

Rio + 20 – WTO Secretariat contribution regarding "a facilitation mechanism that promotes the development, transfer and dissemination of clean and environmentally sound technologies"

1. Introduction

Paragraph 273 of the Rio Declaration requests UN agencies to identify options for "a facilitation mechanism that promotes the development, transfer and dissemination of clean and environmentally sound technologies". The following is the WTO Secretariat contribution on this subject.

Technology is identified as the essential source of most trans-boundary environmental problems; but equally, technology is seen as an indispensable part of the solution. It is therefore unsurprising that technology - and the impact on development and dissemination of technology of the intellectual property (IP) system - have invariably been a bone of contention in international policy debates on environmental issues. The body of multilateral environmental law and policy instruments since the Rio Earth Summit 1992 addresses the role of technology in meeting environmental challenges in several ways, for instance:

- Agenda 21 recognized the "need for favourable access to and transfer of environmentally sound technologies, in particular to developing countries"
- The Desertification Convention includes obligations to "promote and facilitate access by affected country Parties ... to appropriate technology, knowledge and know-how."
- The UNFCCC commits Parties to promote and cooperate in the development, application and diffusion, including transfer, of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases", a commitment further elaborated in the Kyoto Protocol and the Bali Road Map.
- The Convention on Biological Diversity recognizes that access to and transfer of technology are "essential elements for the attainment of [CBD] objectives" and provides for measures for access to and transfer of technologies "relevant to the conservation and sustainable use of biological diversity" or that "make use of genetic resources and do not cause significant damage to the environment." The Nagoya Protocol recognizes that the role of technology transfer, collaboration and cooperation in achieving equitable benefit sharing, and among potential benefits flowing from access to genetic resources, it cites transfer of technology under fair and most favourable terms, and strengthened capacities for technology transfer.
- And last but not least, the Rio+20 outcome document (A/CONF.216/L.1), in paragraphs 73 and 269 refers directly to the term intellectual property rights while recalling the provisions *inter alia* on intellectual property rights, as agreed in the Johannesburg Plan of Implementation, in the context of technology transfer. In the further paragraphs from 270-272, this document stresses the importance of both innovation and access to new environmentally sound technologies and the need for enabling environments, and capacity building in developing countries.

These legal provisions and the policy concerns that lie behind them have sparked considerable debate and analysis about the practical impact and potential roles of patents and other IP rights in promoting innovation of such green technologies, and in leveraging access to and transfer of such technologies, as well as potential barriers posed to the uptake of these technologies, including in the negotiations leading up to the Rio+20 outcome document. The WTO Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS), which is the most comprehensive international IP treaty, is frequently invoked in these debates.

This section outlines the core issues and summarizes the international debates on this subject, particularly on TRIPS aspects and shed some light on the main controversies. Where relevant, it also includes ideas for a future research agenda.

The Rio Conventions frame environmentally friendly technology in several contexts, and no attempt is made in this section to define “green technology” in a formal way. However, as a general concept, it can be considered to include technology that makes products and processes more environmentally friendly, for example, by reducing CO2 emissions or by making products more biodegradable; other technologies may be used to monitor or manage the environment. Overall, green technology aims at contributing to environmental sustainability.¹Sometimes green technologies are referred to as simply ‘environmentally friendly technologies’ or ‘environmentally sound technologies’ (ESTs). These terms are used interchangeably in this section. These technologies include certain defined categories of technology such as wind, solar, or geothermal power as well as technologies that have specific environmental functions, such as technologies that monitor climate or record biodiversity.

2. The role of patents and other IPRs in the innovation and diffusion of green technology

Green technologies, particularly those relevant to the MEAs, can be considered to be global public goods since, in principle, the entire world can benefit from existing innovations as well as incentives to innovate given in any one part of the world. The classical characteristics of a public good are non-excludability and non-rivalry.² In the case of public goods, the problem is chronic underinvestment in their creation if markets are left to themselves, as they would fail to produce them in socially optimal quantities.

Patents and some other relevant IPRs restrict the use, reproduce and distribute new inventions, generally for a limited period of time and/or under certain conditions. This helps inventors appropriate for themselves at least part of the social benefit of their innovations, thus providing an incentive to invest in R&D toward the generation of green technologies. On the other hand, once a patent expires, competition will normally drive the price of a product down to marginal cost of production, allowing only normal profits, thus promoting even wider diffusion of such technologies.

¹FT glossary available at <http://lexicon.ft.com/Search?searchText=green-technology>.

²Non-excludability means that it is not possible to exclude others from using the knowledge once it is made public. Non-rivalry means that one person's use of the knowledge does not restrict or diminish the amount of it available or its value for use by others.

While patents may increase costs to society in the short run or in a static sense, they are intended to lead to greater dynamic benefits in terms of leading to more innovation and broader access in the long run. Patents also have transactional value as they are useful instruments in obtaining initial finance (venture capital), as well as in agreeing to licences and other forms of contracts relating to technology sharing arrangements, including in patent pools. It is in this latter way that patents on green inventions tend to be used as the business model is usually not one of exclusive production with the patent owner as the sole supplier, unlike in the pharmaceutical sector. Hence analogies with the access to medicines debate may well be misguided as seen further below.

Patents provide time-limited legal rights to their owners to exclude others from making, using, importing or selling the protected product without permission. Patents are only valid if granted for inventions that are new, not evident and are useful. Although TRIPS and other international agreements set general standards for patent protection, there is no such thing as a worldwide patent. Patents are granted separately in each jurisdiction and rights are independent of each other. This means that a patent granted in one country conveys no rights in any other country. Therefore, if no patent is applied for or granted in a particular jurisdiction, there are no restrictions on making, using or selling the patented technology in that jurisdiction. Consequently, in the great majority of developing countries and least-developed countries, much "patented" green technology is likely already to be in the public domain, i.e. free to be used without legal constraint (provided there are no regulations, such as environmental laws, that prevent its use). Patent exceptions can allow some use of the invention before the patent expires: for example a research exception allows further innovation or use by governments or others for public interest reasons.

Trade secrets protect information of commercial value that is likely to be diminished by disclosure, and includes the know-how to produce a particular product or use a certain process. Trade secrets do not have a limited duration but are only protected against theft or other unfair means to obtain them and not against independent discovery.

The most relevant IPRs for the purposes of this section are perhaps patents and trade secrets, as these are considered crucial to the generation and effective transfer of technology. In the area of climate adaptation technologies, patents or plant variety protection for climate-tolerant crops could be important. Indeed, much of the empirical work done so far focuses in the area of patents. There is no discussion in this section on trademarks that identify goods and services as being environmentally friendly because, although relevant, these are less controversial and do not figure in the discussions on transfer of technology. There are a number of other issues raised in the context of some environmental concerns, such as issues of "biopiracy" and traditional knowledge referred to in relation to the conservation and sustainable use of biodiversity, which are not touched upon either in this section.

A question that arises in the context of innovation that goes towards 'greening' an economy is whether the world should depend upon traditional IP systems or create new models for incentivising innovation. In this context, both 'push' and 'pull' models of incentivising R&D have been explored. Supply of green products and services may require direct financing of R&D wholly or partly by governments or other large donors (the 'push' incentive), for example in forming public-private partnerships to supply clean technology or to provide the basic R&D. On the other hand, regulation,

such as targets set in MEAs, or end-rewards such as prizes could provide the 'pull' required for private sector to invest in green R&D.³

Current discussions about how to optimize green innovation have also turned to models for collaborative innovation and shared technological platforms to support innovation. These models have typically been developed on a voluntary basis, by technology holders who realize that the benefits of pooling technologies from several sources outweigh any immediate advantage of closely restricting access to their technology. In these cases, there is a common incentive to share technology. A cluster of broadly similar concepts have been put forward:

- 'open source' originated from a software development model that ensures access to the human-readable 'source code', and permits others to use and adapt the software, and to redistribute it, whether or not it is modified. It is sometimes used as a metaphor for more transparent and non-exclusive innovation models in other fields such as green technology.
- 'open innovation' refers to a broader set of innovation models, emphasizing the interest of many firms in seeking synergies and collaboration with other actors working on related technologies, as opposed to closed innovation which would emphasize firm boundaries between rival companies.
- 'commons-based peer production' refers to the development of new products through widespread collaborative networks without a formal hierarchy, often brought about by a sense of collective purpose: the *Wikipedia* online encyclopedia is a good example.
- 'distributed innovation' refers to the development of innovative products through collective efforts in networks spanning different organizations, institutions or individuals. The underlying theme is the search for forms of innovation and technology diffusion that maximizes the collaboration that is the lifeblood of innovation, while enabling innovators to appropriate a fair and equitable share of the benefits from their research efforts and investment of resources into creating green technologies.

Just what it means to adapt, learn from or apply these different models of innovation in the very diverse space of green technology itself drives a wide-ranging debate, which seeks to reconcile legal, policy, economic and technological factors. Behind the debate is a sense of urgency in both the demand for technological solutions to address environmental concerns and the need for strategies for the rapid dissemination of proven new technologies to be rapidly distributed; while cast often in legal terms, the debate also takes up questions of appropriate incentives for the private sector, strategies for managing public sector research, and tools both for sharing technologies and for promoting technology partnerships and other forms of collaboration.

And beyond the analysis of specific innovation models, the debate over green technology has also gone to the heart of the balance of private incentive and public interest that defines the patent system, particularly as to whether the general rules set by TRIPS, and the choices countries make in implementing them in practice, have enough flexibility to allow for widespread access to innovative

³ Barrett, Scott: 'Climate Change Negotiations Reconsidered', 2008, available at http://tria.fcampalans.cat/images//Scott_Barrett.pdf.

environmentally friendly technologies to all who need them, with issues touching both on practical availability and the affordability of such technologies.

The practical impact of the patent system is significant given the key role of the private sector in developing and implementing much green technology. Agenda 21 includes carefully negotiated language that recognizes that much of the technology is or will be in the hands of the private sector and thus includes words such as "as appropriate" or "on mutually agreed terms".⁴ The Kyoto Protocol marked a departure in that it takes into consideration the fact that transfer of technology is market-driven, providing market-based mechanisms to drive technology transfer, at least for technologies that mitigate or reduce GHG emissions. To this end, it establishes a clean development mechanism (CDM)⁵ and allows for joint implementation among Annex 1 Parties and emissions trading (in what are now well-established carbon markets) among Parties in order to fulfil the commitments laid down.⁶ At the same time Parties are encouraged to research on, and promote, develop and increase the use of new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced and innovative.

The essential technologies in many important areas such as solar energy, wind energy and bio-fuels are said to be mostly in the public domain - particularly in the majority of developing countries, where relatively few patents are filed on green technologies - which means that there is the potential to have many competitors for the same product. And given the diffuse character of these technologies, individual patents rarely offer absolute barriers, but indeed can spur further innovation in the search for alternatives: so far, even where there is patent protection, the likelihood of alternative technologies and substitute products being available is said to be high.⁷ Nevertheless, some concerns have been expressed in a few cases of emerging technologies and improved products such as sophisticated turbine blades for wind energy or enzymes and catalysts for bio-fuels or new plant varieties.⁸ It has been found that among the areas of technology most actively patented in emerging countries, solar power is clearly the lead with about half of the

⁴ See Agenda 21, Section IV, Chapter 34, available at http://www.un.org/esa/dsd/agenda21/res_agenda21_34.shtml, accessed on 30.07.2009.

⁵ CDM permits projects by an entity in an Annex 1 (developed) country that result in certified emissions reductions in other countries to be counted against commitments undertaken by that country (Article 12).

⁶ Article 17 of the Kyoto protocol.

⁷ Barton, John: "Intellectual Property and Access to Clean Energy Technologies in Developing Countries", Issue Paper No. 2, ICTSD, pp. x-xi of Executive Summary; and Copenhagen Economics: "IPRs as a Barrier to Transfer of Climate Change Technology", 18.03.2009, available at <http://www.copenhageneconomics.com/Publications/Impact-Assesment.aspx>.

⁸ Littleton, M. (2008), "The TRIPS Agreement and Transfer of Climate-Change-Related Technologies to Developing Countries", UNDESA Working Paper 71, ST/ESA/2008/DWP/71, available at http://www.un.org/esa/desa/papers/2008/wp71_2008.pdf

patenting activity there, followed by fuel cell technology and wind energy. Others technology areas are found to register fairly low levels of patenting activity.⁹

Three broad views are expressed in this debate - a sense that the existing system, while far from perfect, has worked reasonably well given the right economic and regulatory settings, and can be made to work better with improved transparency tools and easier matching of supply and demand of technologies; a critical approach that has led to some calls for patents to be excluded or revoked altogether on certain green technologies or technologies on genetic materials; and a view, expressed for instance by some participants in the UNFCCC climate change negotiations, that specific interventions are needed, as was done in 2001 for access to medicines in the Doha Declaration on TRIPS and Public Health, so as to bolster or even expand the range of options countries have to leverage access to green technologies. Even so, as outlined below, TRIPS already allows considerable flexibility in the use of compulsory licences and other forms of exception and limitation, that provides a broad policy space for mechanisms to leverage improved access to and transfer of green technologies, while also providing incentives to absorb the risks of innovation.

3. TRIPS provisions relevant to IP and green technology

TRIPS (Article 7) stipulates that the objective of the protection and enforcement of intellectual property rights should be both to promote innovation and to facilitate the diffusion of technology, balancing legitimate interests in a socially beneficial manner.¹⁰ This provision reflects the search for a balanced approach to IPR protection in the societal interest, taking into account the interests of creators and inventors and the interests of users of technology. TRIPS (Article 8) also recognizes the right of WTO Members to adopt measures, to protect, *inter alia*, the public interest in sectors of vital importance to their socio-economic and technological development, provided those measures are consistent with TRIPS (for instance, in not being discriminatory). This provision also recognizes that Members may need to take appropriate measures (again provided they are TRIPS-consistent) "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."

The most relevant TRIPS standards for the protection and dissemination of green technology are to be found in Section 5 (on patents) and Section 7 (on undisclosed information) in Part II of the TRIPS Agreement. As a general principle, WTO Members are obliged under Article 27.1 to make patents available to applicants for any invention, whether product or process, in all fields of

⁹ Copenhagen Economics: "IPRs as a Barrier to Transfer of Climate Change Technology", 18.03.2009, available at <http://www.copenhageneconomics.com/Publications/Impact-Assesment.aspx>, accessed on 03.08.09.

¹⁰Article 7 sets out that intellectual property protection "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".

technology, provided three criteria are met, namely that the invention is new, non-obvious or involves an inventive step and is useful or industrially applicable. Some exclusions to this rule are permitted, but are not required. WTO Members are further obliged not to discriminate in the availability of patents or in the enjoyment of patent rights on the basis of field of technology, place of invention or whether products are imported or locally produced. For example, this standard would preclude Members from legislating blanket exceptions for inventions pertaining to designated fields of environmental technologies. TRIPS sets out three optional exceptions which allow Members to exclude subject matter from the grant of patents, namely on grounds that the matter is contrary to *ordre public* or morality, or that it is a method of medical treatment or that the inventions are plants and animals or essentially biological processes for their production. Article 27.2 specifically mentions inventions that are contrary to human, animal or plant life or health or seriously prejudicial to the environment. However, an important proviso is that the use of this exception is subject to the condition that the commercial exploitation of the invention must be prevented and that this prevention must be necessary for the protection of *ordre public* or morality. This provision does not allow exclusions, on environmental or other public policy grounds, from patent grant for inventions that are beneficial or desirable and that are actually permitted to be commercially exploited in a Member's jurisdiction.

Article 30 recognizes that Members may allow limited exceptions to the exclusive rights conferred by a patent. Often, limited exceptions to patent rights cover the use of the patented invention for private, non-commercial purposes and for research or experimental purposes (to varying degrees according to national legislation and jurisprudence). Article 31 covers both compulsory licences granted to third parties for their own use, and use by or on behalf of governments without the consent of the right holder. TRIPS recognizes the right of Members to authorize compulsory licences and government use authorizations, subject to conditions aimed at protecting the legitimate interests of the right holder that are detailed in Article 31. No restrictions are specified on the grounds for the grant of compulsory licences by national authorities, but national laws typically refer to certain public policy considerations and the need to overcome anti-competitive impacts. As a general rule, an unsuccessful attempt must have first been made to obtain a voluntary licence on reasonable commercial terms and conditions within a reasonable period of time before a compulsory licence is granted. While the TRIPS Agreement, indeed, refers to national emergencies or other circumstances of extreme urgency in connection with compulsory licensing (Article 31(b)), this is only to indicate that, in these circumstances, the usual condition that efforts must be first made to seek a voluntary licence does not apply - in this context, the term does not refer to the substantive grounds for issuing the compulsory licence. The right holder is to be paid adequate remuneration (Article 31(h)) and licences are to be predominantly for the supply of the domestic market of the Member authorizing such use (Article 31(f)).

Article 33 sets out that the minimum term of protection for patents shall be a period of 20 years from the filing date.¹¹ Patents may be revoked, for instance on the grounds that they are invalid.

¹¹In practice, one should never assume that a patent on a particular technology will run for 20 years: an up-to-date check of the records may well reveal that despite a patent earlier having been granted it is no longer in force.

Article 32 of the TRIPS Agreement adds to the relevant provisions in the Paris Convention¹² and provides for the opportunity for judicial review of any decision to revoke or forfeit a patent.

The TRIPS Agreement also sets out general obligations with respect to undisclosed information that cover both trade secrets and test data, under the rubric of giving effect to Article 10*bis* of the Paris Convention (a general provision on the suppression of unfair competition, which is itself incorporated into the TRIPS Agreement). Test data includes for example field trial data on the environmental impact of new pesticides and could be relevant to green technology. However, more relevant are trade secrets, including tacit know-how, which are protected against acquisition through dishonest commercial practices under the provisions of Article 39.2 of the TRIPS Agreement, which obliges Members to protect information that is secret, has commercial value because it is secret, and has been subject to reasonable steps to keep it secret.

Several other TRIPS provisions are relevant to climate policy discussions. These include:

- a renewable exemption for LDCs from applying TRIPS obligations, currently up to mid-2013 (apart from basic non-discriminatory principles), and an additional grace period up to 2016 for pharmaceuticals
- obligations on developed countries to provide incentives for the transfer of technology to LDCs
- latitude to address licensing practices or conditions which restrain competition, may have adverse effects on trade, and may impede the transfer and dissemination of technology, and an obligation to assist other WTO Members in dealing with such practices
- other forms of IP that may be deployed in addressing climate change challenges (such as trademarks – especially certification marks (which are used to vouch for the environmental benefits of certain products, such as low-carbon technologies); plant variety protection; and the suppression of unfair competition (such as false claims about the environmental benefits of a technology or a product)

4. The policy context: IP, green technology and environmental policy

There has been a long-running debate over technology transfer and the patent system, including, within the WTO, under the TRIPS Council and the Working Group of Technology Transfer. In the TRIPS Council, the issue has arisen most often in the implementation of TRIPS Article 66.2 which requires developed countries to provide incentives to entities located in their territories in order to promote and encourage the transfer of technology to least developed countries (LDCs). Technology transfer has been a recurrent theme in multilateral negotiations, notably in the work in the 1970s by UNCTAD on a draft Code of Conduct for the Transfer of Technology. Current debates about technology transfer and the environment therefore raise the question of whether this is 'just another' IP & technology transfer debate, or whether environmentally friendly technologies present distinctive challenges for IP law, policy and administration, calling for distinctive solutions. Despite

¹²Article 5A provides that forfeiture of the patent shall not be provided for in a Member to prevent the abuse of exclusive rights except in cases where the grant of compulsory licences would not have been sufficient to prevent such abuses. No proceedings for the forfeiture or revocation of a patent may be instituted before the end of two years from the grant of the first compulsory licence. In addition, importation by the patentee into the Member where the patent has been granted of an article manufactured in any of the Members shall not entail forfeiture of the patent.

the very diverse character of green technologies, there are some distinguishing factors that set them:

- Generally, MEAs have specific legal obligations between States concerning technology.
- There is a growing sense of urgency to increase transparency and reduce transaction costs so as to accelerate the availability of vitally needed green technologies.
- Existing or emerging ethical/human rights issues also arise: for instance, when considering climate adaptation technologies, there are links to the rights to health, shelter, and food.
- While green technologies may be seen as important for national competitiveness, there is also a perceived national self-interest in promoting the wide diffusion of green technologies to address common environmental challenges.
- It is feared that existing or future important ESTs are proprietary technologies involving the coverage of one or more IPRs. Such technologies are, however, highly diverse in character, unlike the case of pharmaceuticals.

Despite differences of perspectives and a continuing debate about the current effectiveness of the patent system, and about how to make it work better, there is a general sense that a concerted effort and specific initiatives are needed to promote green innovation and to disseminate green technologies.

Within national patent systems, an initial focus is on what technologies should be considered eligible for patenting, and how applications for patenting such technologies should be handled. Many countries do include the possibility of rejecting patents on technologies that would be injurious to the environment should they be commercially exploited. As for environmentally friendly technologies, some patent offices have developed systems for facilitating or fast-tracking patent applications on such technologies so as to accelerate and promote their implementation: for example, the UK Intellectual Property Office introduced a green channel for patent applications on 12 May 2009. Another proposal is for ex-ante agreements for patent term extension for favoured patented product, also called 'wild card' patents, to create a distinct incentive.¹³

Once a patent has been granted, the understanding is growing among policymakers that the effective impact of patents on innovation and technology diffusion is not determined predominantly by the bare existence or otherwise of a patent but rather on the way in which green innovators choose to file for and then to exercise patent rights. There are a range of regulatory interventions that can shape how patent rights are used in the marketplace, including curbs on anticompetitive or otherwise inappropriately restrictive licensing practices, exceptions to patent rights to permit legitimate research and use of technologies for regulatory purposes, and compulsory licences and government use orders to permit third parties to use technologies when the public interest dictates

¹³Maskus, Keith: Differentiated Intellectual Property Regimes for Environmental and Climate Technologies. OECD Environment Working Group Papers, 17 available at <http://www.oecd-ilibrary.org/docserver/download/fulltext/5kmfwjvc83vk.pdf?expires=1317385673&id=id&accname=guest&checksum=4E693A2E2B78CF5F80D3D7D6B6FD2304>.

this need. Codes of conduct or guidelines on licensing practices may also encourage appropriate exercise of patent rights. Equally, however, policy debate has included discussions of voluntary and collaborative mechanisms to promote the use of patent rights, once granted, to further the uptake of green technologies; several of these are discussed below.¹⁴

- **Patent commons:** Patent commons allow technology holders to pledge their patented technologies for widespread use for little or no royalty payment, usually subject to certain general conditions (for instance, agreement not to enforce rights over technologies resulting from access to the commons). A recent initiative, the Eco-Patent Commons, includes patents on environmentally beneficial technologies which are not central to the business of the patent holders.
- **Patent pools:** While definitions vary greatly, the essential idea is that participating patent holders agree to license their technologies to one another – some are termed ‘joint licensing schemes’. Usually the technology is in a well-defined field, or specific patents may be identified. A closed patent pool would restrict access to technology. In some cases, this kind of arrangement might attract the attention of competition watchdogs, particularly where it excludes legitimate competition by those not taking part in the pool. An open patent pool would enable access by any party to the technologies covered.
- **Licences of right:** In some countries, a ‘license of right’ system provides for a reduction in official fees for patent holders who agree to make their patented technology available to anyone requesting a license, subject to terms that can be negotiated or determined by the authorities. The U.K. Patent Office, for instance, maintains a database of patented technology that is endorsed as available for a license of right – this includes alternative fuel technologies patented by major automotive companies.
- **Non-assertion pledge or covenant:** Rather than cancelling or abandoning their patents, patent holders may choose to make their technology widely available by legally pledging not to assert their patent rights against anyone using the technology. This may be restricted to specific uses of the technology (such as for specific environmentally friendly uses), limited to certain geographical locations (such as countries below a certain average level of income), or conditional on the person who uses the technology making available improvements or derivative inventions on similar terms (in the spirit of a ‘commons’).
- **Humanitarian or preferential licensing:** This type of voluntary licensing policy provides highly favourable or free terms to certain beneficiaries, for example, low income developing country recipients, social marketing programs or public sector/philanthropic initiatives.

¹⁴This summary draws on Taubman, AS: "Sharing technology to meet a common challenge", WIPO Magazine, March 2009.

- **Public-Private Partnerships**, including those based on publicly or philanthropic funded technologies, may include ex-ante arrangements on maintaining IPRs in rich countries, while restricting them in poorer countries, or requiring access guarantees for such countries.
- **Placing in public domain**: Placing technologies directly in the public domain is one avenue for their transfer and dissemination. Often, technologies are patented in a relatively small number of countries, effectively placing them in the public domain in all other countries as soon as the patent applications are published. New technologies may be consigned to the public domain, so that anyone is free to use them without legal constraint (unless, of course, health and safety, environmental, ethical or other regulations apply), by the simple act of publishing or otherwise communicating them to the public. Special patent search tools can identify those technologies that have entered the public domain when patents lapse or expire.

Other measures discussed in recent policy debate include patent buy-outs, other forms of technology pools, and technology brokering and clearing house initiatives, and more effective use of patent information tools to locate useful technologies, with the development of specific programs to tap into the latent potential of patent information to enhance transparency and technology partnerships.

Ultimately, the impact of technology on the environment - for better or worse - depends not on the existence or absence of any particular proprietary technology, but rather *how* and *where* it is deployed. The patent system is intrinsically associated with the generation, publication and dissemination of new technologies. How best to deploy it in structuring technological responses for greening the economy is the subject of debate. While there is a better understanding of the subject, and a more nuanced understanding of the range and impact of both regulatory interventions and voluntary choices in the exercise of IP rights, it is unlikely that such a diverse range of technological solutions to such a challenging range of environmental problems will be accommodated within one standard responses or policy nostrums; the continuing debate on the subject should therefore continue to probe for more tailored and focused responses to the diverse environmental challenges posed by achieving the goals of the MEAs.