in 1997 (see Table 1).

Table 1: Major Source Countries of Technologies, 2000

Country	R&D expenditure (1997)		US patents taken (1977-2000)		Technology fees received (1997)	
	$ billion PPP	% of total	'000	% of total	$ billion	% of total
USA	212.8	40.8	1337.0	57	33.8	42.2
Japan	90.1	17.3	429.4	18	6.9	8.6
Germany	42.0	8.0	173.8	7	11.9	14.9
France	28.1	5.4	68.2	3	2.2	2.7
UK	22.6	4.3	67.4	3	5.8	7.2
Italy	12.1	2.3	29.0	1	1.6	2.0
Canada	11.4	2.2	48.4	2	1.3	1.6
Netherlands	7.5	1.4	22.0	1	6.2	7.7
Sweden	7.1	1.4	22.9	1	0.4	0.5
Switzerland	4.8	0.9	31.0	1	2.8	3.5
Subtotal 10	438.5	84.0	2229.1	94	72.9	91.0
World	522.0	100.0	2364.9	100	80.1	100.0

Source: Kumar (2002)

The primary objective of proponents of the TRIPS Agreement (i.e., the developed countries) was to secure protection for owners of IPRs, which largely come from developed countries. Developing countries' concerns about the implications of stronger IPRs on technology transfer received limited attention during the TRIPS negotiations.[21]

The TRIPS Agreement has several references and provisions that specifically refer to technology transfer (e.g., Articles 7, 8, 40 and 66).

Article 7, which contains the objectives of the Agreement, states: "The protection and enforcement of intellectual property rights should contribute to the promotion

of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations." Article 7 seems to indicate that the protection and enforcement of IPRs may not in itself necessarily promote technological innovation and transfer, but should be implemented to ensure innovation and transfer of technology.

Article 8.2, which is on principles, is another important provision of the TRIPS Agreement. It recognizes the need for "appropriate measures" "to prevent the abuse of intellectual property rights by right holders or the resort to practices which unreasonably restrain trade or adversely affect the international transfer of technology", but "provided that they are consistent with the provisions of this Agreement". This Article acknowledges the right of WTO Member states to adopt "appropriate measures" where the IP holders resort to practices which may adversely affect international transfer of technology.

Article 40 of the TRIPS Agreement contains a set of rules aimed at the "control of anti-competitive practices" in voluntary licensing. Article 40.1 states WTO Members' recognition and agreement that "some licensing practices or conditions pertaining to intellectual property rights which restrain competition may have adverse effects on trade and may impede the transfer and dissemination of technology". Article 40.2 expressly allows WTO Members to specify "in their legislation licensing practices or conditions that may in particular cases constitute an abuse of intellectual property rights having an adverse effect on competition in the relevant market". Thus it allows Members to adopt measures to control or prevent restrictive practices on a case-by-case basis, where the case constitutes an "abuse" of intellectual property rights which has an "adverse effect on competition in the relevant market".

Article 40.2 further provides a few examples of practices that may be deemed restrictive. They include: (i) exclusive grant-back conditions (i.e., provisions that require the licensee to transfer back improvements on the licensed technology exclusively to the licensor); (ii) conditions preventing challenges to validity; and (iii) coercive package licensing (i.e., requiring the licensee to acquire inputs from the licensor that the licensee does not need).

Article 40.3 provides for a consultation system between Members. A Member may request consultations with another Member if it believes that a national or

domicile of that other Member "is undertaking practices in violation of the requesting Member's laws and regulations" and "wishes to secure compliance with such legislation", "without prejudice to any action under the law and to the full freedom of an ultimate decision of either Member". The Member with whom the consultations are requested "shall accord full and sympathetic consideration to, and shall afford adequate opportunity for, consultations with the requesting Member, and shall cooperate through supply of publicly available non-confidential information of relevance to the matter in question and of other information available to the Member, subject to domestic law and to the conclusion of mutually satisfactory agreements concerning the safeguarding of its confidentiality by the requesting Member".

A Member whose nationals or domiciliaries are subject to proceedings by another Member concerning alleged violations of the latter's legislation on anti-competitive practices, may also request consultations.[22] In such a case, the requesting Member "shall be granted an opportunity for consultations" with the other Member under the same conditions as in Article 40.3.

Some analysts contend that there are no records on the actual use of the consultation system.[23]

In Article 66.2, the TRIPS Agreement also establishes a specific obligation on developed countries to take measures to promote and encourage technology transfer to least developed countries (LDCs). Article 66.2 states: "Developed country Members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members in order to enable them to create a sound and viable technological base."

Developing and least developed countries have frequently noted and raised alarm in the Council for TRIPS, the WTO body which monitors the operation of the TRIPS Agreement, about the fact that developed countries' compliance with Article 66.2 is not satisfactory. For example, in a paper to the WTO's governing General Council and to the TRIPS Council, the Indian delegation stated: "There has been little effort to implement this provision (Article 66.2), raising doubts about the effectiveness of the Agreement to facilitate technology transfers."[24]

Steps have been taken to reaffirm commitments of developed countries under Article 66.2 but little has changed with regard to the effective implementation of the commitments to create a sound and viable technological base in LDCs. According to Moon (2008), "Based on the evidence from country reports, the picture of developed-country compliance with 66.2 is rather weak," although she noticed an improvement in country reports over time, especially after the 2003 TRIPS Council decision demanding that developed-country Members submit annual reports on actions taken or planned to fulfil their commitments under Article 66.2.[25] The importance of commitments under Article 66.2 has been reaffirmed in paragraph 11.2 of the implementation Decision adopted by the WTO Ministerial Conference at the start of the Doha Round of multilateral trade negotiations in 2001[26] and in paragraph 7 of the Doha Declaration on the TRIPS Agreement and Public Health.[27]

There are also other aspects of the Agreement (e.g., provisions on disclosure as well as compulsory licences) which have implications for technology transfer, but which are not discussed in this part of the paper. The issues of disclosure of patent information and compulsory licensing are discussed below.

IPRs and Technology Transfer in the Context of Climate Change Negotiations

Scientific consensus about climate change has led to increasing emphasis on climate-friendly technological solutions as the key to moving forward in dealing with the climate change challenge. Thus, broad diffusion of existing and future technologies is imperative.

For developing countries, the need for transfer of climate-friendly technologies has, for a long time, been seen as one of the major aspects of the process of sustainable development. However, most climate-friendly technologies are developed in industrialized countries, although potential for these technologies to make significant reductions in carbon emissions is located in developing countries, where fossil fuel consumption is increasing rapidly. In sum, migration of global energy systems to lower-carbon pathways depends upon the successful transfer and absorption of low-carbon technologies to and within developing-country economies.[28]

During the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro and the process leading to it, technology transfer and financial resources were the two major cross-cutting issues, and constituted the two main demands of the developing countries. In the UNCED negotiating process, the key issue in technology transfer was IPRs.

The Group of 77 (G77) developing countries argued that IPRs had to be relaxed in the case of climate-friendly technologies, for otherwise IPRs would hinder the developing countries' access to such technologies.[29] The developed countries' delegations were very sensitive on this point and refused to concede. Whilst agreeing that concessional terms should be encouraged for the transfer of climate-friendly technologies, they insisted that IPRs (such as patents) be applied and that an exception should not be made in IPRs regimes on such technologies.

Finally, the chapter on technology in Agenda 21 (a programme of action for sustainable development adopted at UNCED) called for action to promote and finance the access to and transfer of environmentally sound technologies to developing countries on favourable (including concessional and preferential) terms. But it also says that these terms must be "mutually agreed" upon and also take into account the need to protect IPRs.

Since UNCED, there has been little or no progress on facilitating the transfer of climate-friendly technologies to the South.[30] In 1993, at the United Nations Commission on Sustainable Development, a working group on technology transfer was set up, but after a few years the group was closed down, illustrating the erosion and loss of importance the subject has suffered. Instead of the concessions asked for by developing countries, the reverse trend towards much stricter IPRs regimes (including for climate-friendly technologies) prevailed when the TRIPS Agreement came into force together with the WTO in 1995.

The UN Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol also require Parties to promote and cooperate in the development and diffusion, including transfer, of technologies that control, reduce or prevent greenhouse gas emissions.[31]

Under Article 4.1(h) of the UNFCCC, (all Parties taking into account their common but differentiated responsibilities shall): "Promote and cooperate in the full, open

and prompt exchange of relevant scientific, technological, technical, socio-economic and legal information related to the climate system and climate change, and to the economic and social consequences of various response strategies."

Article 4.3 of the UNFCCC requires developed countries to provide the financial resources needed by the developing-country Parties to meet the agreed full incremental costs of implementing necessary measures under the UNFCCC, including for the related transfer of technology.

Under Article 4.5 of the UNFCCC, developed countries have an obligation to "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" and to "support the development and enhancement of endogenous capacities and technologies of developing country Parties".

Article 4.7 further states that "The extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology …"

It is clear that the extent to which developing-country Parties are required to implement their own commitments depends on the fulfilment by developed-country Parties of their commitments on finance and transfer of technology to developing countries.

The Group of 77 and China stressed at the UNFCCC climate talks in Bangkok in 2008:[32] "There needs to be clear commitment from developed countries to meet their obligations. In accordance with the principles of the Convention, developed country parties should acknowledge and honour their obligations to provide technology and financial support for the adaptation and mitigation needs of developing countries. The failure of Annex I parties [i.e., developed-country Parties] to date has been a major source of concern."

The need for solutions to promote effective transfer of technology to developing countries and, in this context, the importance of enhanced action on technology

development and transfer to support action on climate change mitigation and adaptation is central to enabling effective and sustained implementation of the UNFCCC beyond 2012. This was explicitly recognized in the Bali Action Plan adopted by the Conference of the Parties to the UNFCCC in Bali in 2007 (see Box 1).

Box 1

Technology transfer in the Bali Action Plan

The Bali Action Plan launched "a comprehensive process to enable the full, effective and sustained implementation of the [UNFCCC] through long-term cooperative action", by addressing, inter alia:

"… 1.(d) 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; …"

As negotiations on post-2012 commitments and transfer of technology in the context of the UNFCCC pick up, there have been numerous calls by developing countries and others to address the potential adverse effects of IPRs on the transfer of climate-friendly technologies.

The European Parliament has adopted a resolution that states that an ambitious post-Kyoto agreement might require "corresponding adjustments" to be made to other international agreements, including on IP.[33]

3 Developing Countries' Views on IPRs and Technology Transfer

DURING the discussions about the Bali Action Plan in 2008, following the Bali UNFCCC meeting in December 2007, several developing countries raised the issue of IP as one of the various obstacles that must be addressed in a systematic and cross-cutting manner to promote the transfer of technology. Cuba, India, Tanzania, Indonesia, China and other countries stressed the need to address IP within technology discussions.[34]

The issue of IPRs emerged again at the UNFCCC Bonn climate meeting in 2008 wherein developing countries called for the creation of an international mechanism under the UNFCCC aimed at operationalizing the transfer of technology to developing countries and to assist in adapting or developing technologies of their own to address climate change.

Brazil called for the establishment of a "coherent and comprehensive" instrument for technology development and transfer, i.e., a "Technology Protocol" under the UNFCCC. It also said there was a need for a technology revolution given the urgent challenges faced by developing countries. Brazil stressed the importance of acting beyond the "business as usual scenario" and the need for a "beyond the box" approach.[35]

Brazil also called for multilateral funding to disseminate existing technologies (including those where the patents have expired) as well as know-how to adapt, use and develop technologies, experience and equipment for mitigating and adaptation to climate change. In relation to patented technologies, Brazil proposed a public multilateral fund for purchasing licences with a view to facilitating transfer. In this context it also stressed the need to consider the use of compulsory licensing,

as well as producing a declaration similar to the Doha Declaration on the TRIPS Agreement and Public Health.

In relation to new technologies, Brazil spoke about the need to foster the establishment of national and regional technology excellence centres to promote technology development, deployment and transfer, stimulate capacity building, improve access to information and establish an appropriate environment for international cooperation.

India was of the view that the full potential of technology will require mechanisms across all stages of the technology cycle, which is not just a question of transfer alone, but also of generating new technologies as well as research, development and deployment.[36] According to India, in the area of new technologies, the transfer of technology and know-how should be aided by a suitable IPR regime. Private sector owners of technologies in developed countries could be compensated by their governments for the transfer and deployment of these technologies in developing countries. On accelerating technology development, India proposed joint development with IPR sharing, adding that global financing arrangements require global public procurement of IPRs to ensure the affordability of the products and services.

In relation to a wider deployment of technology, South Africa said that there should be preferential terms provided to developing countries, with the LDCs obtaining the technologies for free. Pakistan proposed the establishment of an international system or an agreement on compulsory licensing for climate-friendly technologies as well as a joint technology pool for transferring technologies to developing countries at a low cost.

At the Accra climate talks in August 2008,[37] the G77 and China proposed a new technology mechanism to accelerate the development and transfer of technology and to support the effective implementation of the provisions on technology and finance in the UNFCCC. The Philippines, presenting the proposal on behalf of the G77 and China, said that the aim of the proposed mechanism was to enhance the achievement of the Convention by avoiding the lock-in effects of environmentally sound technologies and by promoting a shift to sustainable development paths. The Philippines stressed that "There is in particular an urgent need to provide access to technologies for adaptation at regional and national levels. This should

be enabled by capacity building and by new and additional funding to meet the costs of integrating adaptation into the development process and of stand-alone adaptation activities".[38]

The proposal sets out institutional arrangements that would be needed to enable implementation of the Convention's technology-related obligations to support action on mitigation and adaptation. It also envisages a Multilateral Climate Technology Fund and a Technology Action Plan (TAP). The former is intended to finance enhanced action on technology development and transfer. The latter is aimed at supporting concrete actions by all countries to enhance implementation of the Convention by defining policies, actions and funding requirements for all relevant classes of technologies and by seeking to realize the full potential of technology at all stages of the technology cycle.

In relation to technologies in the public domain, the Technology Action Plan will establish a system for international cooperation to ensure that the needs of developing countries are met through the lowest-cost technology options, and to transfer know-how about how to use, maintain and adapt technologies to local conditions, thereby contributing to the development of endogenous technologies.

With regard to patented technologies, the G77 and China's proposal envisages the TAP ensuring that privately owned technologies are available on an affordable basis, including through measures to resolve barriers posed by IPRs. Technologies that emerged through public funding, which are either wholly or partially owned, are to be made available on a reduced- or no-cost basis. In relation to future technologies, it is anticipated that the TAP will support the establishment of national and regional technology excellence centres and will reinforce North-South, South-South triangular cooperation, including in the area of joint R&D.

At the UN climate meeting in Poznan in December 2008 as well, developing countries made similar points.

India said it was imperative to recognize the importance of technology as a transformation agent and initiate urgent action in this regard. It also highlighted the lessons learned from the current financial crisis, i.e., the importance of government action in direction and paradigm setting and political will. Developed countries could raise important amounts of financial resources at short notice.

South Korea said that there was a need for fundamental change in policies on IPRs and R&D. "The present regime does not integrate climate change as a goal. IPR is purely to protect the private interest of companies. How can IPR work for climate change? IPR currently is working for the profit of the private sector," South Korea said.[39] It further added that government intervention was necessary for change in public policies in this regard.

China stressed the need for change and for a new ideal institution that removes barriers and other negative market forces so as to enable technology transfer, adding that there was a need to find a way to share IPRs in technology development and research.[40] China also reiterated its proposal for a Multilateral Technology Acquisition Fund to support regional and national R&D in developing countries.

In sum, the numerous statements of developing countries at the various climate meetings reflect a serious concern about IPRs as a barrier to access and a call for countries to avoid a "business-as-usual" approach to IPRs, since it is a climate emergency that the international community is facing. Whenever possible, developing countries have accentuated the need for a new partnership and cooperation under the UNFCCC to enable technology development, deployment and diffusion, including "thinking out of the box" to deal with IPRs.[41]

In contrast, developed countries stress the importance of IPRs in climate technologies and thus the maintenance of the status quo.

4 Current Patenting Trends in Climate-Related Technologies

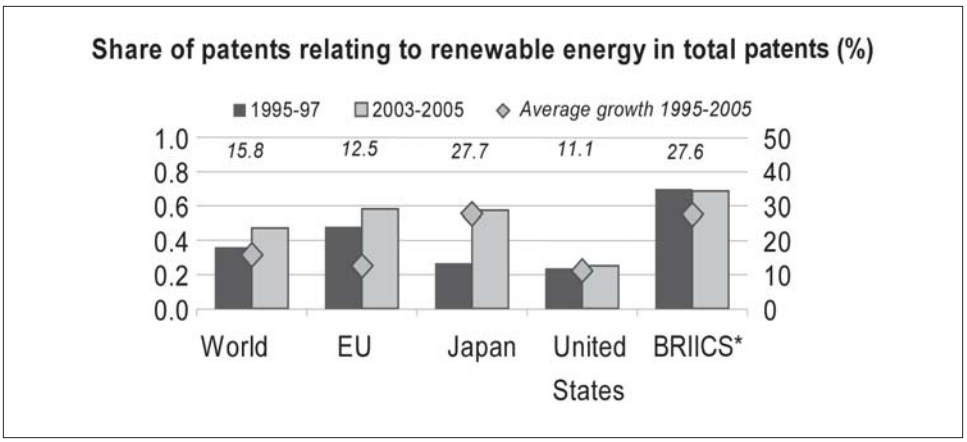
PATENTING of climate-related technologies has grown significantly especially since the mid-1990s. In addition, patent filings and grants on these technologies are largely made or held by entities in developed countries. In comparison, applicants from developing countries own a small share of the patents for such technologies.

This chapter provides an insight into the patenting trends in relation to climate-related technologies.

Energy Technologies

On average, the proportion of Patent Cooperation Treaty (PCT)[42] filings to protect renewable energy technologies in relation to all patents increased in most countries, especially the European Union (EU) and Japan. See Figures 1 and 2 below.

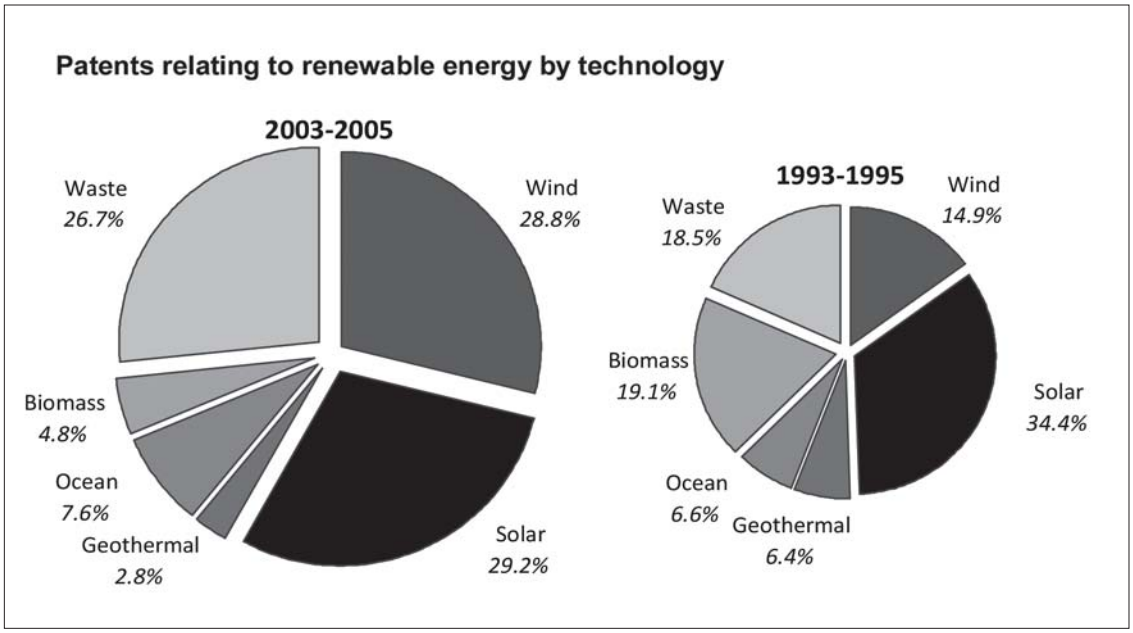
Figure 1



Source: OECD (2008)

*Refers to Brazil, China, India, Indonesia, the Russian Federation and South Africa

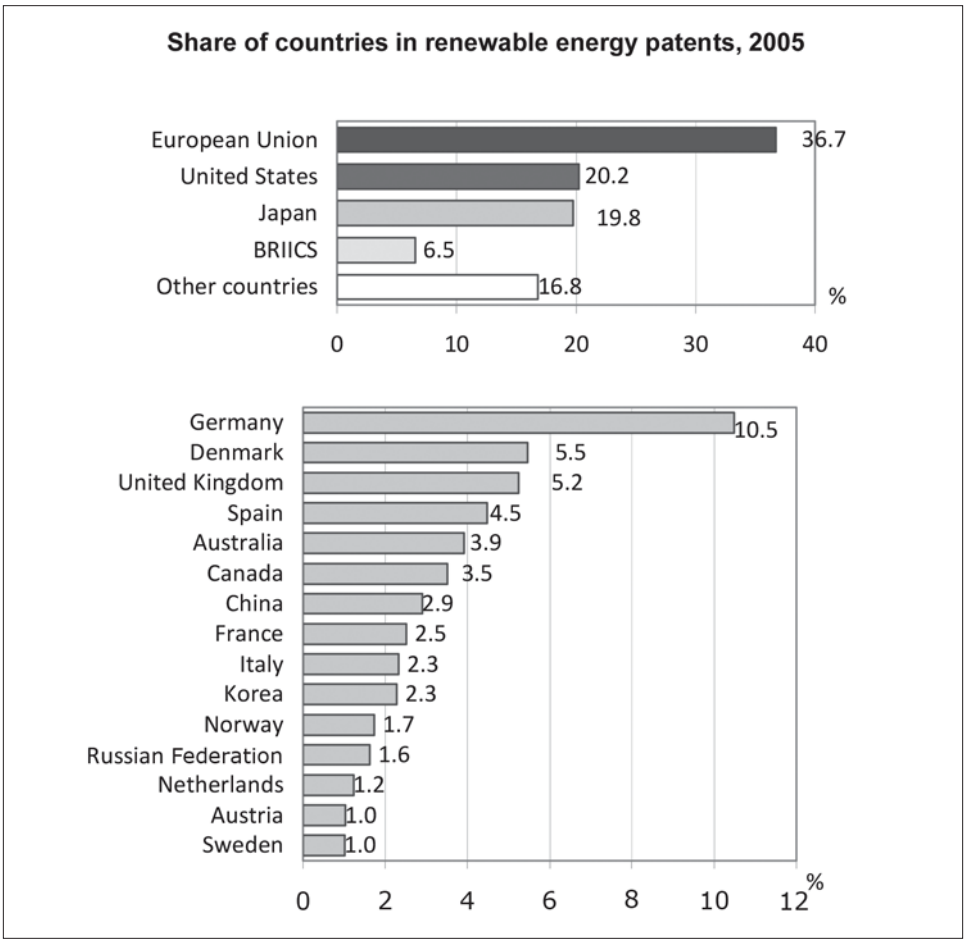
Figure 2



Source: OECD (2008)

In 2005, the EU, the US and Japan had the highest number of renewable energy patents. Within the EU, Germany, Denmark, the UK and Spain have the highest share of patents in renewable energy. Denmark had 161 patents taken between 2003 and 2005, focusing on wind energy (OECD 2008). See Figure 3 below.

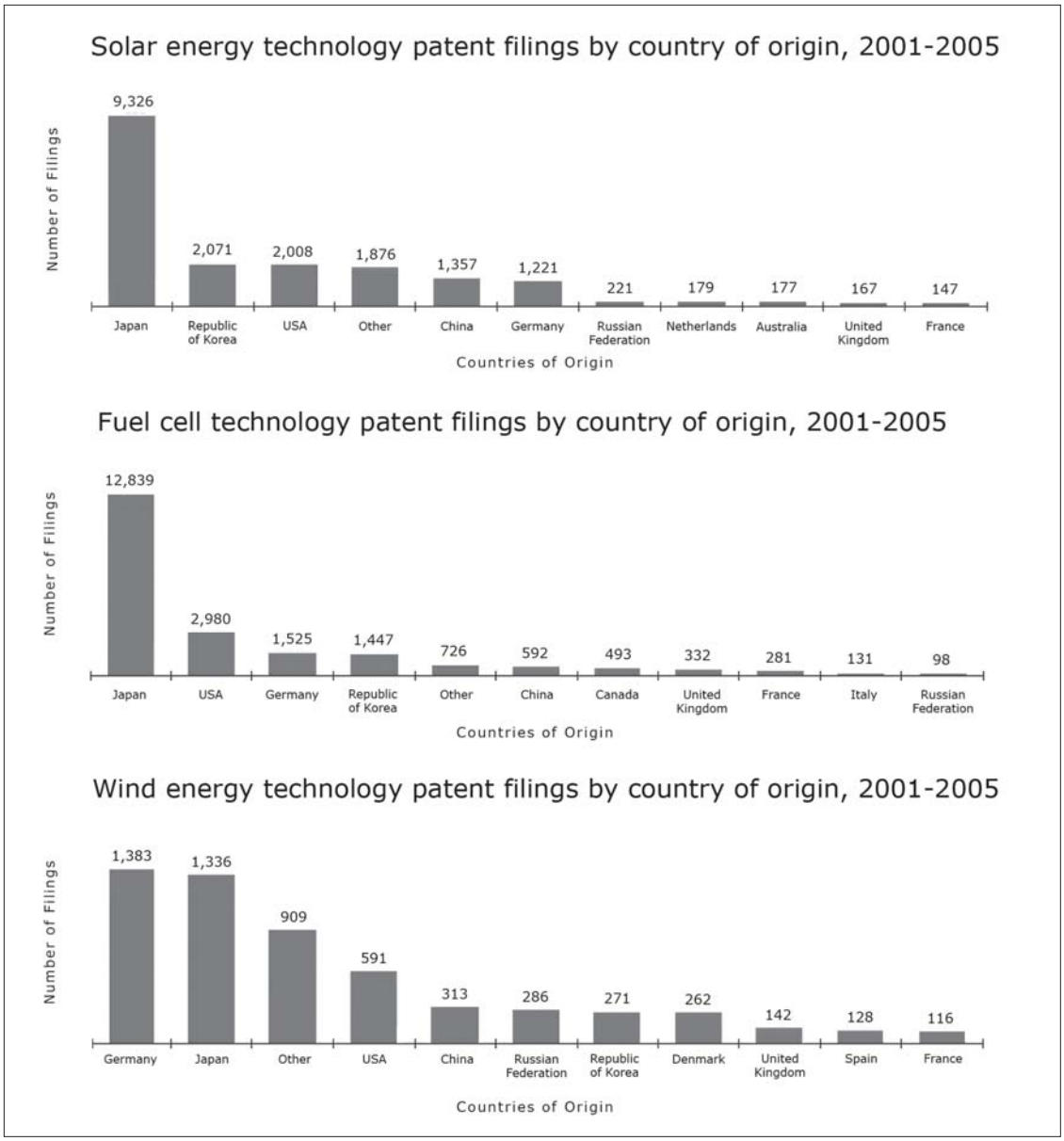
Figure 3



Source: OECD (2008)

Figure 4 below shows patent filings (2001-05) related to solar (thermal and photo) energy, fuel cell and wind energy by country of origin.

Figure 4



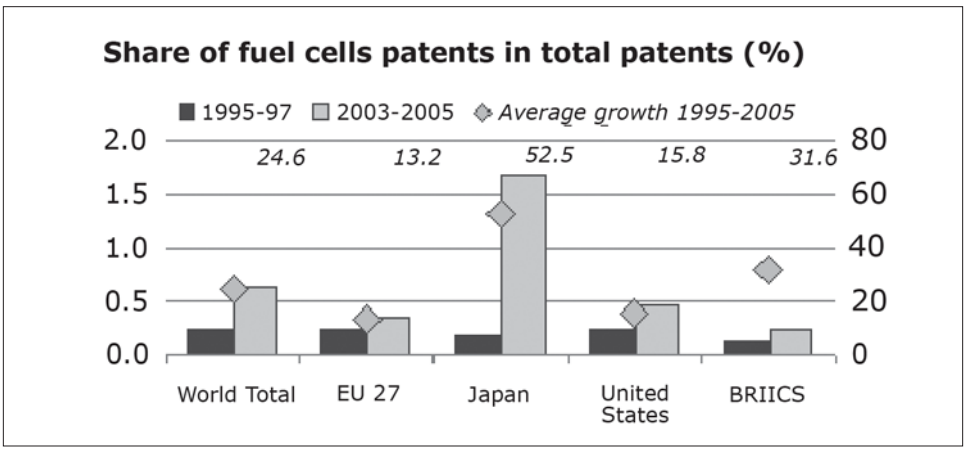
Source: WIPO (2008a)

Figure 4 also shows that patent filings in the fields of solar energy and fuel cell are dominated by Japan, while patent filings in the area of wind energy technology are almost equally dominated by Germany and Japan. There is no specific mention of any developing country aside from China, indicating the insignificant role that other developing countries play in patent filing in the abovementioned technologies.

It is also worth noting that the total number of patent applications in the field of wind energy was considerably less than that in the other two technological fields.

Statistics compiled by the Organization for Economic Cooperation and Development (OECD) in relation to fuel cell technology show that there has been a sharp increase in the number of patents filed under the PCT to protect inventions on fuel cells since the mid-1990s, i.e., at an average pace of 25% a year between 1995 and 2005.[43] In the field of fuel cells, Japan shows the strongest average growth in the number of patents. See Figure 5 below.

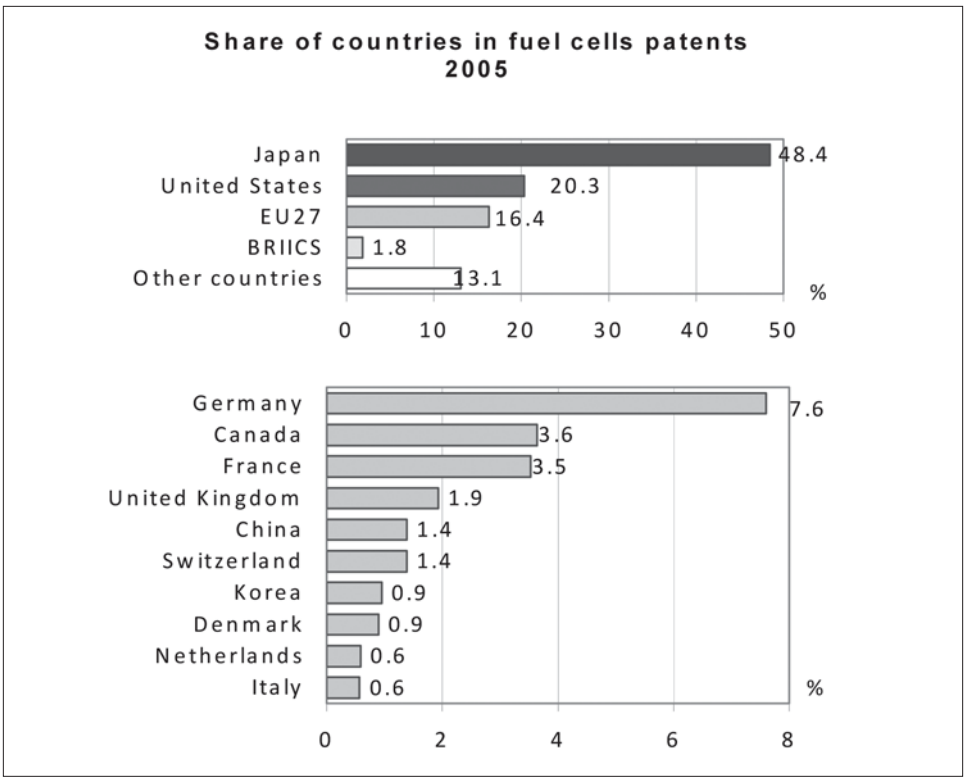
Figure 5



Source: OECD (2008)

In 2005, 48% of fuel cell patents originated from Japan, with the US following with about 20% and the EU with 16%. Brazil, China, India, Indonesia, the Russian Federation and South Africa (BRIICS) held only 1.8% of the patents while other countries held 13.1% of the share of patents. See Figure 6 below.

Figure 6

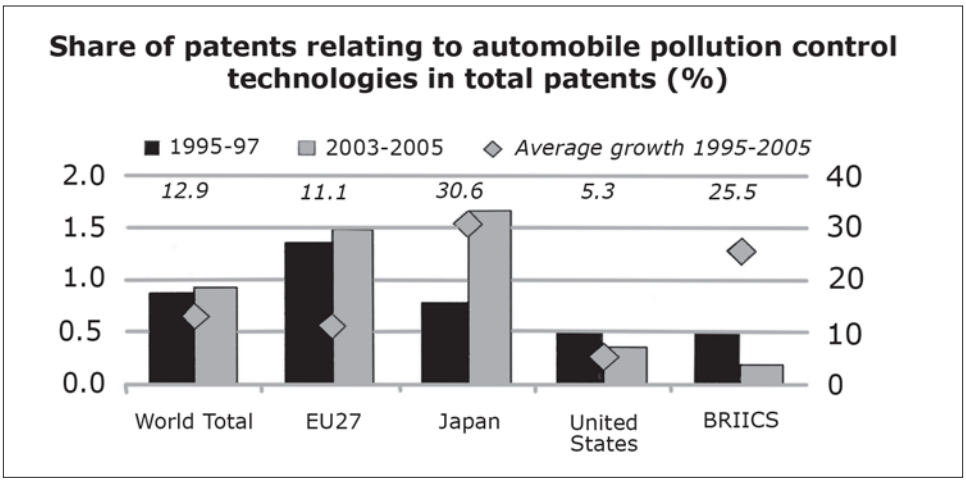


Source: OECD (2008)

Automobile Pollution Control Technologies

Automobile pollution control technologies comprise all technologies used to reduce pollutants produced and released into the atmosphere by automobiles.

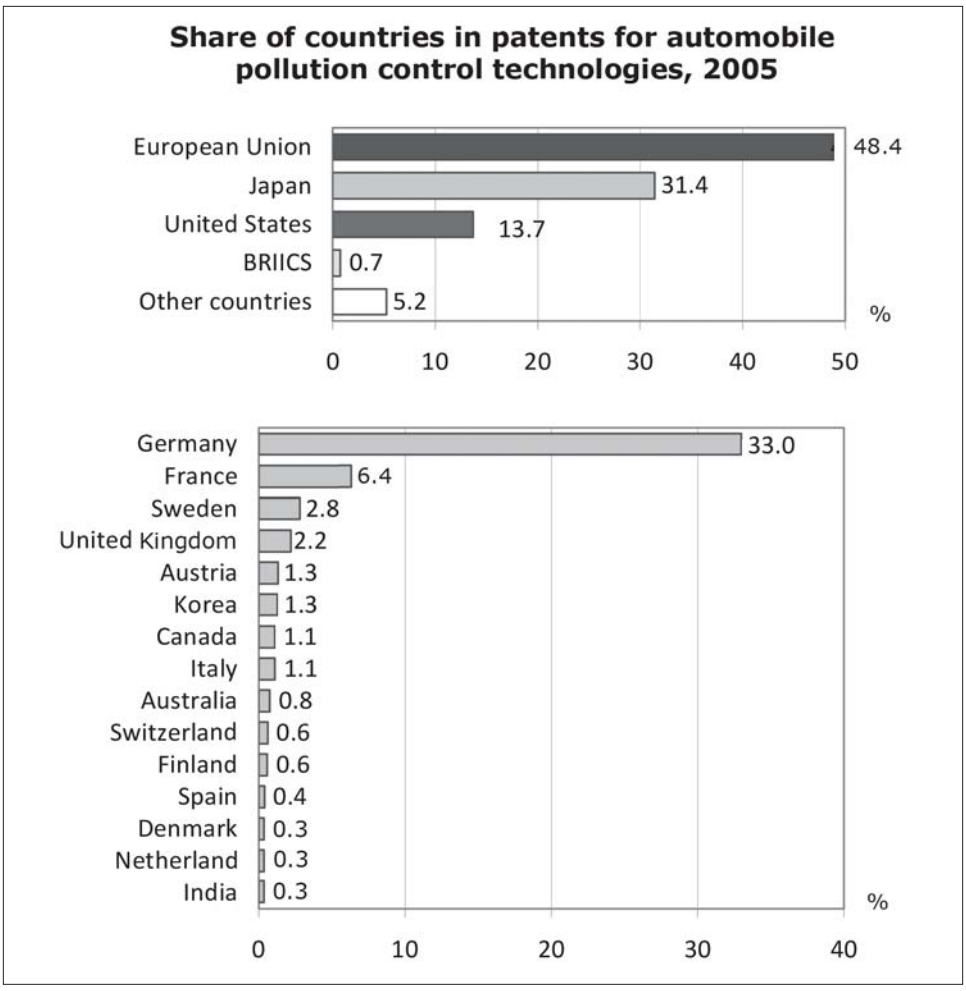
Figure 7



Source: OECD (2008)

The share of automobile pollution control technology patents in all patent applications has remained stable over the last 10 years. However, it has more than doubled in Japan, reaching about 1.7% of international patents originating from Japan.[44] See Figure 7.

Figure 8



Source: OECD (2008)

In 2005, the EU, Japan and the US held the highest shares in patents for automobile pollution control technologies. The BRIICS countries held only 0.7% of the patents while other countries held 5.2% of the patents. See Figure 8.

Japan is the second-ranked patenting country in this specific technology field, behind Germany, which contributes to one-third of patent applications for automotive emissions control.

Biofuels

Over the last six years, a total of 2,796 biofuel-related patents were published in the US, with the number increasing by over 150% in each of the past two years. Analysis of biofuel-related patents published in 2006 to 2007 revealed the following breakdown of patents: biodiesel (299), agricultural biotechnology (110), ethanol and other alcohols (42), enzymes (35) and biomass (41). Further broken down by ownership entity, the patents published in the selected technologies in 2006 to 2007 were 57% owned by corporate entities, 11% owned by universities or other academic institutions and 32% undesignated (i.e., the patent applications do not list the patent owner). Worldwide, the highest number of biofuel patents in 2006 to 2007 originated from the US (184), Germany (34), Japan (14), Italy (10) and France (10). It is claimed that in the US, the patents are owned by 78 different entities. It is anticipated that as venture funding and government funding increase, the number of biofuel patents will continue to grow steadily. Future legislation directed towards climate change is also expected to strongly influence biofuel patents.[45]

Climate-Tolerant Crops

In the field of climate-tolerant crops, serious concerns have been expressed over the monopoly a few companies hold over genes in plants. According to the non-governmental ETC Group (2008), BASF (Germany), Monsanto (US), Bayer (Germany), Syngenta (Switzerland), DuPont (US) and other biotechnology companies (known as "Gene Giants") have filed 532 patent documents (a total of 55 patent families) on "climate-ready" genes at patent offices around the world. Monsanto (the world's largest seed company) and BASF (the world's largest chemical firm) together account for 27 of the 55 patent families identified. Much of the rest is accounted for by Ceres, Inc. (US – partners with Monsanto), DuPont, Evogene Ltd. (Israel – partners with Monsanto and DuPont), Mendel Biotechnology, Inc. (US – Monsanto holds equity stake) and Syngenta. Ceres, Inc. and Mendel Biotechnology conduct joint research with Monsanto; thus, together, Monsanto with its research partners and BASF hold 34 of the 55 patent families.[46]

According to the ETC Group analysis, the Gene Giants are "staking sweeping patent claims on genes related to environmental stresses – not just those in a single

engineered plant species – but also to a substantially similar genetic sequence in virtually all engineered food crops". Developed (US, Europe) and developing countries such as Argentina, Brazil, China and South Africa (major food-producing countries) are swamped with such patent filings.

In view of the monopolistic grip over "climate-ready" genes by a few Northern companies that are also major players in the present concentrated seed and chemical industry,[47] there are concerns that the proprietary technologies will concentrate corporate power, drive up costs, inhibit independent research and undermine farmers' rights to save and exchange seeds.

5 Effects of IPRs on Transfer of Climate Technologies

IT is apparent from Chapter 4 that there are an increasing number of patents on climate-related technology. This trend will likely intensify as climate change concerns further heighten, funding for R&D increases, and governments adopt legislative and regulatory frameworks for a greener economy. In addition, most of the climate-related technology is held by industrialized countries.

Such a trend raises fundamental questions for developing countries, in particular, whether developing countries will be hampered in their ability to gain, on reasonable terms, timely access to mitigation and adaptation technologies as well as associated know-how for purposes of R&D, especially to adapt these technologies to suit local conditions and for production.

Where technologies are in the public domain (i.e., not patent-protected), the key supply-side issues are the costs of technology and the transfer of know-how to use, maintain and adapt the technology to local conditions for developing countries. For developing countries that have the capacity or ambition, there should be transfer of know-how on how to produce these technologies instead of simply importing the equipment. In such a scenario it is important to consider mechanisms to facilitate the lowest prices being offered to developing countries, as well as to finance the purchase of technology and the R&D that is needed to adapt and manufacture the technology. It is also important to consider mechanisms to make available the know-how (which may in some circumstances be protected as trade secrets[48]) that is needed.

The situation is more complex when technologies are patented. Patents grant exclusive rights to the patent holder, which also means that the inventor may exclude third parties from utilizing, exploiting or commercializing the protected invention in

the countries where the invention is patented. Having exclusive rights enables the patent holder to have a monopoly over the market and dictate the price it charges and the basis on which it will license the use of the invention. The patent holder may impose unreasonable conditions for use of the protected technologies or simply refuse to license the product to any other entity for fear of competition from the licensee.

The abuse of patent rights has occurred on numerous occasions in many fields of technology, resulting in problems of "access" for developing countries. For example, in the area of pharmaceuticals, due to the monopoly grip of the multinational pharmaceutical companies over the market, HIV/AIDS treatment initially cost almost $10,000 per person per year. Only with the introduction of competition from producers of generic medicines from India (which retailed them at the price of $200-300 per person per year) did HIV/AIDS treatment become more affordable for developing-country populations.

The multinational pharmaceutical industry has also been aggressive in enforcing its patent rights, as well as reluctant to provide licences on reasonable terms to entities in developing countries, even where the issue was one of life and death of patients in developing countries. For example, in 2001 the South African government introduced measures to enable imports of cheap, generic, life-prolonging, HIV-fighting medications from countries such as Brazil and India. However, it found itself having to fight 39 pharmaceutical companies that brought an action against the government on the grounds that the measures were unconstitutional. The lawsuit was later dropped following strong protests from civil society worldwide. In 2002, Hazel Tau, working with the Treatment Action Campaign (TAC), filed a complaint with South Africa's Competition Commission against the multinational drug companies GlaxoSmithKline (GSK) and Boehringer Ingelheim (BI). GSK and BI respectively offered 30% and 15% royalty for licences to produce cheaper versions of the patented product. The Competition Commission ruled against the companies inter alia on the grounds of having denied a competitor access to an essential facility as well as excessive pricing. In a settlement that followed, it was agreed inter alia that voluntary licences would be granted, export of antiretroviral HIV/AIDS drugs (ARVs) to sub-Saharan African countries as well as import of cheaper drugs were permitted, and royalties were reduced to a maximum of 5% of the net sales of the relevant ARVs.[49]

The pharmaceutical industry's approach is but one example of the oft-used strategies of the patent holder. The Intergovernmental Panel on Climate Change (IPCC) (2000) itself notes that: "Several studies have been done that verify this strategy of using intellectual property rights as a market advantage and as a strategy to control markets as well as dominate innovation within industrial sectors." The same report elaborates on how scholars had noted problems at company level, and how companies have prevented the introduction of new technologies in the marketplace in order to advance and retain their own technological advantages. For example, in 1994 when Korea was in the process of industrialization, technologies introduced by the Japanese and the US came with a variety of restrictions, such as prohibition of consignment to a third party and sharing of improved technologies, as well as export prohibition and denial of permission to the licensee to deal in competitive products or technologies.[50]

These and other examples in other fields of technology (the literature is rife with problems of "access" as a result of patent thickets,[51] patent trolls,[52] high royalty fees, licensing restrictions and other anti-competitive behaviour), seen against the background of an increasing number of patents (as noted above and likely in the future in most climate technology sectors), point towards a very strong possibility of patents being a barrier to the transfer of climate-friendly technologies to developing countries. Studies on this matter raise IPRs not only as a possible barrier to transfer of technology but also as a concern that needs action on the part of UNFCCC Parties negotiating post-2012 commitments. Of course, access to patents alone by firms in developing countries will not be sufficient for effective transfer of technology, since full use of the patent may also require access to know-how.

IPRs: A Barrier to Climate-Friendly Technologies?

There are examples of developing countries and their firms being hampered from adopting climate-friendly technologies or products due to the existence of patents on these products, and unreasonable demands made by the patent holders on companies in developing countries that requested a voluntary licence from the patent holder.

Watal (1998), in a study on the effect of IPRs on technology transfer in India in the context of the Montreal Protocol to protect the Earth's ozone layer, provides two

specific cases of the acute problems faced by local firms in their attempts to access technology from suppliers holding patents.[53]

One case concerned an Indian company seeking access to HFC-134a (a substitute for chlorofluorocarbon (CFC), an ozone-depleting substance (ODS) used in refrigerators and air-conditioners). The patent holder, a transnational company producing HFC-134a, quoted a high price of $25 million for access to the technology. The supplier also proposed two alternatives to the sale, namely, that the Indian firm allows the supplier to take majority ownership in a joint venture to be set up, or that the Indian firm agrees to export restrictions on HFC-134a produced in India. Both options were unacceptable to the Indian company. The quoted price was also unrealistically high as the Indian company estimated that the technology fee should at most have been between $2 and $8 million.

Indian producers of CFCs were very keen to acquire the technology for making HFC-134a for domestic and export sale, as most Indian refrigerator manufacturers wished to convert to using HFC-134a. However, their efforts to access the technology were unsuccessful. Only a few companies in the developed countries control the patents and trade secrets related to HFC-134a, and thus developing countries have to either pay high royalty fees to produce it locally or lose international markets.[54]

The second case is that of the ozone-depleting substance halon, used in fire extinguishers and many other products. The substitute for this ODS is HFC-227ea (commercially known as FM 200). FM 200 is covered by a method and composition patent filed by a US company in 1995. It was filed in several countries including China, Korea and Russia (but not in India, which, up to the time of the study, did not allow such patents).

The costs to India to produce the alternative to halon 1301 included $1.5 million for licence fees to produce alternatives just for the halon 1301 sub-sector and another $1.4 million to convert halon portable systems to ODS-free systems. Indian firms that tried to acquire the technology faced the problem not only of finance, but found that the patent owner was not interested in licensing the technology to wholly owned companies. The patent holder was interested only in joint ventures in which it would hold a majority share. However, Indian firms did not want to divest their equity holding but only wanted to buy the technology. Thus, in the case

of HFC-227ea, as in the case of HFC-134a, the technology supplier, which also owned the patent, was unwilling to transfer to India, even on commercial terms. Thus the users of halon 1301 had to depend entirely on imports of HFC-227ea to meet their demand.

Watal (1998) concluded that: "Efforts at acquiring substitute technology have not been successful as the technologies are covered by IPRs and are inaccessible either on account of the high price quoted by the technology suppliers and/or due to the conditions laid down by the suppliers. This would require domestically owned firms to give up their majority equity holding through joint ventures or to agree to export restrictions in order to gain access to the alternative technology."[55]

Korean firms also faced difficulties when they wanted to replace CFCs with acceptable substitutes HFC-134a and HCFC-141b, which had been patented by foreign companies in Korea. As mentioned above, many of the technology agreements between Korean firms and their partners in Japan and the US contain restrictions such as not being allowed to consign to a third party or to export, and that the improved technologies should be shared.[56] Andersen et al. pointed out in their study that: "South Korean firms are of the opinion that the concession fees demanded by technology owners represent a lack of intention to transfer the alternative technology."[57]

According to Korean firms and R&D institutions, there have been cases where the private and public sector refused to license climate-friendly technologies such as HFC-134a, fuel cell and IGCC (Integrated Gasification Combined Cycle). In some cases private sector entities sell their equipment under the condition that the buyer cannot disassemble the equipment.[58]

In the case of Korea it was further seen that when it launched its programme to develop HFC-134a technology, a (foreign) company already having this technology registered 40 process patents in Korea in 1993 in an attempt to block the development of similar technology. The patent holder only changed its policy when Korea neared completion of its own HFC-134a technology. The IPCC (2000) report notes that the case of Korea is "only one among many".

Several other recent studies that have analyzed specific sectors of climate-related technology have also pointed out that protection of IPRs can be a barrier to transfer

of technology. The IP holder can prevent access to and use of the protected technology and associated know-how. This would prevent other firms from imitating the technology and/or innovating on the basis of new technologies.[59]

Ockwell et al. (2007) looked at Light Emitting Diode (LED) lighting technology[60] and the main barriers that India faces in the transfer of such technology. On IPRs, the study concludes: "Another barrier relates to the IPR issue associated with LED manufacturing. It is a highly protected technology. As there are various processes involved in manufacturing LED chips, each process is patented and requires huge investment. At present, the cost of investing in both chip manufacturing and resolving IPR issues is substantially high compared to importing the chips."

On "biomass technology", the study found that IPRs, though "not a very important issue" in this sector in the context of India, have created "some friction between the European and Indian manufacturers of briquetting[61] machines" as "small-scale industries such as briquetting machine manufacturers are typically 'copycat' businesses based on reverse engineering…". The study also recognizes that Europe is dominant in biomass fuel of pellets[62] and not briquettes; thus it concludes that "The growth of the pellet market in Europe has some implications for technology transfer to developing countries like India".[63]

On hybrid vehicles,[64] Ockwell et al. (2007) found that commercially viable technologies for hybrid vehicles are held by companies in developed countries.[65] The companies involved are not limited to automotive companies but also include other types of companies such as engineering companies and electrical equipment developers. They also found that "there may be IPR issues associated with imitating patented hybrid drive-trains" since companies such as Toyota, GM and BAE have strict patents relating to their hybrid drive-trains. The issue of IPRs was not specifically referred to in two other sectors examined by Ockwell et al. (2007), i.e., coal gasification and improving combustion efficiency.

Ockwell (2008) reviewed three studies on the issue of IPRs in the context of low-carbon-technology transfer and concluded: "Developing country firms were generally not observed to have access to the most cutting edge technologies within the sectors examined."

Barton (2007) looked at three sectors, i.e., solar photovoltaic,[66] biofuels and wind, largely in the context of the bigger emerging economies of Brazil, China and India. Despite the overall optimistic tone of Barton's analysis, the study does not rule out the possibility of IPRs being a barrier for developing countries in the sectors examined. In fact, Barton raises various concerns regarding "serious plausible patent issues … likely to arise from the new technologies"; the risk of broad patents which may "complicate the development of … new more efficient or less expensive technologies", and the issue of anti-competitive practices if the "relative small number of suppliers … cooperate in a way that would violate competition-law principles".[67]

It is also worth mentioning Barton's observations on other technologies that may be needed to effectively operationalize climate technologies, especially wind and photovoltaic technologies. For example, in the photovoltaic and wind sector, technology such as "inverters"[68] may be needed to connect to the electricity grid. Such technology is continuously evolving, pertains to a more concentrated industry and is an important area of patent activity.[69] Batteries are another technology related to effective operation of photovoltaic panels when the sun is not shining.[70]

On Barton's study, Ockwell (2008) states: "It is notable that for all of the case studies he examines, uncertainty is expressed as to the likelihood of developing country firms gaining access to the most advanced technologies in these industries."

In the case of photovoltaic technology, Barton suggests that access to the newer thin-film technologies (which are subject to much more extensive patenting than the older silicon-slice technology) is likely to be difficult. Similarly patent holders of new methods, enzymes or microorganisms important in the case of biofuels may be hesitant to make these technologies available to developing-country firms.[71] Barton also identifies wind technologies as an area where existing industrial leaders are hesitant to share their leading technology for fear of creating competitors.

On wind technologies, Ockwell (2008) argues that only the smaller companies which are likely to gain more from licensing and lose less from competition are willing to sell licences for use of their technologies. In support, Ockwell refers to a study by Lewis on how leading wind technology manufacturers in India (Suzlon) and China (Goldwind) acquired access to wind technology by licence purchases from second-tier developed-country firms. Lewis argued that it was a disincentive

for leading companies to license to potential developing-country competitors that have cheaper labour and materials available, and that while the technology received was not necessarily inferior, it had less operational experience.[72]

Importantly, Ockwell (2008) observes that "the key to ensuring long-term, sustained uptake of low carbon technologies in developing countries is the development of low carbon technological capacity within these economies" and this "relies on access to the knowledge that underpins cutting-edge technological developments, as well as exposure to the tacit knowledge that is often integral to developing the absorptive capacity necessary to work with emerging technologies". Ockwell argues that for this to happen, access to IPRs is important as it will enable entities in developing countries to understand and work with or imitate the knowledge that underlies new low-carbon technologies.

Ockwell also points out that if the intention is to assimilate new technologies and hence increase the technological capacity of developing countries, then IPRs are likely to be used by developed-country IP holders to prohibit access. IPR issues are likely to be less substantial if the idea is to simply sell the technology without risk of local competition.[73] In both scenarios cost may still be a barrier to access.[74]

There are several arguments that point to a favourable impact of the patent system on technology transfer. However, often these arguments fail to take into account the realities and limitations of developing countries.

One argument is that the disclosure of patent information can serve as a major boost to technology transfer by avoiding duplicative R&D and enabling technological leapfrogging.[75] Disclosure of the claimed invention's specifications in the patent application is a provision of Article 29.1 of the TRIPS Agreement. According to the Article, Members "shall" require disclosure of the invention "in a manner sufficiently clear and complete for the invention to be carried out by a person skilled in the art". Members "may" also require the applicant to "indicate the best mode for carrying out the invention known to the inventor at the filing date or, where priority is claimed, at the priority date of the application".

There are several problems with this argument:[76] (i) patent agents usually avoid including information that would enable competitors to invent around or exploit the invention on patent expiry; (ii) the applicant also often omits information that

would allow the reproduction of all embodiments, when several embodiments of an invention are claimed; (iii) patent disclosure, while making known information about the invention, does not allow exploitation of the invention until patent expiry or unless consent of the patent holder is obtained or measures (e.g., compulsory licensing) are taken as allowed by the TRIPS Agreement to override the patent barrier; (iv) where inventions pertain to microorganisms, access to the relevant technology only becomes possible through access to the biological material, which may only be allowed for experimental and not for commercial purposes; and (v) technicians in developing countries often are without experience in a particular field, thus making it difficult to work the disclosed patent specifications. In addition, skills and know-how may be needed to work the disclosed patent specification. The latter is seldom included in the patent application.

Thus, Correa (2005) points out that "the informative effects of patent grants cannot be deemed a substitute for transfer of technology mechanisms through which companies in developing countries actually gain access to proven and commercially viable technologies as well as associated know-how".[77]

In addition, most developing countries are at the stage of "initiation" and "internalization" of technology, wherein they would have to innovate using existing inventions through reverse engineering while making minor adaptations, rather than "leapfrogging" over known technology. Thus one should be careful to not overstate the benefits of patent information in the context of developing countries which are at different levels of development and have different technological capability and needs, which further vary sector by sector.

Another frequent argument is that patents can be used as a means to leverage access to other related technologies.[78] This argument would again not work in the context of developing countries since generally and even in the area of climate change, patents on most of the technologies are held by developed countries. Developing countries generally are not major users of the patent system. In 2005, 18 countries were considered intensive users (i.e., had more than 1,000 PCT filings), making up 94.8% of the filings. Aside from Korea and China, these were developed countries. The great difference between PCT filings originating from China and Korea and those from the US, Japan and Germany is also noteworthy. While Korea and China's PCT filings numbered less than 10,000, the three developed countries had between 20,000 and more than 50,000 PCT filings in

2005. In 2007, more than 60% of the PCT filings originated from the US, Japan and Germany.[79]

It is also argued that there are pre-grant and post-grant mechanisms within the patent system that can be used to ensure that the resulting effect of the patent system benefits the public.[80] Pre-grant mechanisms referred to are: (i) ensuring that patents are only granted for technologies that are novel, involve an inventive step and are industrially applicable, thus avoiding frivolous patents; and (ii) excluding technologies that would cause damage to the environment. Post-grant mechanisms referred to include: (i) exceptions and limitations to patent rights; and (ii) interventions such as compulsory licences and remedies for anti-competitive practices.

While the TRIPS Agreement does provide several flexibilities with regard to pre-grant and post-grant mechanisms that can be adopted to manage the exclusive rights given to the patent holder for the benefit of the public, there are significant difficulties in terms of applying these flexibilities in practice in the context of developing countries. For example, in most developing countries, including emerging economies, there is a lack of patent examination capacity, thus making it difficult to use the pre-grant mechanisms. In relation to post-grant mechanisms, developing countries often face pressures from multinational companies, as well as developed countries, when attempting to use such mechanisms (for further elaboration, see below). Furthermore, in recent years a number of North-South trade agreements contain provisions that limit the use of pre- and post-grant flexibilities.[81]

Another argument is that most of the technologies are in the public domain (as the patent applicant is not interested in seeking patent protection) in most developing countries[82] and thus there should not be any cause for concern. This argument is problematic because the technology is most likely to be patented in countries that have the technological capacity to reverse engineer and innovate on the basis of existing technologies and pose some risk of competition. Thus while it may be true that patent applicants may not bother to file and maintain an application in all developing countries, particularly the poorest countries, patent protection will almost certainly be sought in developing countries where the local industries are likely to pose a risk of competition. In addition, in many developing countries it is difficult to ascertain the patent status of technologies, which essentially means that firms in developing countries may be bullied into abandoning the use of a technology simply by a mere allegation by the patent holder of a patent being held in that country.

A frequent argument of developed countries in relation to the patent system is that it is an incentive for innovation and will facilitate technology transfer. The relationship between IP and technology transfer has already been addressed in Chapter 2 above.

The relationship between strengthened patent protection and innovation is also the subject of much debate. There is now evidence that the impact of the patent system as an incentive for innovation depends on many conditions such as significant market, sufficient capital, qualified personnel at the firm level and innovation-oriented entrepreneurs, as well as a solid scientific base open to collaboration with industry. There is also evidence that even when such conditions are met, IP may not promote innovation. For instance, a review of 23 empirical studies found weak or no evidence that strengthening patent protection increased innovation, only the number of patents applied for.[83] IP protection may be neutral to innovation even in high-tech sectors, particularly where the product cycle is so short that "if you just imitate others' ideas, your products will always be outdated and obsolete".[84]

In the context of climate technologies, it is apparent from the section below on "IPRs and Publicly Funded Technologies" that patent protection is not a sufficient condition for innovation. Governments of developed countries have to provide substantial subsidies for R&D. Thus many other types of incentives can be considered that would still incentivize the private sector to make the investments required without the exclusivity of the patent system. These could include additional funding for R&D, tax incentives, monetary prizes for outstanding R&D outcomes, regulation, etc.

Opportunistic and Anti-Competitive Lawsuits: Hampering Access to Climate Technologies

IP holders are known to use legal suits in an attempt to preserve their market monopoly, or to place themselves in such a position as to be able to extract significant royalties from the opposing entity that has used or intends to use the protected technology.

Several patent disputes have emerged particularly in the US in the context of climate technologies. For example, in 1996 Enercon was barred from importing wind turbines into the US through a proceeding before the US International Trade

Commission (ITC)[85] (a procedure under which a firm's imports to the US can be barred if it is shown that the firm's product violates a US patent).[86] The patent holder of the technology was Kinetech, a "technology investment and patent holder"[87] company managed by Lachman Goldman Ventures. Gamesa has also sought to enforce a patent on a strategy to control the turbine speed against GE.[88] GE successfully used litigation over patent infringement to block foreign access to the US market, thus some firms have had to design around the patent in order to market in the US.[89]

Toyota, well known for its commercially successful gasoline-electric hybrid vehicle Prius, was also engaged in a patent infringement battle related to its Hybrid Synergy Drive brought by Paice LLC (a non-manufacturing patentee) in 2004. The trial court found that Toyota's hybrid vehicles infringed Paice's patents, and awarded Paice $25 per vehicle. In its appeal to the US Supreme Court, Toyota said Paice was a "patent litigation company" attempting to "impose a royalty toll on the Prius and similar Toyota hybrid vehicles based on an obscure patent".[90] However, the Supreme Court let stand the $4.3 million award against Toyota. According to reports, Toyota also may have to pay Paice royalties for future vehicles it produces using the disputed technology. The disputed technology involves a microprocessor that accepts torque information from both the internal combustion engine and electric motor.

Paice had sought a permanent injunction which was denied by the courts. What is interesting in this case is that Paice extended Toyota an offer to license its technology throughout its motion for a permanent injunction, which in itself became one of the grounds for the court rejecting the injunction request. Paice does not compete for market share with the hybrid vehicles and does license its patent to other companies. However, Paice's actions suggest an opportunistic behaviour, i.e., that it always intended to license the technology to Toyota but engaged in protracted court proceedings to place itself in a more favourable position to extract royalties.

In 2005, Toyota faced another legal challenge from Solomon Technologies Inc. claiming infringement of its patent, primarily relating to Toyota's use of the Hybrid Synergy Drive technology in its Prius and Highlander hybrid vehicles.[91] In 2006 Solomon also filed an additional complaint against Toyota with the ITC, seeking to exclude importation of infringing technology. The court ruled in Toyota's favour,

leading to an appeal by Solomon. Their first lawsuit has been stayed awaiting the resolution of the ITC case.[92]

The above examples show how patent holders often use litigation or the threat of litigation to engage in anti-competitive behaviour, in an attempt either to preserve their market share or opportunistically to extract benefits such as high royalties.

In the context of developing countries, patent litigation or the threat of litigation may deter firms in these countries from investing in mitigation and adaptation technologies. Ockwell et al. (2007) refer to a discussion with Prof. N. Narendran, Director of Research, Lighting Research Center in New York, which highlighted that "As there are a number of patents associated with each process and almost all manufacturers sue each other over patents it is really difficult to resolve IPR issues".[93]

Thus, an outcome of extensive litigation could be a disincentive to invest in innovation. For example, on experimental science the amount of litigation tripled between 1987 and 1997, and the costs of patent litigation now outweigh the value of patents to owners by about 2%, constituting a tax on overall research and development investment.[94]

IPRs and Publicly Funded Technologies

Governments in developed countries play an important role in providing funding for R&D in general and climate technologies in particular. According to the UN Conference on Trade and Development (UNCTAD), in the past decade about 40% of annual national R&D spending within some developed member countries of the OECD was publicly funded.[95] The private sector is often reluctant to invest in substantial research on its own, especially when the technology lacks short-term commercial viability.

Governments sponsor a range of R&D that underpins private sector investments in developing climate technologies.[96] For example, in 2001 EU governments spent more than half of the total expenditure for R&D in renewable energy. The public sector spent 349.3 million euros while other sectors spent 340 million euros.[97] Public sector spending is equally important in the US. For example, for the wind, biofuels and photovoltaic sectors, the US Department of Energy spent approximately $356 million.[98]

Sathaye et al. (2005) surveyed government-sponsored R&D in the US, Canada, the UK, Korea and other OECD countries and found that it is a common practice for governments to grant ownership of IPRs (patents, copyrights, trademarks, etc.) to the recipient research institutions.

In the US, government-sponsored research usually ends up being patented.[99] This trend has emerged due to the Bayh-Dole Act introduced in 1980, which gave non-profit organizations (primarily universities) and small business the right to retain ownership of their inventions and to patent them and license them to firms.[100] Section 204 of the Bayh-Dole Act even allows the inventor to grant "exclusive licences", provided that "any products embodying the subject invention or produced through the use of the subject invention will be manufactured substantially in the United States". The latter requirement can be waived in specific circumstances.

Barton (2007) made note of the extensive role the US government played in terms of funding R&D in solar photovoltaic, biofuel and wind technologies. He also noted that the technologies that would emerge will almost definitely be protected by patents. In some cases the patents will be licensed exclusively.[101] For example, Dartmouth College has granted a worldwide exclusive licence to Mascoma to research and produce ethanol from cellulosic biomass based on several patents owned by Dartmouth. Dartmouth has also taken an undisclosed equity position in Mascoma.[102] More generally, Barton (2007) identifies access to government-funded technologies as an important overall concern in the three sectors he examined.[103]

The issue of transfer of publicly owned technology was addressed at UNCED in 1992. Agenda 21 (Chapter 34, paragraph 34.18a) states: "Governments and international organizations should promote the formulation of policies and programmes for the effective transfer of environmentally sound technologies that are publicly owned or in the public domain." Implementation of this provision has, however, been very weak.[104]

Policies similar to the Bayh-Dole Act are aimed at improving the industrial competitiveness of their respective industries. Thus, diffusion of climate technology would "typically be along a pathway of licensing or royalty payments rather than use without restriction in the public domain."[105]

However, given the several environmental challenges facing the international community and developing countries in particular, and the role governments play as main drivers of R&D for climate technologies, it is imperative to explore modalities for the transfer of publicly funded climate technologies to developing countries. OECD countries, which tend to hold ownership of most of the technology needed for mitigation and abatement, are in a strategic position to influence technology flows directly through their influence on the private sector or on public institutes which receive funding for their R&D. That would allow them to be more active in transferring technologies to developing countries.[106]

6 Measures That Can Be Taken on Intellectual Property and Climate Technologies

"FUEL-CELL innovation was drowning in a global patent thicket. By 2015, it was covered by 18,000 patents owned by hundreds of patent holders. Finding willing licensors, negotiating and paying the required licence fees led to crippling transaction costs. Most serious was the ability of one or more individual patent holders to hold the entire fuel-cell development regime to ransom. Patent trolls, attracted by the huge governmental investments, made things worse: interoperability in fuel-cell technology was almost entirely lost by the trolls increasingly enforcing their patents."

This striking story was related by the European Patent Office (EPO)'s "Blue Skies Scenario: The Journey to 2025".[107] It foreshadows the difficulties that are likely to arise from the patent system as it is today. It envisions a lack of political will among proponents of the IP system to take concrete steps to anticipate and address problems until catastrophes hit developed countries and force them to rethink the operation of the patent system.

This chapter explores the options available or which could be made available at the national and international level to address IPRs and to facilitate technology transfer to developing countries, which is critical for dealing with climate change.

Excluding Climate-Friendly Technologies from Patents

Prior to the TRIPS Agreement, countries could exclude whichever sectors they wanted from patenting. Thus, many countries excluded sectors critical for social and economic development such as the pharmaceutical and chemical sectors. However, with the advent of the TRIPS Agreement, this was no longer possible. Article 27.1 of the Agreement requires WTO Members to grant patents "for any

inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application".[108] The Article further requires that "patents shall be available and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced".

Thus, the flexibility enjoyed by many countries to exclude sectors from patent protection was taken away by the TRIPS Agreement's minimum standards that all developing-country Members had to adhere to once the transitional period for implementing the Agreement was over. For example, India was able to exclude patent protection for pharmaceutical products between 1970 and 2005. In 2005, due to obligations undertaken under the TRIPS Agreement, it had to begin the patent examination process for pharmaceutical products and grant patents where the patentability criteria were fulfilled. During the period of no patent protection for pharmaceutical products, India had been able to reverse engineer and develop its own generic drug industry, which today is an important world supplier of affordable medicines.

The international community could consider reverting to a pre-TRIPS situation wherein countries (or alternatively, at least developing countries) could exclude certain critical sectors from patent protection.

The least developed countries already have some flexibility in this regard. LDCs that are Members of the WTO have a special transition period for the implementation of the TRIPS Agreement, which was extended and now expires on 1 July 2013. As such, until the expiry of the transitional period, LDCs do not have to provide IP protection as required by the TRIPS Agreement. For a variety of reasons, however, many LDCs already have IP laws (in some cases inherited from their colonial masters), which many of them have updated or are in the process of updating to make them compliant with the minimum standards of the TRIPS Agreement. Thus, despite the availability of transition periods for LDCs, they would still benefit from an amendment of the TRIPS Agreement that would allow certain sectors to opt out from patent protection. Without such an amendment, LDCs may be hesitant to roll back the TRIPS-compliant provisions they have adopted.[109]

The international community could even go as far as to require all climate-friendly technologies to be free of IPRs worldwide, to ensure their widest availability as

climate change represents a grave and potentially irreversible threat to human societies.[110]

The options presented above could apply worldwide or, alternatively, only to developing countries while patents continue to be granted in the richer markets of developed countries and royalties are paid in those countries. This is a justifiable demand if climate change is considered a serious challenge. Developed countries cannot justify business as usual in the old system while also demanding a radical departure by developing countries from business as usual in their emissions pathways.[111]

Proposals along a similar vein were made by India at the WTO's Committee on Trade and Environment in March 1996, in the context of issues relating to TRIPS, technology and environment from the perspective of developing countries. India proposed three points for cases where other measures for technology transfer are not possible and to encourage the global use of environmentally beneficial technologies. The points were:

(i) Members may have to exclude these technologies from patentability to allow free production and use of such technologies, as they are essential to safeguard or improve the environment. Such an exclusion is not incompatible with the TRIPS Agreement and may have to be incorporated through a suitable amendment;

(ii) For currently patented technologies, Members may revoke patents already granted, if this is done in consonance with the Paris Convention and is subject to judicial review;

(iii) To encourage the use of environmentally beneficial technology, Members should be allowed to reduce the term of patent protection from the present minimum of 20 years to, say, 10 years, "so as to allow free access to environmentally-beneficial technologies within a shorter period."

Given the severity of the climate change challenge facing the international community, it is important to consider progressive solutions. For example, the TRIPS Agreement recognizes that in situations of "war or other emergency in international relations" nothing in TRIPS will be construed as preventing a Member from taking any action which it considers necessary for the protection of its essential security

interests.[112] Similarly climate change could justify a systemic relaxation of intellectual property rights to strike an appropriate balance between private interests and the global public good.[113]

India recently reiterated the call to address IPR issues with regard to technologies for energy efficiency and for clean energy at a climate change summit in Gleneagles. In its country paper titled "Dealing with the threat of climate change", one option proposed by India was to "redefine the extent of patent protection for such technologies" so that the "protection could exclude the use of such technologies in developing countries".

The options mentioned above would require an amendment of the TRIPS Agreement.

Strict Application of Patentability Criteria

The TRIPS Agreement allows WTO Members to determine on a case-by-case basis whether to grant a patent for an invention. An invention needs to fulfil three criteria for it to be granted patent protection. The TRIPS Agreement refers to these criteria in Article 27.1, i.e., novelty, inventive step and industrial application, but does not define them. Thus, countries have the right to define the criteria in any manner they deem fit.

Developed countries, which tend to be generators of technology, often define the criteria loosely (i.e., adopt low patentability criteria), thus enabling their entities to file many extensive patents. Such application of the patentability criteria has raised concerns given the increasing rise of trivial and broad patents. If developing countries adopt similar loose criteria, the resulting effect will be an increase in the number of patents granted to foreign applicants from developed countries, which are the main beneficiaries of the patent system.

The flexibility provided by the TRIPS Agreement allows developing countries to adopt a much stricter approach to the definition and application of the patentability criteria, thus limiting the number of patents granted on climate technologies. Without a patent, a country with some technological capacity would be able to innovate on the basis of climate technology (which is not patented) through reverse engineering.

However, patent issues would still arise in the case of exports where the technology is patent-protected in the importing country.

The option of strict application of patentability criteria is of limited value. In most developing countries save for a handful, there is a severe lack of patent examination capacity. Many patent examination offices grant patents or reject patent applications on the basis of patents granted by patent offices in developed countries such as the US Patent and Trademark Office (USPTO) or the European Patent Office. Thus, even where the national patent law provides for a higher standard of patentability criteria, in practice in most developing countries these standards may not be applied. In addition, strict application of patentability criteria would work only to reduce the number of patents granted, as it would avoid low-quality or trivial patents. The issue of access to the patented technology would still need to be addressed.

Compulsory Licensing in Developing Countries

Compulsory licences are licences that are granted by a government to use patents, copyrighted works or other types of intellectual property without the consent of the IP holder. In the context of patents, Article 31 of the TRIPS Agreement provides WTO Member states the right to grant compulsory licences, although no specific reference to the term "compulsory licence" is made in the said Article. The TRIPS Agreement gives examples of some grounds for granting compulsory licences, but does not restrict the possible grounds to those actually cited. WTO Members have not only the right to issue compulsory licences but also the freedom to determine the grounds upon which such licences are to be granted. This was confirmed by the WTO Ministerial Declaration on the TRIPS Agreement and Public Health adopted in Doha in 2001[114] (Doha Declaration on the TRIPS Agreement and Public Health).

Grounds for issuing compulsory licences could include:[115]

- refusal to deal (when the patent holder refuses to grant a voluntary licence which was requested on reasonable commercial terms and conditions within a reasonable period of time);
- national emergency or other circumstances of extreme urgency;
- to remedy against anti-competitive practices;
- lack or insufficiency of local working of the patent;

- public interest;
- public non-commercial use (also known as government-use licence);
- public health;
- security reasons;
- environmental reasons;
- interdependent patents.[116]

The TRIPS Agreement also lists a number of conditions for issuing compulsory licences. Some key conditions include:

- The proposed user (of the compulsory licence) must have made efforts to obtain authorization from the patent owner on reasonable commercial terms and conditions and must demonstrate that such efforts have not been successful within a reasonable period of time. However, this requirement is waived where the compulsory licence is issued for a national emergency or other circumstances of extreme urgency or public non-commercial use.[117]

- The patent owner must be paid adequate remuneration in the circumstances of each case, taking into account the economic value of the authorization.[118]

- The issued compulsory licence shall be predominantly for the supply of the domestic market of the Member authorizing such use.[119]

Most countries provide for compulsory and/or government-use licences in their laws. These provisions usually list the grounds on which compulsory licences can be issued as well as conditions for using the licences.

Compulsory licensing is not a unique or exceptional policy. According to Reichman (2003), "the United States government has broad powers to seize and use any invention protected by privately owned patents, subject to the payment of reasonable and entire compensation, and it makes extensive use of this power".

In the US, compulsory patent licensing provisions have also been addressed in specific legislation.[120] Some relevant examples include:

- *The Atomic Energy Act*[121] allows for such licensing when the patented innovation is "[u]seful in the production or utilization of special nuclear material

or atomic energy." The Atomic Energy Commission can determine whether a compulsory patent licence should be granted and the reasonable royalty owed by the licensee.

- *The Bayh-Dole Act*[122] permits compulsory patent licensing when a recipient of federal grants and contracts "has not taken, or is not expected to take within a reasonable time, effective steps to achieve practical application of the subject invention." The federal government can also exercise its "march-in rights" by showing that a compulsory patent licence is necessary "to alleviate health or safety needs", or "to meet requirements for public use specified by Federal regulations".

- *The Clean Air Act*[123] also provides for compulsory patent licences when the patented innovation is necessary to comply with emission requirements, no reasonable alternative is available, and where non-use of the patented innovation would lead to a "lessening of competition or a tendency to create a monopoly". A district court can, with the Attorney General's assistance, determine whether a compulsory patent licence should be granted and set the reasonable terms.

There are many cases of developed-country governments having used or threatened to use compulsory licences to overcome the patent barrier for various purposes.[124] Courts in many of these countries have also exercised compulsory licensing by opting for payment of royalties by the infringing party to the patent holder, in lieu of granting an injunction to the patent holder. Developing countries are also increasingly using the compulsory licensing provision, although largely for purposes of either importing or producing affordable generic medicines.

A key question that arises is to what extent compulsory licences are sufficient to overcome the IP barrier and be a vehicle for technology transfer to developing countries. Usually compulsory licences only permit the use of a patent but do not oblige the patentee to transfer the technological package developed to execute the invention. Hence, it is quite useful in situations where trade secrets and know-how are not important issues and entities in developing countries have some technological capacity to reverse engineer once a compulsory licence is issued. However, in developing countries where firms are less technically endowed, a mechanism that does not ensure access to the required skills and know-how essential

for the absorption and operation of the relevant technology, is unlikely to be very beneficial.[125]

It is worth noting that there have been some anti-trust cases in the US wherein the transfer of know-how was required as part of a compulsory licence or settlement decree. One such instance is a case in 1994 where the US Federal Trade Commission[126] required Dow Chemical to license to a potential entrant "all formulations, patents, trade secrets, technology, know-how, specifications, designs, drawings, processes ... [etc.]". In another case, *Federal Trade Commission vs. Xerox Corporation*,[127] the barriers of patent and know-how to compete were eliminated when the consent decree required Xerox to license some of its patents free of royalty, and others at a low royalty, as well as to offer all its office copier know-how royalty-free to US patent licensees.[128]

As seen above, provisions of the TRIPS Agreement (although imperfect) do entitle developing countries considerable latitude to use compulsory licences to advance national goals, including those relating to mitigating and adapting to climate change. Provisions in US laws, including those relating to clean air, confirm this, and provide a useful example for developing countries (particularly those with technological and entrepreneurial skills) seeking to ensure that technology is available on a fair and favourable basis to address the challenges of climate change.[129]

There are, however, factors specific to developing countries that discourage the use of compulsory licences. These include:

- Pressures from the patent holders supported by their (developed-country) governments to not issue or to abandon the compulsory licences ("pressure factor"). Rather than face stiff opposition from the patent holders (including the possibility of being embroiled in expensive, protracted and unpredictable litigation with the patent holder) and political pressures from their governments, entities in developing countries may attempt to negotiate a voluntary licence, failing which they may abandon the idea of using the patented invention.

- A compulsory licence may be revoked when the circumstances that led to its granting have ceased to exist and are unlikely to recur. Although the legitimate interest of the compulsory licensee should be considered before revocation, it remains uncertain how this safeguard will be used.

International Declaration on IPRs and Climate Technologies

The "pressure factor" mentioned above is a major reason why developing countries are hesitant to use compulsory licences, although it is a recognized core principle of the patent system, it is enshrined in the TRIPS Agreement and it is often exercised by developed countries. Whenever developing countries have used or attempted to use flexibilities available in the TRIPS Agreement, including compulsory licensing, patent holders and their governments have used any tactic available to intimidate those countries. Several such incidents have been noted in the context of access to medicines, thus leading to the Doha Declaration on the TRIPS Agreement and Public Health.

It is noteworthy that in several cases some developed countries objected to the use by developing countries of validly issued compulsory licences even when it was a matter of life and death for patients in the developing countries. Thus, it can be predicted that some developed countries will raise objections to developing countries using compulsory licences to access climate-friendly technologies.

Therefore, it will be useful to establish a WTO Declaration on IPRs and Climate Technologies, using the Doha Declaration on the TRIPS Agreement and Public Health as an example.[130] Such a declaration could reaffirm and/or clarify, inter alia, that nothing in the TRIPS Agreement prevents WTO Members from taking measures to deal with the challenges of climate change, including to promote access to climate-friendly technologies and associated know-how; and that the TRIPS Agreement shall be interpreted and implemented in a manner supportive of Members' right to protect the environment and the right to use flexibilities provided for in the Agreement. The idea of a declaration on IPRs and climate change technologies similar to the one on public health was proposed by the Brazilian Foreign Minister in his speech to the 2007 UNFCCC Conference of the Parties in Bali.

An important point raised in the Doha Declaration on the TRIPS Agreement and Public Health is the issue of export to countries with inadequate manufacturing capacity in the pharmaceutical sector. This issue arose as a result of restrictions placed on compulsory licences. Under the TRIPS Agreement, a compulsory licence shall be predominantly for the supply of the domestic market of the Member authorizing such use (Article 31(f)). This means that the amount that can be exported

to another country is limited. In the context of pharmaceuticals, this created problems since many countries do not have manufacturing capacity. This problem was recognized in paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health, which states: "We recognize that WTO Members with insufficient or no manufacturing capacities in the pharmaceutical sector could face difficulties in making effective use of compulsory licensing under the TRIPS Agreement. We instruct the Council for TRIPS to find an expeditious solution to this problem and to report to the General Council before the end of 2002." After intensive negotiations that were often deadlocked along North-South lines, a solution was eventually found in the form of a temporary solution in a WTO General Council Decision of 30 August 2003. On 6 December 2005, WTO Members agreed to convert this temporary solution into an amendment of the TRIPS Agreement. As yet, however, the amendment has not entered into force.

It is important to explore whether similar problems could arise in the context of climate-friendly technologies and, if so, to identify solutions to resolve such problems.

Regulating Restrictive Practices in Licensing Agreements and Anti-Competitive Uses of IPRs

There is little in terms of international rules on the relationship between IP and competition. Therefore, except for some provisions in the TRIPS Agreement, developing countries are relatively free to follow their own conceptions about competition law and IP.

Article 40 of the TRIPS Agreement, which has been elaborated on above, contains a set of rules aimed at the "control of anti-competitive practices" in voluntary licences. Measures to regulate terms of voluntary licences are important to ensure that the cost is affordable, and that there are no anti-competitive conditions (such as high price of licences, restrictions on markets, or insistence on taking a majority share in the company to which the licence is provided, which have all happened in recent cases). Article 31 of the TRIPS Agreement allows countries to issue compulsory licences to remedy anti-competitive behaviour.

Generally, on the issue of competition it is important to note that a majority of developing countries have little or no tradition in the application of competition law and policies. In fact, the trend seen in many developing countries is that IPRs have

been broadened and strengthened in the absence of an operative body of competition law.[131] Developing countries do not apply competition laws to correct anti-competitive uses of IPRs due to lack of legislation, weak implementation or absence of policies to deal with the IP- competition relationship.

Even where competition legislation and policies exist, there are many conditions missing in developing countries for effective application of the laws to correct anti-competitive distortions.[132] For example, enforcing agencies generally lack the financial and human resources, as well as the legal mechanisms (such as investigative tools and the capacity to impose high penalties); enforcing agencies normally have little expertise on IPRs; and clear criteria or guidelines to deal with anti-competitive acquisition and use of IPRs have not been established.

Thus, developing countries should establish and strengthen policies and institutions to deal with abuses emerging from the acquisition and exercise of IPRs. However, this option, while useful in some specific circumstances, may not resolve all IP-related barriers to transfer of technology.

Exceptions to Patent Rights

All national patent laws have provisions relating to exceptions to the exclusive rights granted by a patent, although the scope and content of these provisions vary from country to country. Exceptions to the exclusive rights granted by patents are justified on the grounds that in certain circumstances limited use of the patented inventions is required to achieve public policy purposes of encouraging innovation and protecting other public interests.

Article 30 of the TRIPS Agreement allows "limited exceptions" to exclusive patent rights provided that the exceptions satisfy the three-fold test of: (1) not unreasonably conflicting with the normal exploitation of the patent; (2) not unreasonably prejudicing the legitimate interests of the patent owner; and (3) taking into account the legitimate interests of third parties. Thus, under Article 30 countries may, under certain circumstances, automatically allow the use of the patented invention by a third party without the consent of the patent holder. The TRIPS Agreement does not define these circumstances. It is up to each country to define these circumstances depending on national policies as long as the three-fold test can be satisfied.

Some exceptions to patent rights that should be provided in national patent laws, as they could be relevant to dealing with climate technologies, are: (1) acts done privately and on a non-commercial scale or for a non-commercial purpose; (2) uses for scientific research; (3) uses for teaching purposes; and (4) experimentation on the invention for commercial purposes, for instance to test it or improve on it.[133]

Technology Pooling through a Collective Global Approach[134]

In situations where technologies are patented, a collective or global approach to enhance access and affordability has been proposed. A "Global Technology Pool for Climate Change", for example, could be developed in which patent owners of climate-friendly technologies are required to place their patents and associated trade secrets as well as know-how, and make them available to developing-country firms. Access to the technologies and associated trade secrets and know-how would be conditioned on payment of a low level of compensation (in some circumstances, royalty-free) and on standard terms (that are to be negotiated).[135] This would manage the patent system, prevent abusive practices by the IP holder that deny access to developing countries, and make it administratively and financially easier for access to take place.

Similar approaches have also been advocated by various prominent experts and academics. One proposal is a compulsory licensing framework that could ensure that licences to patent are available as a matter of right to third parties.[136] On a similar licence of right model, Prof. William Kingston from the School of Business Studies at Trinity College in Dublin states: "Of all types of industry and business which use intellectual property rights, the proposed change (to a licence of rights regime) would be most beneficial in complex technologies which are rapidly increasing in importance."[137]

Another proposal by Reichman and Lewis (2005) has promoted the idea of a "compensatory liability regime", i.e., a liability rule which is an option for one to use another party's innovation under specified conditions, which include: (i) how the innovation may be employed; (ii) the period for which it may be employed; (iii) the compensation the innovator should receive (or at least a method for determining it); and (iv) provisions for revising the terms of use upon mutual agreement. On this model, Reichman has also noted that "the success of multiple players in the relevant

technical universe should correspondingly augment the flow of investment and technical information to that universe as a whole, as players participate in the industry-wide virtual partnership that a liability rule supports".[138]

In all the above ideas, the basic theme is to allow a third party access to and use of the protected subject matter for specified purposes, without permission but subject to payment of some compensation to the IP holder for these uses. Payment of remuneration for patent infringement is found even in the US law. Specifically, section 1498(a) of Title 28 of the US Code provides in part: "Whenever an invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the United States Claims Court for the recovery of his reasonable and entire compensation for such use and manufacture." Reichman and Lewis (2005) refer to this law as a "de facto liability regime".[139]

US courts have also commonly applied a similar principle in their decisions. For example, in the Paice-Toyota case mentioned above, injunctive relief was denied to Paice LLC and instead the court allowed Toyota to continue its patent infringement, although subject to payment of royalties.[140] The main case in the US on the issue of payment of compensation in lieu of granting injunctive relief is *eBay Inc. v. MercExchange LLC*.[141] The TRIPS Agreement also recognizes the possibility of WTO Member states limiting remedies for infringement to payment of compensation.[142]

From the above it is apparent that the idea of allowing the use of a patent in return for payment of compensation is a concept that has been around for a while. In the proposed concept of a global technology pool, the beneficiaries are intended to be firms in developing countries. Thus patent holders would still be able to extract high commercial royalties from the richer developed markets.

The nature of the pool should be mandatory in that developed and developing countries both have to ensure, either through law or policy (e.g., a condition for receiving public funding for R&D), that the protected subject matter is given to the global technology pool for climate change for licensing to developing-country firms as envisaged above.

Sharing of Know-How and Trade Secrets

Parties to the UNFCCC may also consider a global cooperation system for sharing know-how and trade secrets, which is also important, as the lack of this is another serious barrier to technology transfer.[143] Even if a technology is not patented, the withholding of trade secrets, or how to make the technology, can prevent the development of endogenous technology in developing countries. This should be a component of the "Global Technology Pool for Climate Change" proposed above, as well as any technology transfer framework that emerges under the UNFCCC.

Publicly Funded Technologies

The US, in a presentation at a UNFCCC meeting in 2008, acknowledged that there is a need for a "global effort to share government-developed and owned technologies at low or no cost".[144] The sharing should also include the know-how.

As noted above, the public sector plays a critical role in provision of R&D funding and the amounts spent are significant. However, it was also noted that governments particularly in the OECD countries fund R&D programmes as part of their industrial policy aimed at improving their industrial competitiveness. Thus the inventor (usually public research institutions, universities and other governmental bodies) is allowed to claim patents over publicly funded technologies and to license them to the private sector. As a result, even technologies which are wholly or partially funded by the public sector are not easily available to firms in developing countries.

On this point it has been contended that governments being the main driver of public R&D programmes for climate-friendly technologies can play a critical role in promoting the transfer and dissemination of these technologies and that modalities for such transfer should be explored and worked out with the aim of building consensus at a multilateral level.

It is suggested that fully owned government technologies should be transferred at no cost. Where governments partially fund R&D, they should have partial ownership of any resulting patent.[145] When a licence is issued to a developing-country firm, a corresponding proportion of the cost of the licence should be waived, thus reducing the overall cost to developing countries. Incentives can also be given to entities

(that are publicly funded) to make the patented technology, with its know-how, available to developing countries. It has also been proposed that to support no- and low-cost transfer, developed-country governments should compile a "Publicly Owned Technology Inventory".[146] Governments can also use their leverage as a funder of R&D to place conditions on recipients of the grants as to licensing to firms in developing countries.

One example of publicly funded research being made available to the public is the mandatory Public Access Policy of the US National Institutes of Health (NIH). According to the law,[147] the Director of NIH shall require all investigators funded by NIH to submit, or have submitted for them, to the National Library of Medicine's PubMed Central digital archive their final peer-reviewed manuscripts upon acceptance for publication, to be made publicly available no later than 12 months after the official date of publication.[148] Compliance with this Policy is a statutory requirement and a term and condition of the grant award and cooperative agreement, in accordance with the NIH Grants Policy Statement.[149]

This is the first time the US government mandated public access to research funded by a major government agency. On the passing of the law, Heather Joseph, Executive Director of SPARC (the Scholarly Publishing and Academic Resources Coalition), said: "Congress has just unlocked the taxpayers' $29 billion investment in NIH … This policy will directly improve the sharing of scientific findings, the pace of medical advances, and the rate of return on benefits to the taxpayer." While the law applies to articles funded by NIH, a similar concept could also be used to address prompt availability of publicly funded technologies to developing countries.

Future Technologies

At the UNFCCC meeting in Accra in 2008, the G77 and China put forward a proposal for the establishment of a Multilateral Climate Technology Fund.[150] The expectation is for the fund to finance enhanced action on technology development and transfer. More specifically, it is proposed that the fund will finance, inter alia, support for research, development, manufacture, commercialization, deployment and diffusion of technologies for adaptation and mitigation and creation of manufacturing facilities for environmentally sound technologies, etc.

The financing of R&D for new technologies by any future fund should be subject to conditions concerning IPRs. The IPRs on any technology resulting from R&D financed from the fund should belong to the fund under the UNFCCC. The technology with its associated know-how should be made available royalty-free and on fair and reasonable terms to firms in developing countries that would like to produce or do further R&D (e.g., to adapt the technology to local conditions). Where countries are more interested in purchasing the technology (that has been developed through financing under the fund), rather than manufacturing or conducting R&D, the technology should be made available at prices affordable to the population of the said developing country. In short, provision of financing for R&D of new technologies should be subject to certain conditions that ensure there is no impediment to equitable and affordable access to the products of the research or follow-on research by others.

7 Some Conclusions

IN light of the imminent challenges posed by climate change and the patenting trend (with ownership of technology focused in industrialized nations, a trend likely to continue more robustly in coming years), there is a need for action on the part of governments negotiating at the UNFCCC to agree to measures that overcome the IP barrier and facilitate transfer of technology, as well as associated skills and know-how.

There are several flexibilities available within the TRIPS Agreement such as compulsory licences, exceptions to patent rights, regulating voluntary licences, and strict application of patentability criteria, which may enable access to technologies to a certain degree, but the use of such measures is limited to specific circumstances. In addition, as mentioned above, in the context of developing countries, these measures are usually more difficult to put in practice due to the pressure factor and lack of capacity.

Options such as allowing developing countries to exclude critical sectors from patenting, as well as a "Global Technology Pool for Climate Change", need serious consideration as these options will provide certainty and predictability in accessing technologies and further enable the much-needed R&D for local adaptation and competition that would further reduce the cost of the technologies. Both options also have to include cooperation to share know-how in relation to the critical technologies for combating climate change. In addition, modalities for access to publicly funded technologies by developing-country firms need to be explored.

Climate change is truly a serious crisis threatening human well-being and there are only a few years left to start very strong action. Thus, the situation is similar to emergency war-like conditions. In such conditions, individual commercial interests

such as patents and other intellectual property rights are suspended or managed in such a manner that there can be concerted action in the most effective way to face the common threat.

If developed countries treat intellectual property rights as something sacrosanct and to be upheld at all costs, it would signal that climate change is not a serious threat for them, as commercial profits for a few are more important on the scale of values and priorities than the human lives that are at stake due to global warming.[151] However, technology transfer to developing countries to enable them to combat climate change should be the higher priority. Developed countries should also not treat climate technology as a new source of monopoly profits, as this would damage the ability of developing countries to phase in existing or new climate-friendly technologies for both mitigation and adaptation.

Endnotes

[1] Ockwell et al. (2007), p. 29.
[2] Evans (1999), quoted in Ockwell et al. (2007), p. 29.
[3] Saad and Zawdie (2005), quoted in Ockwell et al. (2007), p. 29.
[4] The Intergovernmental Panel on Climate Change (IPCC) (2000) 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, NGOs [non-governmental organizations] and research/education institutions… It comprises the process of learning to understand, utilize and replicate the technology, including the capacity to choose it and adapt it to local conditions and integrate it with indigenous technologies."
[5] Bell (1990), quoted in Ockwell et al. (2007), p. 27.
[6] Khor (2008a).
[7] Correa (2005), p. 230.
[8] Correa (2005), p. 228.
[9] Khor (2008a); UNCTAD (1996). See also Correa (2000), pp. 26-37.
[10] Correa (2000), p. 27.
[11] UNDP (1999), p. 73. See also Gerster (2001).
[12] See also CIPR (2001), p. 26, which states: "As regards the analyses of the impact on foreign investment, we have similar reservations. There is a considerable literature which discusses the extent to which stronger IPRs influence foreign investment, licensing behaviour and the transfer of technology. Much of this literature reaches only tentative conclusions, because of weaknesses in data or methodology."
[13] United Nations (1993).
[14] Correa (2005), p. 231.
[15] Chaudhuri (2005).
[16] Gerster (2001).
[17] Correa (2005).
[18] Khor (2008a).
[19] Correa (2005).
[20] See also Khor (2008a).
[21] Correa (2005), p. 233.
[22] See Article 40.4 of the TRIPS Agreement, available at: http://www.wto.org/english/docs_e/legal_e/27-trips_04d_e.htm.
[23] Correa (2005), p. 238.

[24] India, Government (2000).
[25] Saez (2008); see also Moon (2008).
[26] "Reaffirming that the provisions of article 66.2 of the TRIPS Agreement are mandatory, it is agreed that the TRIPS Council shall put in place a mechanism for ensuring the monitoring and full implementation of the obligations in question. To this end, developed-country members shall submit prior to the end of 2002 detailed reports on the functioning in practice of the incentives provided to their enterprises for the transfer of technology in pursuance of their commitments under article 66.2. This submission shall be subject to a review in the TRIPS Council and information shall be updated by Members annually." See WTO document WT/MIN(01)/17 (20 November 2001).
[27] Paragraph 7 of the Doha Declaration on the TRIPS Agreement and Public Health: "We reaffirm the commitment of developed-country Members to provide incentives to their enterprises and institutions to promote and encourage technology transfer to least-developed country Members pursuant to Article 66.2. We also agree that the least-developed country Members will not be obliged, with respect to pharmaceutical products, to implement or apply Sections 5 and 7 of Part II of the TRIPS Agreement or to enforce rights provided for under these Sections until 1 January 2016, without prejudice to the right of least-developed country Members to seek other extensions of the transition periods as provided for in Article 66.1 of the TRIPS Agreement. We instruct the Council for TRIPS to take the necessary action to give effect to this pursuant to Article 66.1 of the TRIPS Agreement."
[28] Ockwell et al. (2007).
[29] Khor (2008a).
[30] Khor (2008a).
[31] See, e.g., Article 4.1(c) of the UNFCCC and Article 10 of the Kyoto Protocol.
[32] Khor (2008c).
[33] European Parliament resolution of 29 November 2007 on trade and climate change (2007/2003(INI)).
[34] The first meetings since the Bali conference of the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol and the Ad Hoc Working Group on Long-term Cooperative Action under the Convention were held in Bangkok in April 2008.
[35] Raman (2008).
[36] Raman (2008).
[37] Stilwell (2008a).
[38] Stilwell (2008a).

[39] Raman (2008).
[40] Raman (2008).
[41] Statement by the Philippines on behalf of the G77 and China. The IPR issue arose in the contact group on "delivering on technology and financing, including consideration of institutional arrangements", which met at its second session on 10 December 2008. The contact group is one of four contact groups formed under the UNFCCC Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA). See Raman (2008).
[42] The Treaty makes it possible to seek patent protection for an invention simultaneously in each of a large number of countries by filing an "international" patent application.
[43] OECD (2008).
[44] OECD (2008).
[45] Kamis and Joshi (2008).
[46] ETC Group (2008).
[47] ETC Group (2008): "After decades of seed industry mergers and acquisitions, accompanied by a steady decline in public sector plant breeding, the top 10 seeds companies control 57% of the global seed market."
[48] The TRIPS Agreement makes no reference to "trade secrets" or "know-how". However, it does recognize "undisclosed information" as one of the categories of "intellectual property" (see Article 1.2 of the TRIPS Agreement) and provides for "protection of undisclosed information" in Article 39. The term "undisclosed information" is considered as referring to "trade secrets" or "know-how". The obligation established under Article 39.1 is limited to the protection of undisclosed information against unfair competition as provided in Article 10*bis* of the Paris Convention. The discipline of unfair competition provides a remedy against acts of competition contrary to honest business practices, such as confusing or misleading the customer and discrediting the competitor. Unfair competition rules supplement in some cases the protection of industrial property rights, such as patents and trademarks. Unlike the latter, however, the protection against unfair competition does not entail the granting of exclusive rights. National laws must only provide for remedies to be applied in cases where dishonest practices have occurred.
[49] Love (2008).
[50] IPCC (2000).
[51] A patent thicket is a dense web of overlapping intellectual property rights that a company must hack its way through in order to actually commercialize new technology.

[52] "Patent troll" is a pejorative term used for a person or company that enforces its patents against one or more alleged infringers in a manner considered unduly aggressive or opportunistic, often with no intention to manufacture or market the patented invention.
[53] See also Khor (2002).
[54] Khor (2002).
[55] See also Khor (2002).
[56] Khor (2008b).
[57] Andersen, S.O. et al. (2007). *Technology Transfer for the Ozone Layer: Lessons for Climate Change*. Earthscan, London. Quoted in Khor (2008b).
[58] IPCC (2000), Chapter 3.
[59] See Ockwell et al. (2007), p. 40.
[60] LED is a semiconductor diode that emits light when an electric current is applied in the forward direction of the device. LEDs are widely used as indicator lights on electronic devices and increasingly in higher-power applications such as flashlights and area lighting.
[61] A briquette is a block of flammable matter which is used as fuel to start and maintain a fire. Biomass briquettes are made from agricultural waste and are a replacement for fossil fuels such as oil or coal, and can be used to heat boilers in manufacturing plants, and also have applications in developing countries. Biomass briquettes are a renewable source of energy and avoid adding fossil carbon to the atmosphere.
[62] Pellets are shorter and narrower compared to briquettes. Pellets can be made from various biomass materials like sawdust, wood, crop residues or straw.
[63] Ockwell et al. (2007), p. 82.
[64] Hybrid vehicles are viewed by many as having a significant role to play in reduction of carbon emissions related to transport, for example buses and private vehicles. These vehicles combine a conventional internal combustion engine with battery-driven electric motors to achieve a significant reduction in fuel consumption and thus carbon emissions.
[65] Ockwell et al. (2007), p. 90.
[66] A photovoltaic panel produces electricity when exposed to sunlight.
[67] Barton (2007), p. 20.
[68] For converting direct current to alternating current and could also include mechanisms to ensure that solar panels operate under efficient conditions and satisfy the requirements for connecting to the grid.
[69] Barton (2007), pp. 11 and 15.

[70] Barton (2007), p. 9.
[71] Ockwell (2008).
[72] Lewis (2007), quoted in Ockwell (2008).
[73] Ockwell (2008).
[74] Lewis (2007).
[75] WIPO (2008b).
[76] Correa (2005), p. 239.
[77] Correa (2005), p. 239.
[78] WIPO (2008b).
[79] Shashikant (2008).
[80] WIPO (2008b).
[81] Smith (2008).
[82] WIPO (2008b).
[83] Boldrin and Levine (2007).
[84] Virén and Malkamäki (2002).
[85] *Enercon GmbH vs. International Trade Commission*, 151 F.3d 1376 (CAFC 1998).
[86] Barton (2007), p. 16.
[87] http://www.lachmangoldman.com
[88] *Gamesa Eolica, S.A. vs. General Electric Co*, 359 F. Supp. 790 (WD Wis. 2005).
[89] Ockwell (2008); Barton (2007), p. 16.
[90] Rizo (2008).
[91] http://www.autoindustry.co.uk/news/13-05-08
[92] http://www.autobloggreen.com/2008/04/16/solomon-technologies-completes-toyota-hybrid-patent-appeal-argum/
[93] See Ockwell et al. (2007), p. 69.
[94] Shashikant (2006).
[95] Khor (2008b) and UNCTAD (1998).
[96] IPCC (2000), Chapter 3, p. 95.
[97] European Commission (2004).
[98] Barton (2007), p. 8.
[99] Barton (2007), p. 8.
[100] Sathaye et al. (2005), p. 4.
[101] Barton (2007), pp. 7-8.
[102] Mascoma (2006); Darmourth (2007).
[103] Barton (2007), p. 18.

[104] IPCC (2000).
[105] Sathaye et al. (2005).
[106] IPCC (2000).
[107] European Patent Office (2007).
[108] For the purposes of this Article, the terms "inventive step" and "capable of industrial application" may be deemed by a Member to be synonymous with the terms "non-obvious" and "useful" respectively.
[109] The 29 November 2005 decision of the TRIPS Council on the Extension of the Transition Period under Article 66.1 for LDCs (IP/C/40), while allowing for a transitional period until 1 July 2013, also states that "Least-developed country Members will ensure that any changes in their laws, regulations and practice made during the additional transitional period do not result in a lesser degree of consistency with the provisions of the TRIPS Agreement", i.e., implying that once a TRIPS-compliant provision is adopted, there can be no rollback of that provision. Some experts have challenged the legality of the "no-rollback" clause in that decision since there is nothing in the TRIPS Agreement that prescribes such a clause to LDCs.
[110] TWN (2008).
[111] TWN (2008).
[112] Article 73 of the TRIPS Agreement.
[113] TWN (2008).
[114] WT/MIN(01)/DEC/2, 20 November 2001.
[115] Correa (2000), p. 243.
[116] Article 31(l) of the TRIPS Agreement.
[117] Article 31(b) of the TRIPS Agreement.
[118] Article 31(h) of the TRIPS Agreement.
[119] Article 31(f) of the TRIPS Agreement.
[120] Stilwell (2008b).
[121] 42 USC Sec 2183. See also http://www4.law.cornell.edu/uscode/42/2183.html and http://www.cptech.org/ip/health/cl/us-misc.html.
[122] 42 USC Sec 7608. See also http://www4.law.cornell.edu/uscode/42/7608.html.
[123] 35 USC 203. See also http://www4.law.cornell.edu/uscode/35/203.html.
[124] Love (2007).
[125] Correa (2005).
[126] 59 Fed. Reg. 34625-01 (6 July 1994).
[127] *Federal Trade Commission vs. Xerox Corporation*, 86 F.T.C. 364 (1975).
[128] Correa (2005), p. 248.

[129] Stilwell (2008b).
[130] TWN (2008).
[131] Correa (2007), p. 1.
[132] Correa (2007), p. 1.
[133] Correa (2000), p. 241.
[134] TWN (2008).
[135] TWN (2008).
[136] European Patent Office (2007), p. 95.
[137] Quoted in European Patent Office (2007), p. 95.
[138] European Patent Office (2007), p. 95.
[139] Reichman and Lewis (2005), p. 350.
[140] *Paice LLC vs. Toyota Motor Corporation*, CAFC 2006-1610-1631. See also www.ipfrontline.com/printtemplate.asp?id=16410
[141] Love (2007): "In May 2006, the US Supreme Court issued an opinion in eBay v. MercExchange which set the standards under which a court should evaluate requests for injunctions to enforce a patent owner's exclusive right to authorize the use of a patented invention. To get an injunction, a patent owner must show the court: (1) that it has suffered irreparable injury; (2) that other possible legal remedies, including the payment of royalties, are inadequate to compensate for that injury; (3) that considering the balance of hardships between the plaintiff and defendant a remedy in equity is warranted; and (4) that the public interest would not be disserved by a permanent injunction. Under this standard, a court can choose to issue a compulsory license to use the patent rather than enforce the exclusive right, a path that has been taken several times since May 2006."
[142] Article 44.2 of the TRIPS Agreement.
[143] TWN (2008).
[144] TWN (2008).
[145] TWN (2008).
[146] TWN (2008).
[147] Consolidated Appropriations Act of 2007 (H.R. 2764).
[148] See http://publicaccess.nih.gov/policy.htm.
[149] See http://grants.nih.gov/grants/guide/notice-files/NOT-OD-08-033.html.
[150] Stilwell (2008a).
[151] Khor (2008a).

Bibliography

Barton, John H. (2007). "Intellectual Property and Access to Clean Energy Technologies in Developing Countries: An Analysis of Solar Photovoltaic, Biofuel and Wind Technologies". ICTSD Trade and Sustainable Energy Series Issue Paper No. 2, International Centre for Trade and Sustainable Development, Geneva.

Bell, M. (1990). "Continuing Industrialization, Climate Change and International Technology Transfer". University of Sussex, Brighton.

Boldrin, Michele and David Levine (2007). *Against Intellectual Monopoly*. http://www.dklevine.com/general/intellectual/againstnew.htm.

Centre for International Studies, MIT and J. Watson (1999). "The transfer of clean coal technologies to China: learning from experience". Second International Symposium on Clean Coal Technology, Beijing.

Chaudhuri, Sudip (2005). *The WTO and India's Pharmaceuticals Industry. Patent Protection, TRIPS and Developing Countries*. Oxford University Press, New Delhi.

CIPR (2001). *Integrating Intellectual Property Rights and Development Policy*. Commission on Intellectual Property Rights, http://www.iprcommission.org/graphic/documents/final_report.htm.

Correa, Carlos (2000). *Intellectual Property Rights, the WTO and Developing Countries*. Third World Network, Penang.

Correa, Carlos (2005). "Can the TRIPS Agreement foster technology transfer to developing countries?". In *International Public Goods and Transfer of Technology: Under a Globalized Intellectual Property Regime*, edited by Keith E. Maskus and Jerome H. Reichman, Cambridge University Press, Cambridge.

Correa, Carlos (2007). "Intellectual Property and Competition Law: Exploration of Some Issues of Relevance to Developing Countries". ICTSD IPRs and Sustainable Development Programme Issue Paper No. 21, International Centre for Trade and Sustainable Development, Geneva.

Dartmouth (2007). *Technology Transfer in the Era of Globalization*. Fiscal Year 2007 Annual Report, Dartmouth College Technology Transfer Office.

ETC Group (2008). "Patenting the 'Climate Genes'… And Capturing the Climate Agenda". *Communiqué*, Issue No. 99.

European Commission (2004). "European research spending for renewable energy sources".

European Patent Office (2007). "Scenarios for the Future". http://www.epo.org/topics/patent-system/scenarios-for-the-future.html.

Evans, P.C. (1999). "Cleaner Coal Combustion in China: The Role of International Aid and Export Credit Agencies for Energy Development and Environmental Protection, 1998-1997". Centre for International Studies, MIT.

Gerster, Richard (2001). "Patents and Development: Lessons Learnt from the Economic History of Switzerland". Intellectual Property Rights Series No. 4, Third World Network, Penang.

India, Government (2000). "Proposals on intellectual property rights issues". Paper submitted to the WTO, 12 July (IP/C/W/195).

IPCC (2000). *Methodological and Technological Issues in Technology Transfer*. Intergovernmental Panel on Climate Change.

Kamis, Ronald and Mandar Joshi (2008). "Biofuel patents are booming".

Khor, Martin (2002). *Intellectual Property, Biodiversity and Sustainable Development: Resolving the Difficult Issues*. Zed Books, London and New York; Third World Network, Penang.

Khor, Martin (2008a). "IPRs, Technology Transfer and Climate Change". Third World Network, Penang.

Khor, Martin (2008b). "Note on Access to Technology, IPR and Climate Change". TWN Briefing Paper 1, Third World Network, available at http://www.twnside.org.sg.

Khor, Martin (2008c). "Meet your commitments first, G77 tells developed countries". TWN Bangkok News Update 1, Third World Network, Penang.

Kumar, Nagesh (2002). "Intellectual Property Rights, Technology and Economic Development: Experiences of Asian Countries". Study paper prepared for the Commission on Intellectual Property Rights.

Lewis, J. (2007). "Technology Acquisition and Innovation in the Developing World: Wind Turbine Development in China and India". *Studies in Comparative International Development*, 42: 208-232.

Love, James (2007). "Recent examples of the use of compulsory licenses on patents". KEI Research Note 2007:2, Knowledge Ecology International.

Love, James (2008). "Patents, Prizes and Climate Change". Presentation at the Greens/EFA workshop on Intellectual Property Rights and Green Energy Technologies, European Parliament, Brussels.

Mascoma (2006). "Mascoma Corporation Names Dr. Andrew Richard as CTO, Partners with Dartmouth for Expanded Cellulosic Ethanol Research". News release, available at http://www.mascoma.com.

Moon, Suerie (2008). "Does TRIPS Art. 66.2 Encourage Technology Transfer to LDCs?: An Analysis of Country Submissions to the TRIPS Council (1999-2007)". Policy Brief No. 2, ICTSD Project on IPRs and Sustainable Development.

Ockwell, David (2008). "UK-India Collaboration to Overcome Barriers to the Transfer of Low Carbon Energy Technology: Phase 2: Intellectual property rights and low carbon technology transfer to developing countries – a review of the evidence to date". Sussex Energy Group, Freeman Centre, University of Sussex, Brighton; TERI (The Energy and Resources Institute), New Delhi; Institute of Development Studies, University of Sussex, Brighton.

Ockwell, David, Jim Watson, Gordon MacKerron, Prosanto Pal, Farhana Yamin, N. Vasudevan and Parimita Mohanty (2007). "Final Report: UK-India collaboration to identify the barriers to the transfer of low carbon energy technology". University of Sussex, The Energy and Resources Institute, and Institute of Development Studies, March.

OECD (2008). "Compendium of Patent Statistics". Organization for Economic Cooperation and Development, http://www.oecd.org/dataoecd/5/19/37569377.pdf.

Raman, Meena (2008). "Divergence over IPR issue in technology transfer". Available at http://www.twnside.org.sg/climate.htm.

Reichman, Jerome H. (2003). "Non-Voluntary Licensing of Patented Inventions". International Centre for Trade and Sustainable Development.

Reichman, Jerome H. and Tracy Lewis (2005). "Using liability rules to stimulate local innovation in developing countries: Application to traditional knowledge". In *International Public Goods and Transfer of Technology: Under a Globalized Intellectual Property Regime*, edited by Keith E. Maskus and Jerome H. Reichman, Cambridge University Press, Cambridge.

Rizo, Chris (2008). "Toyota loses $4.3 million patent appeal for hybrid technology". Legal Newsline, http://www.legalnewsline.com/news/212252-toyota-loses-4.3-million-patent-appeal-for-hybrid-technology.

Saad, M. and G. Zawdie (2005). "From technology transfer to the emergence of a triple helix culture: The experience of Algeria in innovation and technological capability development". *Technology Analysis & Strategic Management*, Vol. 17, Issue 1: 89-103.

Saez, Catherine (2008). "Panel: Policy Answers Needed to Boost Technology Transfer to LDCs". Intellectual Property Watch.

Sathaye, Jayant A., Elmer C. Holt and Stephane De La Rue du Can (2005). "Overview of IPR Practices for Publicly-funded Technologies".

http://unfccc.int/ttclear/pdf/EGTT/11%20Bonn%202005/IPRandOtherIssuesAssociatedwithPublicly-FundedTech.pdf.

Shashikant, Sangeeta (2006). "Speakers warn against patent harmonization at WIPO forum". *South-North Development Monitor (SUNS)*, No. 5978, 3 March.

Shashikant, Sangeeta (2008). "Meeting on patent law, as Secretariat issues report". *South-North Development Monitor (SUNS)*, No. 6501, 23 June.

Smith, Sanya (2008). *Intellectual Property in Free Trade Agreements*. Third World Network, Penang.

Stilwell, Matthew (2008a). "G77 and China Propose Comprehensive Technology Mechanism for UNFCCC". TWN Accra News Update 11, Third World Network, available at http://www.twnside.org.sg.

Stilwell, Matthew (2008b). "Use of Compulsory Licenses: Selected Practice and Provisions in the United States' and International Law". Memo prepared for Third World Network.

TWN (2008). "Possible Elements of an Enhanced Institutional Architecture for Cooperation on Technology Development and Transfer under the UNFCCC". Third World Network, available at http://www.twnside.org.sg.

UNCTAD (1996). *The TRIPS Agreement and Developing Countries*. United Nations Conference on Trade and Development, New York and Geneva.

UNCTAD (1998). "The role of publicly-funded research and publicly owned technologies in the transfer and diffusion of ESTs". United Nations Conference on Trade and Development, Geneva, January.

UNDP (1999). *Human Development Report 1999*. Published for the United Nations Development Programme by Oxford University Press, New York.

United Nations (1993). "Intellectual Property Rights and Foreign Direct Investment". United Nations, New York.

Virén, Matti and Markku Malkamäki (2002). "The Nordic countries". In *Technological Innovation & Economic Performance*, edited by Benn Steil, David G. Victor and Richard R. Nelson, Princeton University Press, Princeton.

Watal, Jayashree (1998). "The issue of technology transfer in the context of the Montreal Protocol: Case study of India".

WIPO (2008a). "World Patent Report: A Statistical Review". World Intellectual Property Organization, Geneva.

WIPO (2008b). "Climate Change and the Intellectual Property System: What Challenges, What Options, What Solutions? – A Summary of the Issues". Informal consultation draft, World Intellectual Property Organization, Geneva.

INTELLECTUAL PROPERTY AND TECHNOLOGY TRANSFER ISSUES IN THE CONTEXT OF CLIMATE CHANGE

The serious threat to human well-being posed by climate change has imparted a sense of urgency to the search for remedial measures. Among the most important steps identified to combat climate change is the application of energy-efficient technologies that will curb the carbon emissions responsible for global warming.

However, access by developing countries to these climate-friendly technologies can be impeded by patents and other intellectual property rights (IPRs) over the technologies, most of which are held by developed-country entities. The monopoly rights conferred by intellectual property ownership hinder diffusion of these technologies and undermine the capacity of developing-country parties to use, maintain and adapt the technologies to local conditions.

This paper examines the relationship between IPRs and technology transfer, and explores options to overcome the IPR barrier in order to facilitate the dissemination of climate-friendly technologies to the developing world with the aim of tackling one of the major environmental problems of our time.

SANGEETA SHASHIKANT *is a Legal Adviser to the Third World Network as well as the Coordinator of the TWN office in Geneva.* **MARTIN KHOR***, former TWN Director, is Executive Director of the South Centre.*

TWN INTELLECTUAL PROPERTY RIGHTS SERIES

is a series of papers published by the Third World Network to provide a critical analysis of intellectual property rights protection from a Third World perspective. A particular focus is given to the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) and its implications for developing countries.

ISBN 978-967-5412-37-0