



Climate Change, Technology and Intellectual Property Rights: Context and Recent Negotiations*

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I. Technology Transfer, Sustainable Development and Climate Change

In order to meet their objectives for mitigation and adaptation in climate change, and move more towards a sustainable development pathway, developing countries need access to environmentally-sound technology at affordable prices.

The central role of technology transfer to developing countries as well as the development of endogenous technology in these countries were recognised in the 1992 Rio Summit, as well as in its related conventions including the United Nations Framework Convention on Climate Change (UNFCCC). It was recognised that technology transfer had to be undertaken beyond the commercial arena, and that a pro-active role of public policy at national and international levels is required to enable developing countries' access to technology.

Thus, technology transfer was one of the two key "means of implementation" in Agenda 21, the other being financial resources. Chapter 34 of Agenda 21 defines environmentally sound technologies in a comprehensive way as not just individual technologies but total systems that include know-how, procedures, goods and services, equipment and organisational and managerial procedures. Thus technology transfer should also address human resource development and local capacity-building aspects of technology choices. It states the principle of the need for favourable access to and transfer of environmentally sound technologies to developing countries through technology cooperation enabling transfer of technological know-how and building up of economic, technical and managerial capabilities for the efficient use and further development of transferred technology.

The UNFCCC also recognises technology development and transfer in several provisions, including article 4.3 (developed countries shall provide financial resources including for technology transfer needed by developing countries to meet their agreed full incremental costs of implementing measures), article 4.5 (developed countries shall take all practicable steps to facilitate and finance transfer of and access to environmentally sound technologies and know-how particularly to developing countries;

and shall support the development and enhancement of endogenous capacities and technologies of developing countries) and article 4.7 (the extent to which developing countries will implement their commitments will depend on effective implementation of developed countries' commitments on financial resources and technology transfer).

Despite the recognition of the central role of technology transfer, there has been in fact little transfer of climate-friendly technology under the UNFCCC. This implementation gap is sought to be rectified. It was agreed under the Bali Action Plan (adopted in December 2007) that developed countries would provide technology support to developing countries in a measurable, reportable and verifiable manner. An executive committee on technology has been established under the UNFCCC to address technology transfer issues.

Technology transfer is not merely the import or purchase of machines and other hardware at commercial rates. A central aspect of technology development and transfer is the building of local capacity so that people and institutions in developing countries can design and make technologies which can be diffused into the domestic economy. As recognised in Agenda 21 (para. 34.12), a "critical mass of research and development capacity is crucial to the effective dissemination and use of environmentally sound technologies and their generation locally".

In the process of technological development, developing countries can go through three stages: (1) initiation stage, where technology as capital goods are imported; (2) internalisation stage, where local firms learn through imitation under a flexible intellectual property rights (IPRs) regime; (3) generation stage, where local firms and institutions innovate through their own research and development (R & D) (UNCTAD, 2007).

In stage 1, the country is dependent on capital imports, some of which may be extra high in cost (those that are patented) because of the higher prices enabled by monopoly margins. In stage 2, costs may be lowered by versions produced locally. In stage 3, the local firms are able to design and make their own original products. Technology transfer may involve the purchase and acquisition of

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equipment; the know-how to use, maintain and repair it; the ability to make it through “emulation” or reverse engineering; to adapt it to local conditions; and eventually to design and manufacture original products. The process of technology transfer involves progressively climbing through all these aspects.

Several conditions have to be present for technology transfer and development to take place. The absence of such conditions can form barriers to technology transfer. Among the barriers that are normally listed are poor infrastructure, inadequate laws and regulations, shortage of skilled personnel, lack of finance, ignorance of technology issues, high cost of certain technology agreements, problems created by equipment suppliers, and intellectual property rights.

Intellectual property rights has become an important and often contested issue in the discussion on technology transfer and development. Whether IPRs constitute a barrier or an important barrier depends on several factors, such as whether or not the particular technology is patented, whether there are viable and cost-effective substitutes or alternatives, the degree of competition, the prices at which it is sold, and the degree of reasonableness of terms for licensing, etc.

II. Categories of Technologies and their Treatment

In terms of proprietary rights, technologies and related products can be usefully placed under three categories: those that are not patented and are thus in the public domain; those that are patented; and future technologies (which are likely to come under patents unless there are new mechanisms or initiatives).

Technologies in the Public Domain

Some technologies are in the public domain; they are not patented or their patents have expired. According to Agenda 21 (para. 34.9), a large body of technological knowledge lies in the public domain (are not covered by patents) and there is a need for the access of developing countries to such technologies as well as the know how and expertise required to use them. In this case, the main barrier to technology transfer may be lack of financial resources, and international funds should be established to enable developing countries to purchase and to manufacture such technologies.

An important measure to promote sustainable development is to expand the space for technologies in the public domain, and to expand the transfer to developing countries of publicly-funded technologies. Governments in developed countries play an important role in funding R & D programmes, many of which are implemented by the private sector. In addition, governments sponsor a range of R & D that underpins private sector investments in developing environmentally sound technologies (ESTs) (IPCC, 2000, Chapter 3, page 95).

A paper for the UNFCCC surveyed government R & D funding of ESTs in the United States, Canada, United

Kingdom and Korea. It found that in most countries, governments allocated their rights (patents, copyrights, trademarks, etc.) to the recipient research institutions to a significant degree. As a result, the diffusion of climate-friendly technology would “typically be along a pathway of licensing or royalty payments rather than use without restriction in the public domain” (Sathaye et al., 2005).

The Intergovernmental Panel on Climate Change (IPCC) study (2000) calls on OECD countries to influence the flow of such technology directly through their influence on the private sector or public institutes that receive funding from government for their R & D to be more active in transferring technologies to developing countries. It cites Agenda 21 (chapter 34, paragraph 34.18a) that “governments and international organisations 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.” Products that emerge from publicly funded R & D should be placed in the public domain. Those that are partially funded should be in the public domain to the extent to which it is publicly funded.

At the international level, there can also be public funding and joint planning of R & D programmes. Products and technologies emerging from such publicly funded programmes should be placed in the public domain.

Patented Technologies

For technologies that are patented, there should be an understanding that patents should not be an obstacle for developing countries to have access to them at affordable prices. Agenda 21 (para. 34.10) states that: “Consideration must be given to the role of patent protection and intellectual property rights along with an examination of their impact on the access to and transfer of environmentally sound technology, in particular to developing countries, as well as to further exploring efficiently the concept of assured access for developing countries to environmentally sound technology in its relation to proprietary rights with a view to developing effective responses to the needs of developing countries in this area.” Agenda 21 (para. 34.18e) also agreed that in the case of privately owned technologies, measures would be adopted particularly for developing countries, including developed countries creating incentives to their companies to transfer technology; purchase of patents and licenses for their transfer to developing countries; prevention of the abuse of IPRs including through compulsory licensing with compensation; providing funds for technology transfer; and developing mechanisms for technology access and transfer.

While the patent system provides incentives for innovation, it can also be a barrier to the transfer of technology to developing countries at affordable prices. There are examples of developing countries and their firms being hampered from adopting climate-friendly technologies or products due to there being patents on these products, and due to the unreasonable demands made by the patent holders on companies in developing countries that requested a voluntary license from the patent holder.

There are also various ways in which the barriers posed by IPRs can be addressed within the framework of the international patent system itself (as characterized by the World Trade Organization's Trade Related Aspects of Intellectual Property Rights (WTO TRIPS) agreement) and also outside of it. Under the TRIPS Agreement, there is considerable flexibility provided to WTO Member States on grounds for issuing compulsory licenses. These grounds are not restricted, as confirmed by the WTO Ministerial Declaration on TRIPS and Public Health (WTO, 2001). In developed countries, there have been many compulsory licenses granted by the government to facilitate cheaper products and technology in the industrial sector. In many developing countries, compulsory licenses have been issued for the import or local production of generic drugs. Thus, compulsory licensing is an option particularly when the patent-holder is unwilling to provide a voluntary license with reasonable conditions.

Some developing countries have previously proposed at the WTO that countries be allowed not to patent environmentally-sound technology so that its transfer and use can be facilitated. The relaxation of the TRIPS rules in the case of climate-related technologies has also been proposed by developing countries in the UNFCCC; however this was opposed by major developed countries. Governments can also facilitate easier access to voluntary licenses. Measures can also be taken to ensure that royalty and other conditions in voluntary licenses are fair and reasonable.

These two aspects (patents as a barrier, and methods to address this) are discussed in more detail later in this paper.

Future Technologies

For technologies to be developed for future use, the nature of the funding of research and development will exert influence on the proprietary nature of the products and technologies.

In line with the goal of having as many technologies in the public domain as possible, a technology fund (or technology window in the Green Climate Fund) to be set up under the UNFCCC could allocate a part of its resources to research and development for new technologies. The fund can establish priority areas for research, based on the decision of UNFCCC members, and research grants can be provided to successful applicants in line with the priority areas. Since the funding is made available by the fund, the patents for the inventions are to be owned by the fund, and this principle should be one of the conditions for the grants. It can be part of the understanding in this scheme that the fund would make the inventions available to firms in developing countries with licenses at no cost or nominal cost, also on the condition that the users cannot apply to patent the technologies.

The up-front funding of innovation, linked to making the ensuing technologies available at the most af-

fordable prices to developing countries since the latter will obtain the technologies without paying for patent royalties and since there will be free competition in the production, would be more cost effective than the Fund having to purchase the technologies (with patents attached to them) at full cost and distributing them to developing countries.

This scheme would not of course prevent privately funded innovation activities from taking place, and the two could co-exist. However, the larger the resources available for global publicly funded R and D activities, the larger will be the share of future technologies that will be in the public domain.

Agenda 21 also has many useful proposals and decisions, including establishment of a collaborative network of research centres, support for cooperation and assistance programmes, and building capacity for technology assessment, and collaborative arrangements. These should be revisited as part of the Rio Plus 20 process.

International collaboration for R and D (including arrangements for its financing) is an important possibility that should be explored fully. This can be within the UNFCCC context, where two important mechanisms (Finance and Technology) are now being established and operationalised. Models of collaboration (such as existed or exists in agriculture, health, etc.) should be examined to see if the lessons learnt can be adopted and adapted for the climate area.

III. Effects of Patents on Access to Climate-related Technologies

In relation to environmentally-sound technologies, there is a strong case that IPRs hinder the ability of developing countries to attain EST as well as new technologies in general. The great majority of patents worldwide are held by companies based in North America, Western Europe or Japan. In climate-related technologies, the developed countries also have an overwhelming share of patents worldwide. In 2005, the European Union countries held 36.7% of patents linked to renewable energy, with the US holding 20.2% and Japan 19.8%, while China held 2.9% and Korea 2.3% (OECD, 2008).

A study by Lee et al. (2009) examined patent ownership of six energy technologies (wind, solar, photovoltaic, concentrated solar power, biomass-to-electricity, cleaner coal and carbon capture) and found that the US, Japan and Germany are clear leaders in energy innovations. The leading emerging countries such as China, Brazil and India have no companies or organisations in the top 10 position in these sectors. The study concluded that companies and institutions in the Organisation for Economic Cooperation and Development (OECD) countries will determine the speed of diffusion of the most advanced energy technologies in the next decade.

Another sector dominated by major developed countries is automobile pollution control technologies, which comprise technologies used to reduce pollutants pro-

duced and released into the atmosphere by automobiles. In 2005, the EU (49% with Germany having 33%), Japan (31%) and the US (14%) held the highest share in patents for these technologies. Brazil, Russian Federation, India, Indonesia, China, and South Africa (BRIICS) held only 0.7% of the patents.

In agriculture, one particular concern over IPRs is the filing of patent applications by large agrochemical and seed companies to pursue exclusive monopoly over plant gene sequences. Hundreds of patents have been applied for in relation to genes of what they term as “climate-friendly” crops that are genetically engineered to withstand environmental stress such as drought, heat, cold and floods. For example, at least 261 families of patents (subsuming 1663 patent documents) published between June 2008 to June 2010 make specific claims to confer “abiotic stress tolerance” (from drought, heat, flood, cold, salt) in plants. These patent application rush could lead to a few mega corporations monopolizing genes, seeds and crops that contain them. Just six gene-related companies and their two biotech partners control 201 or 77% of the 261 patent families referred to. The group ETC has raised concern that this would restrict the access to germplasm and to seeds, and has called for a review of the social and environmental implications of these new varieties, and a review also of IPR laws regarding approval of “climate-related genes” (ETC Group, 2010).

There are several ways in which a strong IPRs regime can hinder access of developing countries to technology, and transfer to developing countries of technology (including EST).

- Firstly, a strict IPRs regime can discourage research and innovation by locals in a developing country. Where most patents in the country are held by foreign inventors or corporations, local R&D can be stifled since the monopoly rights conferred by patents could restrict the research by local researchers.
- Secondly, a strict IPRs regime makes it difficult for local firms or individual researchers to develop or make use of patented technology, as this could be prohibited or expensive.
- Thirdly, should a local firm wish to make use of patented technology, it would usually have to pay significant amounts in royalty or licence fees. TRIPS increases the leverage of technology suppliers to charge a higher price for their technology. Many firms in developing countries may not be able to afford the cost. Even if they could, the additional high cost could make their products unviable.
- Fourthly, even if a local firm is willing to pay the commercial rate for the use of patented technology, the patent holder can withhold permission to the firm (refusal to deal) or impose onerous conditions, thus making it impossible or extremely difficult for the technology to be used by the firm.

- Fifthly, the royalties to be paid by developing countries can be a drain on national resources and foreign exchange. For countries facing balance-of-payments constraints, this may be an acute problem. For India, net royalties and license fees paid in 2010 totalled \$2,309 million compared to \$325 million in 2002 and \$997 million in 2007, according to International Monetary Fund (IMF) balance-of-payments data. For developing countries as a whole (including South Korea), the payments have increased from \$6.8 billion in 1995 to \$50.6 billion in 2009.

South Centre (2009) has pointed out that since most of the IPRs on environmentally-sound technologies are held by firms in developed countries, this can impede the ability of developing countries to have meaningful and affordable access to these technologies. The barriers examined by this study includes (a) high royalty fees; (b) refusal to license by the patent holder; (c) “ever-greening of patents”; (d) increasing patent litigation and (e) impediments to innovation.

A well-documented case of IPRs being a barrier to transfer of climate technology is the difficulties of firms in India and Korea to obtain the rights to producing substitutes for chlorofluorocarbons (CFCs), chemicals used in industrial processes as a coolant, which damage the atmosphere’s ozone layer. This hinders their ability to meet commitments under the Montreal Protocol which tackles ozone-layer loss by phasing out the use of CFCs and other ozone-damaging substances by certain target dates.

In a study of the effect of IPRs on technology transfer in the case of India in the context of the Montreal Protocol, Watal (1998) pointed out that technology-transfer provisions in the Montreal Protocol are particularly relevant for developing countries which are producers of ozone-depleting substances (ODS), such as India, Brazil, China, South Korea and Mexico. In India, Korea and China, such production is dominated by local-owned firms, for which the access to ozone-friendly technology on affordable terms has become a central issue of concern. The study concludes 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.”

Another study that also reviewed transfer of technologies for substitutes for ozone-damaging chemicals under the Montreal Protocol has provided details for some cases in which technology transfer to developing countries’ firms was hindered by either high prices or other unacceptable conditions imposed by companies holding patents on the chemical substitutes onto companies in developing countries that wanted a license to manufacture the substitutes. Examples include:

(a) The case of HFC-134a, a chemical used to replace harmful CFC in refrigeration. When Indian companies

requested a license from a US company owning the patent for HFC-134a, in order to manufacture the chemical, they were asked to pay a very high sum (US\$25 million) which was far above the normal level, or to allow the US company to own a majority equity stake in a joint venture and with export restrictions on the chemical produced in India; both options were unacceptable to the Indian producers.

(b) 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. "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" (Andersen et al., 2007, pp. 262-265).

(c) The case of HFC-227ea: This chemical (known also as FM-200) is a substitute for halon-1301 for fire protection applications. The US owner of FM-200 patent requires that licensed fire protection systems satisfy certain design and inspection requirements and only 3 enterprises (in US, UK, Australia) have satisfied the approvals. The patent owner offered joint ventures with majority share holding but do not want to license the technology to wholly locally owned firms, and thus Indian firms are unable to avail themselves of this product (Andersen et al., 2007, p. 265).

(d) Many of the technology agreements between Korean firms and their partners in Japan and the US contain restrictions such as they are not allowed to consign to a third party, to export, and that the improved technologies should be shared (Andersen et al., 2007).

Some recent studies that analysed specific sectors of climate related technologies have also pointed out the potential for IPR protection for becoming a barrier to technology transfer. The IP holder can prevent access to the protected technology and know-how and thus prevent other firms from imitating the technology or innovating on the basis of new technologies (Ockwell et al., 2007, p. 40).

Ockwell et al. (2007) looked at Light Emitting Diode (LED) lighting technology and the main barriers that India faced 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."

The study also indicates significant IPR issues faced by Indian manufacturers in biomass technology and in manufacturing hybrid vehicles since there are many patents associated with the equipment and technologies. On "biomass technology" the study found that IPRs, though it is "not a very important issue" in this

sector in the context of India, has created "some friction between the European and Indian manufacturers of briquetting machines" as "small-scale industries such as briquetting machine manufacturers are typically 'copycat' businesses based on reverse engineering..." The study also recognises that Europe is dominant in biomass fuel of pellets 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".

On hybrid vehicles, Ockwell et al. (2007) found that commercially viable technologies for hybrid vehicles are held by companies in developed countries. The study also found that "there may be IPR issues associated with imitating patented hybrid drive-trains" since "companies such as Toyota, General Motors and BAE have strict patents relating to their hybrid drive-trains". Ockwell (2008) also reviewed 3 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".

A study by Barton (2007) on three sectors (solar photovoltaic, biofuels and wind technology) found that despite patents being prevalent in these sectors, competition between the various types of energy kept prices and costs relatively low. However his study did not rule out IPRs being a possible barrier, and he warns of "serious plausible patent issues likely to arise from the new technologies" and the risk of broad patents which may complicate the development of new, more efficient or less expensive technologies, as well as anti-competitive practices if the small number of suppliers cooperate to violate competition-law principles. 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 is 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 micro-organisms important in the case of biofuels may be hesitant to make these technologies available to developing country firms. 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 smaller companies in developed countries which are likely to gain more from licensing and lose less from competition are willing to sell licenses for use of their technologies. In support, Ockwell refers to a study by Lewis on how leading wind technology manufacturers in developing countries like Suzlon (India) and Goldwin (China) acquired access to wind technology by license purchases but from second-tier developed country firms which had

less to lose in terms of competition and more to gain in license fees. Leading firms in developed countries have been reluctant to license their technologies to potential developing country competitors. Lewis argued that it was a disincentive for leading companies to license to potential developing country competitors that have cheaper labour and materials available.

The Indian institute TERI (The Energy and Resources Institute) led a study on technology transfer and climate change issues in which research institutes from five Asian countries (China, India, Indonesia, Malaysia and Thailand) participated. The study concluded that where important patents are in the hands of a few dominant players, this creates a monopolistic situation where dissemination of knowledge is restricted on account of limited access and higher prices of climate friendly technologies (TERI, 2009). A case is cited of the Chinese Yantai Integrated Gasification Combined Cycle (IGCC) demonstration power plants, in which Chinese companies failed to get technology from foreign companies "due to high cost and reluctances to transfer the key technologies on the part of patent holders". After prolonged negotiations, the project was stopped.

TERI (2009) also points out that the IPRs create a barrier not only in terms of direct costs (i.e. royalties or license fees) but also increased spending by the recipient company, either due to refusal of technology transfer or unreasonable conditions put in the technology transfer agreements. For instance a Malaysian company Solartif managed to get access to foreign technology only on condition of buying machines from the technology holder. The costs of acquiring technology through imports as a result of conditions in technology transfer agreements "do not get reflected as a part of IPR costs, since these are not royalties or licence fees, but are nevertheless associated with them" (TERI, 2009).

A recent study (Zhuang, 2011) on whether patented wind technologies have been transferred to developing countries shows how wind companies in China have faced problems relating to IPRs. Citing data from Lee (2009), the study points out that Germany, US and Japan owned around 60% of wind technology patents approved in 1998-2007, while Denmark, Spain, UK, France and the Netherlands together accounted for another 23%. China may be the largest owner of patents in emerging economies for wind technology but its share of claimed priority patents was only 1.5%.

The study makes the following findings:

- There has been a major boom in China in companies that manufacture wind power equipment. However, to produce a piece of complete wind power equipment, China has to buy foreign design and technologies related to core components, such as gear boxes, which generally contribute to the largest part of the price.
- The requirements for China to access patented wind-energy technologies are also very strict. Zhuang (2011) cites a survey by Zhou et al. (2010) that on aver-

age Chinese companies have to pay high licensing fees for the technology and 5 per cent royalties per piece of equipment when the final product is sold domestically; however, higher royalty fees usually apply when the final product incorporating foreign patent(s) is exported. Most importantly, Chinese innovation is discouraged because R&D activities relating to the patent are commonly only possible after the agreement of the licensor.

- Technologies transferred are not the most advanced. Because the 'unlikeliness' of leading manufactures in the industry to license to potential competitors, studies show that developing countries manufacturers in China and India often have to obtain technology from second or third tier wind power companies who had less to lose in terms of international competition, and more to gain with regard to license fees.

- China has not acquired the corresponding technological capacities. Much wind power equipment is produced by Chinese enterprises, however, the real owners of the technologies are foreign companies and China has not acquired corresponding technological capabilities. Most applicants for renewable energy-related patents have been foreign enterprise subsidiaries in China; China's top three applicants for wind power patents are all developed country enterprises. During the past twenty years, the gap in wind turbine technology between China and developed countries has not been narrowed.

- To sum up, in the wind energy sector, the innovation is still concentrated in a few developed countries and the technologies have been generally transferred to other industrialized countries. Such technologies are rarely licensed to developing nations, and then mainly to emerging countries like China. The licensees do not have the freedom to use and improve the technologies acquired. Developed country companies often refuse to transfer the advanced or key technologies. The technologies from industrialized countries are strongly protected and it is difficult for developing countries to build their own technological base.

Shashikant (2010) also points out that opportunistic & anti-competitive lawsuits taken by patent owners can hamper access to climate technologies. IP holders are known to use legal suits to preserve their market monopoly, or to place themselves in a position to be able to extract significant royalties from the opposing entity that has used or intends to use the protected technology. Syam (2010) also mentions cases where a large company that hold patents in wind energy technology prevented a European firm from entering the US market through patent litigation, until finally the European firm was acquired by the US firm. Similarly a US firm filed a patent infringement lawsuit against a UK firm claiming infringement of 5 patents over seminal quantum dot technology, used in the solar power sector.

In the context of developing countries that are likely to be a focus of such litigation in the future, patent litigation or the threat of litigation may result in deterring developing country firms from investing in mitigation and adap-

tation technologies. Protracted lawsuits would also slow the diffusion of technologies.

Ockwell et al. (2007) refers 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”. Thus, an outcome of extensive litigation could be a disincentive to invest in innovation.

Proponents of a strong IP regime have argued that patents boost technology transfer because the patent applicants have to disclose information on their claimed invention when submitting their application. However in reality, there are many problems with this, such as that the patent agents usually avoid including information that enable competitors to exploit the invention on patent expiry; the applicant also often omits information that allow reproduction of all embodiments; and technicians in developing countries are often without the experience needed to work the disclosed patent specifications. Moreover, during the term of the patent, the patented invention cannot be exploited by others (unless permission is obtained from the patent holder) even if the information is available (Shashikant, 2009b, p. 33).

IV. Possible Treatment of Patented Technologies

There are a number of measures that can be taken to address problems arising should patents become a barrier to the transfer of climate related technologies.

Regulation of Voluntary Licenses

One option for facilitating the lowering of barriers posed by IPRs is to have better regulation over voluntary licenses and the terms attached to them. This could be part of national legislation. It should also be facilitated by international standards. The issues to be addressed could include a limit to the patent holders’ refusal to grant a license, a reasonable rate of royalty payment (or possible exemption for developing country firms), conditions on other costs imposed on the licensee, and regulation on other conditions to be imposed on the licensee (such as limitations on the licensee’s market including exports, and the ownership or rights over the innovations or modifications made by the licensee on the licensed technology). Regulation of the conditions for voluntary licenses is necessary to remedy the kinds of problems which companies in developing countries faced when trying to get a license from patent holders to produce substitutes to ozone-harmful chemicals.

Compulsory Licenses

An important measure is the exercise by governments of their right to provide compulsory licenses (CL). Under the TRIPS agreement, there is considerable flexibility provided to WTO Member States on the grounds for

issuing compulsory licenses. These grounds are not restricted, as confirmed by the WTO Ministerial Declaration on TRIPS and Public Health (WTO, 2001). For example, and contrary to a quite widespread notion, it is not necessary for a government to declare its country is in a state of health emergency in order for it to issue a compulsory license for a pharmaceutical drug. Certainly the fact that a country requires a product or technology in order to meet its objectives or responsibilities to mitigate climate change or to adapt to climate change is a valid ground for compulsory licensing.

Compulsory licensing is not a unique or exceptional policy. In developed countries like the US and the UK, there have been many compulsory licenses granted by the government to facilitate cheaper products and technology in the industrial sector. 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 fact in the US, compulsory license provisions are incorporated into specific legislation.

For example the US Clean Air Act provides for CL of patented technologies needed to meet agreed standards. The Clean Air Act (35 USC 203) provides for compulsory patent licenses when the patented innovation is necessary to comply with the 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 license should be granted and set the reasonable terms.

In many developing countries, compulsory licenses have been issued for the import or local production of generic drugs. A particular type of compulsory license, “government use”, has been made use of by an increasing number of developing countries in the area of pharmaceutical drugs. In such cases, prior negotiation with the patent holder is not necessary although remuneration or royalty to the patent holder is required.

Compulsory licensing is thus an option that developing countries can consider using for those patented climate-friendly technologies for which they have need, which are expensive, and when negotiations with the patent holder are unable to result in a sufficiently affordable price either for the original product or for a license for an intended generic product.

Use of other TRIPS Flexibilities

Besides compulsory licensing, the TRIPS Agreement has several other flexibilities, which can be used to promote transfer of climate-related technologies. These include parallel importation, exemptions to patentability, exceptions to patent rights, and measures to address anti-competitive behaviour. The possible use of these flexibilities is detailed in South Centre (2009).

WTO Declaration on Patents and Climate Technology

The Brazilian Foreign Minister Mr. Celso Amorim in his speech at the plenary session of the UNFCCC Bali climate conference in December 2007 stated that inspiration should be drawn from the case of TRIPS and access to medicines (which resulted in a WTO Ministerial Declaration on TRIPS and Public Health), and that a move should be considered to have a similar Declaration on TRIPS and climate friendly technologies. Strictly speaking, it is not necessary for such a statement to be made by Ministers before a country exercises rights that are already provided for in the TRIPS Agreement to issue compulsory licenses for climate-related technologies. However some developing countries may not be familiar enough with these rights, or they may fear that the exercise of such rights may lead to an outcry from the companies holding the patents or to penalties from the developed countries. Therefore developing countries may find it useful that an international declaration is made, so that they would have greater confidence to issue compulsory licenses.

An important feature of the TRIPS and Public Health Declaration is that it created new rights for countries to waive a provision in the TRIPS Agreement that limits the supply of a generic product (under compulsory license) to “predominantly” in the domestic market. This restricts application of the volume of exports of a firm producing generics, and it also affects the adequacy of supply of generic products that a country with no or limited manufacturing capacity can import. A Declaration on TRIPS and Climate Change could establish a similar waiver to the restrictive TRIPS provision for climate-related technologies. This will enable an increase of supply of “generic” technologies and products to countries that lack productive capacity to produce their own products.

Details on elements of a possible Declaration are contained in South Centre (2009).

Legislation to Facilitate Easier Compulsory Licensing

To further facilitate compulsory licensing of climate technology, developing countries can be encouraged to introduce legislation that makes it easier to obtain compulsory licenses for certain purposes or category of products. For example, the Clean Air Act of the United States provides for compulsory licenses to be given when the patented innovation is necessary to comply with the emission requirements, when no reasonable alternative is available, and where non-use of the patented invention would lead to a “lessening of competition or a tendency to create a monopoly.” Under the Act, a district court, with the Attorney General’s assistance, can determine whether a compulsory license should be granted and set reasonable terms.

Shashikant (2010) also points out two other US laws that mention compulsory licensing. The Atomic Energy Act (42 USC Sec 2183) allows for compulsory licensing when the patented innovation is “[u]seful in the pro-

duction or utilization of special nuclear material or atomic energy.” The Atomic Energy Commission can determine whether a compulsory patent license should be granted and the reasonable royalty owed by the licensee. The Bayh-Dole Act (42 USC Sec 7608) 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 license is necessary “to alleviate health or safety needs,” or “to meet requirements for public use specified by Federal regulations.”

Exemption from Patentability

Another set of proposals that are more fundamental has to do with exemptions or partial exemptions for climate friendly technologies from patentability. Proposals along this line have already been made at the WTO since many years.

An exemption from patentability for environmentally sound technology was proposed by India at the WTO’s Committee on Trade and Environment in 1996.

More recently, the Indian delegation at a climate change meeting as part of the G8-plus-5 Summit in Gleneagles, proposed as an option the redefinition of the extent of patent protection for climate friendly technologies, so that the protection “could exclude the use of such technologies in developing countries.”

The above provides two options in exclusion of patents, the first is a blanket exclusion of patentability for environmentally sound technologies and the second being an exclusion applied only to developing countries. In the second option, patent holders that funded their own research and development could recoup their innovation costs through a monopoly (for the specified period in the TRIPS agreement) of their products in the developed countries, while in the developing countries, competition to such technologies is allowed through an exemption from patentability. An appropriate amendment of the TRIPS Agreement would be required in either case, to the effect that WTO Members (or WTO developing country Members) can exempt such technologies from patentability.

Such a proposal should not be considered unrealistic. Before the adoption of the TRIPS Agreement, many countries exempted food and pharmaceutical drugs from patentability. Although the TRIPS Agreement does not allow patent exclusion on a sectoral basis, it recognises circumstances in which IPRs can be suspended. For example, Article 73 states 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. There is a strong case for equating the climate crisis with a global emergency situation. Since climate change is an extremely serious crisis threatening human survival, and there are only a few years left for strong action to be effective in preventing catastrophic

effects on human life and the environment, the situation is similar to a global emergency with war-like conditions. In such conditions, individual commercial interests such as patents can be suspended so that there can be concerted global and national actions in the most effective way, to face the common threat. Developing countries require technologies at the cheapest possible prices. If they obtain the needed technology at one third the price, they can increase the rate of change to put into effect mitigation and adaptation measures many times more rapidly and effectively.

This can be considered 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. Least Developed Countries (LDCs) already have some flexibility in this regard. LDCs that are members of WTO have a special transitional period for the implementation of the TRIPS Agreement.

Technology Pooling through a Collective Global Approach

A “Global Technology Pool for Climate Change” could be developed in which owners of ESTs are required to place their IPRs in a pool, and make them available to developing country firms on payment of a low compensation (in some circumstance royalty free) and on standard terms (that are to be negotiated). This approach has the potential (if fair and reasonable terms that take into account development needs are negotiated) to manage the patent system, prevent abusive practices by the IP holder and makes it administratively and financially easier for access to take place. Similar approaches have also been advocated by various experts.

The nature of the pool should be mandatory in that either through law or policy (e.g. a condition for receiving public funding for R&D) the protected subject matter is given to the pool for licensing to developing country firms. Patent holders would still be able to extract high commercial royalties from the far richer developed markets.

Global System to Share Know-How and Trade Secrets

Another measure requiring international cooperation is the establishment of a global system for sharing know-how and trade secrets linked to climate-friendly technologies. The withholding of “trade secrets”, or the knowledge on how to make the technology, can be a major barrier to technology transfer, even for technologies that are not patented, as it can prevent the development of technology in developing countries. Thus, there is a case for an international cooperation mechanism to make trade secrets and know-how that are linked to climate-related technologies more accessible to developing countries.

Understanding or Initiatives on Publicly Funded Technologies

OECD countries which hold ownership of most of the ESTs 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 R&D. That would require them to be more active in transferring technologies to developing countries.

Fully-owned government technologies and related know-how can be transferred at no cost and on favorable terms. Where governments partially fund R&D, they should have partial ownership of any resulting patent. When a license is issued to a developing country firm, a corresponding proportion of the cost of the license should be waived, thus reducing the overall cost to the country. 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”. As noted above, governments can also use their leverage as a funder of R&D to place conditions on recipients to ensure licensing to firms in developing countries on fair terms that take into account their development priorities and needs.

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) which requires all investigators funded by the NIH to make publicly available their publications through the National Library of Medicine’s PubMed Central no later than 12 months after the official date of publication, thus improving the sharing of scientific findings, the pace of medical advances, and the rate of return on benefits to the taxpayer. A similar concept could also be envisaged to address prompt availability of publicly funded technologies to developing countries.

At the UNFCCC meeting in Accra, the Group of 77 (G77) and China put forward a proposal for the establishment of a Multilateral Climate Technology Fund. 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 the creation of manufacturing facilities for ESTs.

Financing of R&D of new technologies by any future fund should be subject to conditions concerning IPRs. IPRs of any technology resulting from R&D financed from the fund should belong to the fund under the UNFCCC. The technology with its know-how should be made available royalty free 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 Technology

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 that there is no impediment to equitable and affordable access to the products of the research or follow-on research by others.

Conclusion

Any WTO member state is already allowed by the TRIPS agreement to make use of “flexibilities” and take measures such as compulsory licenses and parallel importation to obtain technologies or products (that are patented) at more affordable prices. But the processes of negotiating with the patent holder and of issuing compulsory licenses etc can be quite cumbersome to countries not familiar with the procedures. Consideration should thus be given to facilitating the easier use of compulsory licensing and other TRIPS flexibilities, and also the possible exemption by developing countries of at least the critical technologies required for climate adaptation and mitigation. Innovating firms could recover their research costs through patenting in developed countries. Intellectual property should not be treated as something sacred that has to be upheld at all costs. That would send a signal that climate change is not a serious threat, as commercial profits from monopoly would be seen as being on a higher scale of values and priorities than are the human lives that are at stake due to global warming. Technology transfer to developing countries to enable them to combat climate change should be the far higher priority. The UNFCCC process should therefore adopt the principle that developing countries can exempt climate-friendly technologies from patents. This should be supplemented with global measures to enable the sharing of trade secrets. As second-best alternatives, other measures can be considered, such as automatic granting of voluntary licenses and regulation of such licenses, and patent pools.

V. Proposals of Developing Countries in the UNFCCC

In the UNFCCC negotiations since the Bali conference of December 2007, many developing countries and their groupings have presented proposals on technology development and transfer. The most important of these is the proposal by the G77 and China submitted in September 2008. Its main feature is the establishment of a new technology mechanism under the UNFCCC to accelerate the development and transfer of technology and to support the effective implementation of the UNFCCC's provisions relating to technology and finance. The proposal sets out the rationale, criteria and institutional arrangements for a new technology mechanism, which include a new Executive Body on Technology, a Multilateral Climate Technology Fund, a Technology Action Plan and eligible activities. Barriers to transfer also inhibit the adoption of technologies in developing countries. Consequently, access must be urgently pro-

vided to these technologies while balancing rewards for innovators with the common good of humankind, including through jointly developed technology and intellectual property rights (IPR) sharing.

The Plan will also define specific policies, actions and funding requirements for all relevant technologies, classified as follows:

(1) In relation to public domain technologies, it 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 and maintain technologies and adapt them to local conditions, thereby contributing to the development of endogenous technologies.

(2) In relation to patented technologies, the Technology Action Plan will ensure that privately owned technologies are available on an affordable basis including through measures to resolve barriers posed by intellectual property rights, and through compulsory licensing of patented technologies. Technologies with shared ownership (government and private) will be made available on an affordable basis by facilitating transfer of the government proportion on a reduced or no-cost basis. Technologies that are government owned will be made available on an affordable basis by facilitating transfer on a reduced or no-cost basis.

(3) In relation to future technologies the Plan will support the establishment of national and regional technology excellence centers and will reinforce north-south, south-south and triangular cooperation, including in the area of joint research and development.

Besides this G77 and China proposal, many developing countries have also spoken up individually at the UNFCCC on the technology issue. Specifically on the issue of IPRs, several countries including Cuba, India, Tanzania, Indonesia and China have stressed the need to address the IPR issue within context of technology transfer.

At the UNFCCC meeting in Bonn in July 2008, Brazil called for the establishment of a “coherent and comprehensive” instrument for technology development and transfer i.e. a “Technology Protocol” under the UNFCCC. In relation to patented technologies, Brazil proposed a public multilateral fund for purchasing licenses with a view to facilitate transfer. In this context it also stressed the need to consider using compulsory licensing as well as emerge with a Declaration similar to the Doha Declaration on TRIPS Agreement and Public Health.

India was of the view that the full potential of technology will require mechanisms across all stages of technology cycle which is not just a question of transfer alone, but also of generating new technologies as well as research, development and deployment. It stated that in the area of new technologies, the transfer of technology and know-how should be aided by a suitable IPR regime. Technologies owned by the private sector in developed countries could be compensated by their governments for their transfer and deployment in developing countries. On ac-

celerating 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.

Pakistan stated that the IPR regime facilitates technology development by rewarding the inventor, but at the same time it provides monopoly pricing power which acts as a barrier to its diffusion. Consequently, measures are vitally needed to remove these barriers to technology transfer. It proposed: (1) An international system or agreement on compulsory licensing for climate-friendly technologies along the lines of what was undertaken in the health sector; (2) Joint technological or patent pools, transferring technologies to developing countries at low cost; (3) Reduction of the period for patents on climate-friendly technologies; (4) Provision of incentives (tax exemption, subsidies, etc) for technology owners so that they can put in place a system of differential pricing, in which developing countries are charged lower prices.

At the UNFCCC talks in Poznan in December 2008, 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. 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. It reiterated its proposal for a Multilateral Technology Acquisition Fund to support regional and national R&D in developing countries.

In sessions of the UNFCCC in Bonn in June 2009, the G77 and China submitted a proposal specifically on IPRs, which was included in the compilation of the texts proposed by various Members. The G77 and China proposals are that:

Specific measures shall be established to remove barriers to development and transfer of technologies from the developed Parties that have commitments under the Convention to transfer environmentally sound technologies to developing country Parties arising from intellectual property rights (IPR) protection, including:

(a) All necessary steps shall be immediately taken in all relevant fora to mandatorily exclude from patenting climate-friendly technologies held by Annex II countries which can be used to adapt to or mitigate climate change;

(b) Creation of a "Global Technology Pool for Climate Change" that promotes and ensures access to technologies that can be used to adapt to or mitigate climate change and associated know-how and trade secrets to developing countries including on non-exclusive royalty-free terms in order to provide better information service and reduce transaction costs.

The Philippines submitted the following proposal:

- All necessary steps shall be immediately taken in all relevant fora to mandatorily exclude from patenting environmentally sound technologies which can be used to adapt to or mitigate climate change.

- Biological resources including microorganisms, plant and animal species and varieties, and parts thereof that are used for adaptation and mitigation of climate change shall not be patented.

- Specific measures shall be taken and mechanisms developed to remove existing barriers to development and transfer of technologies from developed to developing country Parties arising from intellectual property rights (IPR) protection, including:

- (i) to use to the full flexibilities contained in the Trade Related Aspects of Intellectual Property Rights (TRIPS) including Compulsory licensing to access intellectual property protected technologies;

- (ii) take steps to ensure sharing of publicly funded technologies and related know-how, including by making the technologies available in the public domain at an affordable price and on terms and conditions that promotes access for developing countries;

- (iii) creation of a "Global Technology Pool for Climate Change" that promotes and ensures access to intellectual property protected technologies and associated know-how to developing countries including on non-exclusive royalty-free terms;

- (iv) adoption of a Declaration on IPRs and Environmentally Sound Technologies in relevant fora to, inter alia, reaffirm the flexibilities in the TRIPS Agreement and enhance the enabling environment for implementing these flexibilities.

4. All necessary measures and actions shall be immediately taken to facilitate technology pools that include associated trade secrets and know-how on environmentally sound technologies and enable them to be accessed, including on royalty-free terms for developing countries.

Bolivia also submitted a similar proposal as follows:

Specific measures shall be taken and mechanisms developed to remove barriers to development and transfer of technologies from developed to developing country Parties arising from intellectual property rights (IPR) protection, in particular:

(a) Parties agree that nothing in any international agreement on intellectual property shall be interpreted or implemented in a manner that limits or prevents any Par-

ty from taking any measures to address adaptation or mitigation of climate change, in particular the development and transfer of, and access to technologies;

(b) Immediately to take all steps necessary in all fora to mandatorily exclude from patenting in developing countries environmentally sound technologies to adapt to or mitigate climate change, including those developed through funding by governments or international agencies;

(c) Immediately to take all steps necessary in all fora to revoke in developing countries all existing patents on essential/urgent environmentally sound technologies to adapt to or mitigate climate change;

(d) Immediately to take all necessary measures to facilitate technology pools that includes trade secrets and associated know-how on environmentally sound technologies and enable them to be accessed on royalty-free terms, for developing countries;

(e) Immediately to create and provide new and additional financing that is adequate, predictable and sustainable for joint technology excellence centres in developing countries, to enable entities in these countries to do research and development especially on adaptation as well as mitigation technologies;

(f) Immediately to ensure that any technology transfer to developing countries is appropriate for the developing countries concerned in order to enable its effective utilization.

During the Barcelona Climate talks in November 2009, Bolivia, Bangladesh and India jointly submitted textual proposals on IPRs to the Chairs of the informal drafting group on technology for inclusion into the negotiating draft text on technology. The proposals include a call for Parties to take the necessary steps in all relevant forum to exclude from IPR protection and to revoke existing IPR protection in developing countries and LDCs on ESTs; setting up a Global Technology IPR pool for Climate Change, taking steps to ensure sharing of publicly funded technologies and related know-how, reaffirming developing countries' right to make use of the full flexibilities contained in the TRIPS Agreement.

Repeated attempts were made during the Copenhagen climate negotiations in December 2009 to eliminate these proposals from the text. However the same proposals are contained in the draft decision on technology, Annex D of the Report of the Ad Hoc Working Group on Long Term Cooperative Action under the Convention.

In Copenhagen, the G77 & China also included "Address issues related to intellectual property rights as they arise" as one of the functions of the Executive Body that it proposed to set up.

In contrast, developed countries insist on maintenance of status quo with regard to IPRs. In Copenhagen and in the negotiations prior to that, developed countries taking the cue from the US, took the position that

IPRs simply cannot be mentioned in any outcome on technology.

While the developing countries have advocated new technology mechanisms in the UNFCCC framework and called on "thinking outside the box" on IPRs, the developed countries inside the UNFCCC by contrast have generally continued to maintain that respect for a strong IPR regime is necessary for innovation and for the transfer of technology to developing countries. The proposals above have not been acceptable to the US or EU, which deny that IPRs constitute a barrier to technology transfer. For the developed countries, which own most of the patents on climate-related technologies, maintaining the normal situation regarding IPRs is a matter of having advantage in economic competitiveness. Business associations in developed countries have demanded that their governments do not make concessions on IPRs in the climate negotiations. The US House of Representatives has adopted three bills that contain provisions that condition US participation in any global climate deal and any provision of funding for climate-related purposes to robust compliance and enforcement of existing international legal requirements for the protection of IPRs (Shashikant, 2009a). This could be one reason why the US delegation had been asking that IPR issues be taken off the table in the UNFCCC climate talks.

VI. Technology Assessment

In order to promote the development and transfer of technologies, it is also important to assess the appropriateness of the technologies that are selected for development, transfer, and diffusion. This is to ensure that the technologies that are so promoted are in accordance with the objectives of the UNFCCC, as well as in line with national needs and goals.

Criteria should be adopted to assess technologies that meet general acceptability as well as national conditions, needs and objectives. A mechanism can then be established on applying these criteria when selection of technologies takes place.

It is proposed that the following are among the principles/criteria to be considered:

1. Relevance to the objective of addressing the climate change problem;
2. Environmental soundness;
3. Safety to the environment and to human health;
4. Affordability, especially for developing countries;
5. Social acceptability and effects, including in relation to employment, equity, and cultural norms; and
6. Economic efficiency and cost-effectiveness.

It is clear that there could be trade-offs between and among some of the principles and criteria mentioned above. The methods for making choices in the context of trade-offs are therefore also important to consider and determine.

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- No. 2, December 2009 – Copenhagen and After
- No. 3, November 2010 – Cancun Climate Conference: Some Key Issues
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