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Hee-Eun Kim

The Role of the Patent System in Stimulating Innovation and Technology Transfer for Climate Change

Including Aspects of Licensing and Competition Law

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To my family

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Stanford, Summer 2011 *Hee-Eun Kim*

Abstract

The world is increasingly facing the adverse impact of climate change. In this context, what is the role of intellectual property (IP) for stimulating the innovation and technology transfer that are considered essential to resolving this global issue?

Taking the existence of the IP system as a foundation, this paper aims to provide a comprehensive review of pragmatic IP-based options in the multilateral climate change regime. The paper does so principally by addressing the possibilities afforded by three components of the patent system: patent law, patent policy and patent information. Complementing these public options are technology transfer initiatives by IP communities, some of which the paper describes, together with associated IP issues. The paper also briefly surveys complementary means of balancing IP and competition potentially relevant to climate change solutions.

In providing the above description and analysis, this paper identifies a number of potential controversies at the crossroads of IP and climate change, for example, compulsory licensing for climate change, patent offices' preferential treatment policy for 'green' technology and TRIPS compliance, consideration of 'greenness' in substantive patent law, and emerging patent litigations and antitrust disputes affecting green technology sectors.

The paper illustrates the need for a multifaceted approach to make effective use of IP for combating climate change. Technical progress can be rooted in a range of areas of scientific experimentation; likewise, policy solutions for climate change can come from complementary sources ranging from laws and regulations to tailored means of organizing patent information. Indeed, no matter how such options are combined and whether they are government regulated or privately initiated, the core promise of IP in this context may well be the optimal provision of information to technology users.

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I. Introduction

A. Connecting IP with Climate Change

The case of Tuvalu symbolizes the graveness of climate change. Only three meters above average sea level, the South Pacific island nation is susceptible to the serious adverse effects of global warming. Its Prime Minister has described the situation as follows: "for a highly vulnerable small coral atoll nation like Tuvalu, the consequences of the impacts of climate change are frightening. The survival and security, along with fundamental human rights, and the cultural identity of our entire nation is under threat."[1]

Not only Tuvalu but the entire world is facing the impact of climate change. The Intergovernmental Panel on Climate Change (IPCC), a scientific body jointly organized by the World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP) to assess the risk of climate change, reported that "warming of the climate system is unequivocal" as observed in the increase of global average temperature, melting of glaciers and sea level rise.[2] Such observed change is "very likely due to anthropogenic" (*i.e.*, originating in human activity) greenhouse gas concentration.[3]

The broad implementation of relevant technologies will be essential to international efforts to address climate change. In this context, the question for the IP community is: "what is the role of intellectual property in this scenario?"[4]

B. Purpose of Research

In connection with climate change, IP is often perceived as a double-edged sword.[5] While IP is broadly regarded as a necessary incentive to innovate, such temporary exclusivity is also questioned, especially when the access to technology is essential for public policy purposes, such as combating climate change.[6]

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1 H.E. Apisai Ielemia, Prime Minister of Tuvalu, General Debate at the 63rd U.N. General Assembly (Sept. 26, 2008) (transcript *available at* http://www.un.org/ga/63/generaldebate/pdf/tuvalu_en.pdf).

2 IPCC, Climate Change 2007: Synthesis Report 30 (2007).

3 *Id.* at 39.

4 Francis Gurry, Director General, WIPO, WIPO's Role in Green Technology, Speech at the WIPO Conference on Intellectual Property and Public Policy Issues (July 13, 2009).

5 WIPO, Climate Change and the Intellectual Property System: What Challenges, What Options, What Solutions? 3, *at* http://www.wipo.int/export/sites/www/patentscope/en/life-sciences/pdf/ip_climate.pdf.

This paper does not take a position on the desirability of the IP system as such. Rather, taking the existence of the system as a foundation, it aims to provide a comprehensive review of pragmatic IP-based options for promoting innovation and diffusion of technologies related to climate change. Among the various types of IP relevant to climate change,[7] patents are mainly discussed. In terms of structure, Chapter II starts with the meaning of 'green' technology, and, as background, describes facts and trends on relevant patenting activity and technology transfer. Chapter III summarizes technology development and transfer commitment within the framework of major multilateral environment agreements (MEAs) and discusses compatibility of such MEA commitments with the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement).[8] As the core of this paper, Chapter IV reviews the role of the patent system, subdivided into patent law, policy and information. Chapter V surveys technology transfer initiatives by IP communities and related IP issues. Chapter VI briefly explores complementary means of balancing IP and competition potentially relevant to climate change solutions, through a variety of angles that include patent litigation and standard-setting.

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6 *Cf.* IP is not the only barrier to wide dissemination of climate change technology. See Copenhagen Economics and the IPR Company, Are IPR a Barrier to the Transfer of Climate Change Technology? 30-32 (Jan. 19, 2009) (commenting that non-IP barriers such as lacking capital, trade barriers such as tariffs, poor infrastructure and the level of education are also significant).

7 *Id.* at 9-10 and 32-47; *see also* Antony Taubman, WIPO, The Climate of IP and the IP of Climate: an Overview of the Policy Issues, Speech at the Side Event UNFCCC COP 14 (Poznan, Dec. 1-12, 2008) (explaining that climate change mitigation and adaptation initiatives will utilize a broad spectrum of IP tools including trade secrets, certification and collective marks, geographical indications, undisclosed information and regulatory data, traditional knowledge, plant variety protection and unfair competition), *at* http://www.wipo.int/patentscope/en/lifesciences/ip_climate.html; *see also* Hee-Eun Kim, *Charting the Development of the Trademark Industry through INTA*, World Trademark Review 46 (June/July 2010) ("mirroring general global developments, enhancing the role of trademarks in developing and marketing environmentally responsible goods and services is an item for tomorrow's trademark practice agenda"); *see also* Hee-Eun Kim, Changing Climate, Changing Culture: Adding the Climate Change Dimension to the Protection of Traditional Cultural Expressions (on file with author, forthcoming).

8 Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr 15. 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, Legal Instruments – Results of the Uruguay Round Vol. 31, 33 I.L.M. 81 (1994) [hereinafter TRIPS or the TRIPS Agreement].

II. Defining Green Technology

A. Green Technology

1. What is Green Technology?

The nomenclature of 'green' technology can be nebulous, with different terms being used interchangeably. One example is clean technology, or 'cleantech'. Covering four main sectors, *i.e.*, energy, transportation, water and materials,[9] this typically refers to a "product, service, or process that delivers value using limited or zero non-renewable resources and/or creates significantly less waste than conventional offerings."[10] As cleantech gains popularity among venture capitalists, cleantech investment tends to be motivated by performance-based purchasing whereas environmental or green technology is often driven by regulation.[11]

MEAs frequently use the term 'environmentally sound technologies' (ESTs). Environmental soundness is a relative and normative concept.[12] ESTs "protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes"[13] and produce low or zero waste or end-of-pipe technologies.[14] Rather than separate technologies, these are total systems that include "know-how, procedures, goods and services, and equipment, as well as organizational and managerial procedures".[15]

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9 *E.g.*, James Nurton, *Get Ready for the Clean Tech IP Boom*, 182 Managing Intell. Prop. 40, 40-47 (2008) (stating that the main cleantech sectors are (i) power generation including wind, hydro, wave, geothermal and solar power and fuel cells; (ii) alternative types of fuel, such as biofuel, biomass and synfuels; (iii) technologies to capture and store carbon; (iv) environmental technology including water purification and treatment, recycling and waste treatment and desalination; (v) transportation including batteries and hybrid electric vehicles; and (vi) information technology and other systems to make energy storage and distribution more efficient, reduce unnecessary usage and facilitate emissions trading).

10 Ron Pernick, Clean Tech Revolution: The Next Big Growth and Investment Opportunity 2-5 (HarperCollins Publishers 2007).

11 *E.g.*, *Cleantech Definition: Clean is More than Green*, http://cleantech.com/about/cleantechdefinition.cfm (last visited Sept. 14, 2010).

12 Cristina Tébar Less and Steven McMillan, *Achieving the Successful Transfer of Environmentally Sound Technologies: Trade-Related Aspects* 7 (OECD Trade and Environment, Working Paper No. 2005-2 COM/ENV/TD(2004)33/FINAL, 2005).

13 U.N. Conference on Environment and Development, Rio de Janeiro, Braz., June 3-14, 1992, *Agenda 21*, Chapter 34, U.N. Doc. A/CONF.151/26/Rev. 1 (Vol.I), Annex II (1993) [hereinafter Agenda 21].

14 *Id.* at Chapter 34.2.

15 *Id.* at Chapter 34.3.

The United Nations Framework Convention on Climate Change (UNFCCC) contemplates mainly two types of technology: adaptation and mitigation.

Adaptation is defined as "adjustment in nature or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities."[16] In other words, adaptation concerns taking measures to reduce the negative effects or to exploit positive ones by making appropriate adjustments. Adaptation technologies include 'soft' forms such as crop rotation patterns and traditional knowledge, 'hard' forms like irrigation systems and drought-resistant seeds, and combinations of both such as early-warning systems.[17]

Mitigation involves finding solutions to reduce emission of greenhouse gases, or to capture or to absorb them in some kind of carbon repository. Marketable or close to marketability technologies include, *e.g.*, renewable energy options (solar panels, wind turbines, biofuels, biomass and hydro-power generation), carbon capture and storage, hybrid vehicles, animal waste management, clean coal technologies, and green buildings.[18]

Green technology embraces a variety of technical fields lowering the adverse impact of climate change. The patent system may provide practical assistance on what constitutes green technology, for example, through its classification system. Current efforts to prioritize and categorize green technology within the patent system are discussed in Chapter IV.

2. Facts and Trends in Green Patent Filing

Barton observes that the basic technical solutions of climate change have long been "off-patent," but that "specific improvements or features" are usually patent-protected.[19] This is in contrast with the pharmaceutical sector where an individual

16 UNFCCC, *Glossary of Climate Change Acronyms*, *at* http://unfccc.int/essential_background/glossary/items/3666.php (last visited Jan. 17, 2011).

17 *See generally* UNFCCC, Technologies For Adaptation To Climate Change (2006).

18 UNFCCC, *Fact Sheet: Why Technology Is So Important*, http://unfccc.int/press/fact_sheets/items/4989.php (last visited Sept. 14, 2010). *Also*, *supra* note 16 (explaining that mitigation in the context of climate change is "a human intervention to reduce the sources or enhance the sinks of greenhouse gases. Examples include using fossil fuels more efficiently for industrial processes or electricity generation, switching to solar energy or wind power, improving the insulation of buildings, and expanding forests and other "sinks" to remove greater amounts of carbon dioxide from the atmosphere").

19 John H. Barton, Intellectual Property and Access to Clean Energy Technologies in Developing Countries: An Analysis of Solar Photovoltaic, Biofuel and Wind Technologies 13 (ICTSD 2007).

patent may have a significant impact in the absence of substitutes and the rightholder tends to have a strong market position.[20]

Total patent applications worldwide have increased by 5% on average annually between 1997 and 2007,[21] but green technology patent filings show a much higher growth rate. Between 2009 and 2010 alone, the number of patents in the clean energy sector granted by the United States Patent and Trademark Office (USPTO) increased by 50%.[22] The European Patent Office (EPO) reported a 27% rise between 2008 and 2009 in clean energy patenting.[23]

Patent holders in the field of clean energy technology are based mostly in member countries of the Organisation for Economic Co-operation and Development (OECD) such as Denmark, Germany, Japan, Korea and the US, but China also ranks relatively high across the clean energy technology sectors.[24] In terms of patent activity by country, Japanese and German applicants are particularly active in solar energy and wind power technology, respectively, while US applicants concentrate on bio, geothermal, hydrogen, fuel cells, carbon capture and storage, and waste-to-energy.[25] Denmark is strong in wind power, Australia in bio energy, and China in solar and hydropower.[26] France, Canada and the UK are actively engaged in hydro, wave and tidal power and waste-to-energy, and the Netherlands in biomass.[27]

Among the various technology sectors, solar photovoltaic – light-to-electricity conversion technology – is of particular interest. Power generation from this basis has doubled every two years since 2002, and related international patent filings under the Patent Cooperation Treaty (PCT) have tripled between 2004 and 2008 (from 460 to 1,411 applications).[28] In view of the substantial increase in such patent applications, innovative thin-film technologies with better material and higher efficiency are likely to be "subject to more extensive patenting" in the future.[29]

In the wind power sector, wind turbine manufacturers are emerging not only from developed countries but also from developing countries. According to a Chatham House Report published in September 2009, the top four wind energy patent owners

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20 *Id*. at 4.
21 WIPO, World Intellectual Property Indicators 14 (2009).
22 Heslin Rothenberg Farley & Mesiti P.C., *Clean Energy Patent Growth Index* (June 3, 2010), *available at* http://www.cleanenergypatentgrowthindex.com.
23 EPO, Annual Report 2009 1 (2010).
24 Bernice Lee, Ilian Iliev and Felix Preston, Who Owns Our Low Carbon Future? Intellectual Property and Energy Technologies 12 (Chatham House 2009); for statistics on patent filing in solar energy, fuel cell technology, wind energy between 2001 and 2005, *see* WIPO, World Patent Report – A Statistical Review 44 (2008).
25 *See generally* WIPO, *Patent-based Technology Analysis Report: Alternative Energy* (2009).
26 *Id*.
27 *Id.*
28 WIPO, *Photovoltaic Technology Sunny Side Up*, WIPO Magazine 2-4 (June 2009).
29 *Supra* note 19.

together have 13% of all relevant patents whereas their collective market share for wind turbines is 57%.[30]

3. Increasing Investment and Technology Transfer

Particularly in certain developed countries, companies invest increasingly in green technology business plans and practices.[31] In Silicon Valley, more than 100 green patent technology patents were registered between 2006 and 2008, an increase of 7% over the previous three years.[32] Deutsche Bank predicts an increase in private equity, venture capital and infrastructure investment in climate change.[33] Such investment is propelled by innovation policy,[34] whereby investors want to make sure that what they contribute has appropriate IP protection.[35]

An OECD study reveals that whereas overall green technology innovation is concentrated in developed countries, with Japan, the US and Germany together accounting for 60% of total innovations, innovation in emerging economies such as China and Korea is not insignificant.[36] In terms of international technology diffusion, the percentage of so-called 'exported inventions' (*e.g.*, a patent filed in the US by a German inventor) between 1998 and 2003 suggests that three-quarters of exports occurred among developed countries.[37] Exports of inventions from developed countries to developing countries during the same period were less substantial (17.8%) but growing fast. At 1.5%, technology transfer among developing countries was minimal, leaving important potential for more exchanges in the future.[38]

The least developed countries (LDCs), small island developing states and other non-industrialized nations are vulnerable to climate change as their emissions are

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30 *Supra* note 24 at 25. *Cf. supra* note 24 at ix (the spread of ownership varies significantly across the sectors. For example, the top 20 companies in clean coal technology own 42% of total relevant patents whereas the top 20 in concentrated solar power technology have only 12%).

31 *E.g.*, Michael Hasper, *Green Technology in Developing Countries: Creating Accessibility through a Global Exchange Forum*, 1 Duke L. & Tech. Rev. 1, 3-6 (2009) (referring to Bosch and IBM's examples).

32 Joint Venture Silicon Valley Network, Climate Property: A Greenprint for Silicon Valley – 2009 38 (Feb. 2009) (reporting that 9% of all U.S. solar energy patents between 2005 to 2007 were registered in the Silicon Valley area, up from 3% in the mid-90s).

33 DB Climate Change Advisors, Investing in Climate Change 2010: A Strategic Asset Allocation Perspective 11-17 (2010).

34 *Id.*

35 *Supra* note 9.

36 *See generally*, Antoine Dechezleprêtre, Matthieu Glachant, Ivan Haščič, Nick Johnstone, Yann Ménière, OECD, Invention and Transfer of Climate Change Mitigation Technologies on a Global Scale: A Study Drawing on Patent Data (2008).

37 *Id.*

38 *Id.*

increasing. Attention is needed for "orphan" areas of research even with few market incentives for innovation (*e.g.*, drought-resistant plant varieties or small-scale desalination).[39] To an extent, indigenous innovation or traditional knowledge at the local level could facilitate adaptation to changing weather conditions, but integrating such knowledge with modern technology may be necessary.[40]

39 Wendy Neal, Ashok Gadgil and Josephin Mutugu, Panel Discussion at the Conference on Intellectual Property Rights and Technology Transfer in the U.N. Climate Negotiations, University of California, Berkeley (Oct. 27, 2009).

40 Alfred A. Oteng-Yeboah, Deputy Director General, Council for Scientific and Industrial Research, Ghana, The Challenges Faced by Emerging and Developing Countries Regarding Eco-innovation and on Policies to Remedy These Challenges: The Case of MEAs, Presentation at the Global Forum on Environment on Eco-Innovation, OECD (Nov. 5, 2009).

III. Background: International Legal Framework for Climate Change

A. Green Technology Innovation and Diffusion under International Law

1. Declaration of the UN Conference on the Human Environment (1972)

In 1972, the international community discussed global environmental issues for the first time at the UN Conference on the Human Environment.[41] This conference concluded with the Declaration of the UN Conference on the Human Environment, which contains numerous principles on the preservation and enhancement of the human environment. Among these, Principle 20 states that "environmental technologies should be made available to developing countries on terms which would encourage their wide dissemination without constituting an economic burden on the developing countries."[42]

2. Agenda 21 (1992)

Agenda 21, adopted at the UN Conference on Environment and Development (also known as the Rio Summit) in 1992, affirmed the aforementioned principle. It recognizes a "need for favourable access to and transfer of environmentally sound technologies, in particular to developing countries."[43] In addition, the role of patent protection and IP rights must be considered together with their "impact on the access to and transfer of environmentally sound technology" in order to develop "effective responses to the needs of developing countries in this area."[44]

3. Convention on Biological Diversity (1993)

The access to and transfer of technology commitment under the Convention on Biological Diversity (CBD)[45] provides guidance for climate change negotiations.

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41 Declaration of the U.N. Conference on the Human Environment, Stockholm, June 16, 1972, U.N. Doc. A/CONF.48/14/Rev. 1 (1972) [hereinafter Stockholm Declaration].
42 *Id.*
43 *Supra* note 13 at Chapter 34.4.
44 *Id.* at Chapter 34.10.
45 Convention on Biological Diversity, *open for signature* June 5, 1992, 1760 U.N.T.S. 143, 31 I.L.M. 818 (1972) [hereinafter CBD].

CBD Article 16(1) ensures parties' obligation to provide and facilitate access to and transfer of relevant technologies. According to Article 16(2), this obligation should be fulfilled "under fair and most favourable terms, including on concessional and preferential terms when mutually agreed."[46] Article 16(3) bridges the CBD with TRIPS by stating that parties shall not provide compulsory licenses "under conditions which would contravene the provision of Art. 31 of the TRIPs Agreement."[47] Article 16(5) obliges parties to "cooperate …. subject to national legislation and international law …. to ensure that [IP rights] are supportive of and do not run counter to its objective."[48] In addition, the Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization[49] were published in 2001 to serve a balanced operation of the CBD framework.[50]

4. UN Framework Convention on Climate Change (1994)

A major achievement of the Rio Summit is the UN Framework Convention on Climate Change.[51] The goal of the UNFCCC is "the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[52] Since 1995, the parties to the UNFCCC have met regularly in Conferences of the Parties (COP) to assess progress. In 1997, the Kyoto Protocol established binding targets and obligations for reducing greenhouse gas emissions, as further discussed below.

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46 *Id.* at art. 16(2).
47 *Id.* at art. 16(3).
48 *Id.* at art. 16(5).
49 CBD, The Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization (2002) (following CBD Article 15 on the terms and conditions for access to genetic resources and benefit sharing, the Bonn Guidelines (i) set up steps for access and benefit-sharing stressing users' obligation to seek the prior informed consent of providers; (ii) provide for basic requirements for mutually agreed terms and identify the rights and obligations of users and providers; and (iii) contain elements on incentives, accountability, dispute settlement and verification and elements of material transfer agreement with a non-exhaustive list of monetary and non-monetary benefits.
50 Joseph Straus, *Patents on Biomaterial – A New Colonialism or a Means for Technology Transfer and Benefit-Sharing? in* Bioethics in a Small World 45-72 (Felix Thiele and Richard E. Ashcroft eds. 2005).
51 UN Framework Convention on Climate Change, May 9, 1992, 1771 U.N.T.S 108, *reprinted in* 31 I.L.M. 849 (1992) [hereinafter UNFCCC].
52 *Id.* at art. 2.

a) Responsibility for Vulnerable Countries

Under the UNFCCC, industrialized countries are to support climate-change activities in developing countries by providing financial support and sharing technology.[53] Parties to the UNFCCC are divided into Annex I countries, Annex II, and others. The Annex I group consists of industrialized nations and so-called 'economies in transition'. Annex II is a sub-group of the Annex I countries, with more developed economies.[54] Annex II countries support climate-change activities in developing countries by providing financial and technical support.[55]

b) Push Factors

Hutchison notes that the climate change regime, consistent with other MEAs, takes two complementary approaches in dealing with technology transfer: "push factors" and "pull factors".[56] Push factors are active technology transfer initiatives by governments of developed countries, whereas pull factors are the creation of favourable conditions in developing countries to attract technology through trade and investment.[57] The UNFCCC contains a number of 'push' provisions. UNFCCC Article 4.1 imposes on all parties an obligation to encourage and collaborate in the development and transfer of technologies in relevant sectors.[58] UNFCCC Article 4.7 points out that the implementation of commitments made by developing countries would largely depend on the commitments of developed countries.[59] To this end, UNFCCC Article 4.3 obliges developed countries to provide financial resources to meet the incremental costs of ESTs[60] and UNFCCC Article 4.5 mandates that developed countries shall take all practicable steps to promote the transfer of, or access to, ESTs and know-how to developing countries.[61]

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53 UNFCCC, *Feeling the Heat*, http://unfccc.int/essential_background/feeling_the_heat/items/2914.php (last visited July 18, 2010).

54 In fact, all of the current Annex II countries are OECD members. *Cf.* Turkey had been deleted from Annex II by an amendment that entered into force on June 28, 2001, pursuant to decision 26/CP.7 adopted at the COP 7.

55 *Supra* note 52.

56 Cameron Hutchison, *Does TRIPS Facilitate or Impede Climate Change Technology Transfer into Developing Countries?*, 3 University of Ottawa Law & Technology Journal 519, 519-537 (2006).

57 *Id.*

58 UNFCCC, *supra* note 51 at art. 4.1.

59 UNFCCC, *supra* note 51 at art. 4.7.

60 UNFCCC, *supra* note 51 at art. 4.3.

61 UNFCCC, *supra* note 51 at art. 4.5.

c) Expert Group on Transfer of Technology

At the COP 7 held in Marrakech in 2001, parties adopted a framework for solutions for the implementation of UNFCCC Article 4.5 and, for this purpose, established an expert group on technology transfer.[62] The stated key elements of the technology transfer framework are: (i) technology needs assessments; (ii) technology information; (iii) an enabling environment; (iv) capacity-building; and (v) mechanisms for technology transfer.[63] For technology information, the UNFCCC Secretariat launched a web-based inventory of technology transfer information called "Technology Transfer Clearing House (TT:CLEAR)".[64]

d) Bali Action Plan and Technology Transfer

The COP 13 in 2007 adopted the Bali Road Map and its Action Plan that were to culminate in a binding agreement in Copenhagen in 2009. The Bali Action Plan launched a comprehensive process to enable full implementation of the UNFCCC through long-term cooperative action, now, up to and beyond 2012 by addressing, *inter alia*, "enhanced action on technology development and transfer" and "on the provision of financial resources and investment."[65]

e) Ad Hoc Working Group on Long-term Cooperative Action

The COP 13 also established the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) to conduct the process for implementation of the UNFCCC. In connection with technology development and transfer, the AWG-LCA proposes that a "Technology Mechanism" shall be established to support and accelerate the diffusion of ESTs and that such mechanism will be guided by a "country-driven approach" based on national circumstances and priorities.[66]

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62 Conference of the Parties on its 7th Session, Marrakesh, Morocco, Oct. 29 - Nov. 10, 2001, 4/CP.7 Development and Transfer of Technologies, UNFCCC Doc. FCCC/CP/2001/13/Add. 1 (Jan. 21, 2002).

63 UNFCCC, UNFCCC Expert Group on Technology Transfer, Five Years of Work 3-8 (2007).

64 *See* its website *at* http://unfccc.int/ttclear (last visited Apr. 20, 2011).

65 Conference of the Parties on its 13th Session, Bali, Indonesia, Dec. 3-14, 2007, Decision 1/CP.13 Bali Action Plan, UNFCCC Doc. FCCC/CP/2007/6/Add.1 (Mar. 14, 2008).

66 Ad Hoc Working Group on Long-term Cooperative Action under the UNFCCC on its 8th Session, Copenhagen, Denmark, Dec. 7-15, 2009, agenda item 3, UNFCCC Doc. FCCC/AWGLCA/2009/17 (Feb. 5, 2010).

During the negotiations preceding the COP 15 in Copenhagen, developing countries proposed a number of options for IP rights, including IP sharing, patent pools, compulsory licensing,[67] placing the outcome of publicly funded research on climate change technology in the public domain, and an international instrument similar to the Doha Declaration on Public Health for climate change.[68] These proposals prompted counteraction from developed countries, such as a bill passed by the US House of Representatives in June 2009 against any international negotiations that may weaken IP protection of green technology.[69] Business communities also called for such protection in climate change negotiations.[70]

Failing to produce a legally binding instrument, the COP 15 concluded the Copenhagen Accord which merely took note of the agreements in the past. Paragraph 11 of this Accord states that a Technology Mechanism for rapid development and

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67 UNFCCC AWG-LCA, Oct. 27, 2008, Proposal by the G77 and China for a Technology Mechanism under the UNFCCC *included in* Ideas and Proposals on the Elements Contained in Paragraph 1 of the Bali Action Plan, Paper No.1: Antigua and Barbuda on behalf of the Group of 77 and China 6-9 UNFCCC Doc. FCCC/AWGLCA/2008/MISC.5 (Oct. 27, 2008) (arguing that the Bali Action Plan will "ensure that privately owned technologies are available on an affordable basis including through measures to resolve the barriers posed by intellectual property rights and addressing compulsory licensing of patented technologies").

68 *Id.* at Paper No.4: Brazil 29 (proposing new approaches that combine IP protection and technological sharing, "bearing in mind the example set by decisions in other relevant international fora related to intellectual property rights, such as the Doha Declaration on the TRIPS Agreement and Public Health").

69 Foreign Relations Authorizations Act Fiscal Years 2010 and 2011, H.R. 2410, 111th Cong. Section 1120A (2009-2010) (stating that it shall be the policy of the US that, with respect to the UNFCCC, the President, the Secretary, and the Permanent Representative to the UN should prevent any weakening of international legal protections of IP rights related to energy or environmental technology; *see also* American Clean Energy and Security Act of 1978 as amended in 2009 (also known as ACES or Waxman-Markey Climate Change Bill), H.R. 2454, 111th Cong. Subtitle D – Exporting Clean Technology (2009-2010); *see also* Department of State, Foreign Operations, and Related Programs Appropriations Act 2010, H.R. 3081, 111th Cong. Section 7089 (2009-2010) (stating that "[p]rior to the obligation of the funds made available in this Act for 'Contribution to the Clean Technology Fund' of the World Bank, the Secretary of State shall certify in writing to the Committees on Appropriations that all actions taken during the negotiations of the UNFCCC ensure robust compliance with and enforcement of existing international legal requirements as of the date of the enactment of this Act that respect intellectual property rights and effective intellectual property rights protection and enforcement for energy and environment technology").

70 International Chamber of Commerce (ICC), Submission on the Review and Assessment of the Effectiveness on the Implementation of Articles 4, Paragraph 1(c) and 5, of the Convention (2009) (emphasizing the correlation between IP protection and foreign direct investment *i.e.*, companies are less willing to invest where IP protection is weak); *see also* Joseph Straus, *The Impact of the New World Order on Economic Development: The Role of the Intellectual Property System*, 6 J. Marshall Rev. Intell. Prop. L. 1, 7 (2006)(commenting that foreign companies heavily invested in China because of the new WTO legal system and China's entrance into WTO, and further development of China's IP protection played a decisive role, despite all of the still prevalent deficits to TRIPS standards).

transfer of climate change adaptation and mitigation will be "guided by a country-driven approach" and be based on "national circumstances and priorities."[71]

5. UN Convention to Combat Desertification (1996)

Climate change negotiators can also refer to certain provisions of the UN Convention to Combat Desertification (UNCCD).[72] Article 18 of the UNCCD governs obligations regarding transfer, acquisition, adaptation and development of relevant technology and provides for commitments on technology diffusion from developed countries to developing countries. Parties must take into account the need to protect IP under UNCCD Article 18(1)(b) and (e) and take appropriate measures to create domestic market conditions and incentives conducive to development, transfer, acquisition and adaptation of suitable technology, knowledge, know-how and practices. Parties may employ different technology transfer models such as standards or joint ventures (Article 18(1)(d) of the UNCCD). Pursuant to Article 18(2)(a) of the UNCCD, parties shall publish inventories of technology, knowledge, know-how and practices.[73]

6. Kyoto Protocol (1997)

The Kyoto Protocol to the UNFCCC,[74] adopted in December 1997 and entered into force in February 2005, imposes binding obligations on Annex I countries to reduce greenhouse gas emissions, whereby the benchmark is the 1990 level of greenhouse gases.[75] The Kyoto Protocol provides for flexible market-based mechanisms including emission trading, a Clean Development Mechanism (CDM) and Joint Implementation (JI) options for greenhouse gas reduction.[76] The CDM allows developed countries to invest in emission reduction projects in developing countries and to receive credit for the emission reduction or removal achieved. The resulting emission allowances can be used by developed countries to meet their emission

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71 Conference of the Parties on its 15th Session, Copenhagen, Denmark, Dec.7-19, 2009, Decision 2/CP.15 Copenhagen Accord, UNFCCC Doc. FCCC/CP/2009/11/Add.1 (Mar. 30, 2010).

72 U.N. Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, June 17, 1994 33 I.L.M. 1328 [hereinafter UNCCD].

73 *Id.* at art. 18.

74 Kyoto Protocol to the UNFCCC, *adopted* Dec. 10, 1997, 37. I.L.M. 22 (*entered into force* Feb. 16, 2005) [hereinafter Kyoto Protocol].

75 Conference of the Parties on its 3rd Session, Kyoto, Japan, Dec. 1-11, 1997, Decision 2/CP. 3 Methodological issues related to the Kyoto Protocol, UNFCCC Doc. FCCC/CP/1997/7/Add.1(Mar. 25, 1998).

76 Kyoto Protocol, *supra* note 74 at art. 12.

targets. CDM projects may also include transfer of green technology from developed countries to developing countries.

B. Compatibility with TRIPS Flexibilities

1. Technology Transfer Obligation under TRIPS Articles 7, 8(1) and 66(2)

The TRIPS Agreement includes provisions for creating favourable conditions in developing countries to attract technology through trade and investment (pull factors).[77] However, TRIPS also recognizes LDCs' special need for flexibilities with respect to their national laws in order to allow them to establish "a sound and viable technological base."[78] To list a few TRIPS provisions that emphasize such equilibrium between rights and obligations, Article 7 provides that the protection and enforcement of IP should "contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users."[79] Article 8(1) allows Members to "adopt measures necessary to protect public health …. and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that those measures are consistent with TRIPS."[80] Article 66(2) also provides, as a basis for the active transfer of technology to developing countries, that developed country members shall provide incentives (monetary or otherwise) to institutions to encourage transfer to LDCs for their technology base.[81]

2. Exceptions to Rights under TRIPS Article 30

To cure potential market inefficiencies occurring as a result of exclusive rights, the scope of patents may be balanced out mainly through two mechanisms:[82] (i) ex-

77 *Supra* note 56 (by setting strong minimum standards of protection on patent terms, exclusive rights and national treatment).
78 TRIPS Agreement, *supra* note 8 at the Preamble.
79 *Id.* at art. 7.
80 *Id.* at art. 8(1).
81 *Id.* at art. 66(2). *Cf.* TRIPS Article 66(1) provides an extendable transition period of ten years for LDCs.
82 WIPO Standing Committee on the Law of Patents 13th Session, Exclusions from Patentable Subject Matter and Exceptions and Limitations to the Rights, Mar. 23-27, 2009, Paras. 10-11, WIPO Doc. SCP/13/3 (Feb. 4, 2009).

cluding certain uses of a patented invention from infringement;[83] and (ii) allowing third parties to use a patented invention subject to remuneration (*e.g.*, compulsory licensing). These mechanisms are foreseen by Articles 30 and 31 of the TRIPS regimes, respectively. (Article 31 is discussed further below.)

According to Article 30, countries may provide limited exceptions to the exclusive rights conferred by a patent, as long as such exceptions (i) do not unreasonably conflict with a normal exploitation of the patent; (ii) do not unreasonably prejudice the legitimate interests of the patent owner; and (iii) take into account the legitimate interests of third parties.[84] Examples either codified or recognized in common law include private use, research or teaching, preparation of a medicine under individual prescription, experimentation on the invention, prior use, experiments for seeking regulatory approval for marketing a product after the patent expiration, or import of patented products legally marketed in another country (*i.e.*, the principle of exhaustion).[85]

In connection with the proposals made by developing countries in the process of climate change negotiations, especially the revocation of IP rights or compulsory sharing of publicly funded research, it may be noted that in some developed countries, national legislation concerning the IP management of publicly funded research can limit government options. In the US, for example, the so-called Bayh-Dole Act[86] permits universities, small enterprises and non-profit research institutions to own IP rights generated from research funded by the federal government. Even if the government is granted a license (non-exclusive and non-transferable), further use is subject to permission by the patentee.[87]

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83 *Id.* at Para. 83 (stating that, for instance, Article 27 of the Convention on International Civil Aviation of 1944 contains exceptions to patents regarding "international air navigation so that the authorized entry of an aircraft in the territory shall not entail any seizure of the aircraft on the grounds of a patent infringement" and "the storage of spare parts and spare equipment for the aircraft and the right to use and install the same in the repair of an aircraft" subject to certain conditions).

84 TRIPS Agreement, *supra* note 8. at art. 30.

85 Daniel Gervais, The TRIPS Agreement Drafting History and Analysis 2.271-2.275 (Thomson Reuters (Legal) Limited 3rd ed. 2008).

86 University and Small Business Patent Procedures Act, 35 U.S.C. §§ 200-212 (1980). Japan and Korea also have similar law.

87 *Cf.* however, the Bayh-Dole Act retains the so-called "march-in rights" exception. In case the university or research organization does not reasonably seek patent protection and does not commercialize the patented technology, the federal government can deny the exclusive rights conferred to the patent owner and use the technology.

3. Compulsory Licensing under TRIPS and Beyond

a) For Public Health

Additional to general conditions for patent exceptions under Article 30 of the TRIPS Agreement,[88] Article 31 provides conditions for 'other use'[89] of an invention without the approval of a right-holder upon authorization from the government. Article 31(b) waives the requirement of *ex-ante* efforts to obtain a license from a right-holder in cases of a national or other extreme emergency or public non-commercial use.[90] For example, countries have granted or considered granting compulsory licensing for pharmaceutical products treating malaria, HIV/AIDS,[91] anthrax,[92] bird flu,[93] cancer and heart diseases.[94]

As part of these conditions, TRIPS Article 31(f) stipulates that compulsory licensing shall be "predominantly for the supply of the domestic market."[95] In the context of public health, this provision resulted in restriction of the amount of drugs that could be manufactured and exported under compulsory licensing. It also made it difficult for LDCs with insufficient manufacturing capability to find suppliers under compulsory licensing. To address this issue, the WTO TRIPS Council adopted the Doha Declaration on TRIPS and Public Health in 2001[96] and, in 2003, the WTO General Council decided to waive the requirement under Article 31(f) so as to

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88 TRIPS Agreement, *supra* note 8, at art. 30 (providing for such exceptions that they "do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties").

89 "Other use" refers to use other than that allowed under TRIPS Article 30.

90 TRIPS Agreement, *supra* note 8, at art. 31(b).

91 *See generally*, Frederick M. Abbott, *The Doha Declaration on the TRIPS Agreement and Public Health: Lighting a Dark Corner at the WTO*, 5(2) J. of Int. Economic Law 469 (Oxford University Press, 2002).

92 *See generally*, In re Ciprofloxacin Hydro chloride Antitrust Litigation, 166 F. Supp. 2d 740 (E.D.N.Y. 2001); Timothy J. Burger, *Chuck Pushes Plan to Let Other Firms Make Cipro*, N.Y. Daily News, Oct. 19, 2001, http://www.nydailynews.com/archives/news/2001/10/19/2001-10-19_chuck_pushes_plan_to_let_oth.html; *and* James Thuo Gathii, *Balancing Patent Rights and Affordability of Prescription Drugs in Addressing Bio-Terrorism: An Analysis of In Re Ciprofloxacin Hydro chloride Antitrust Litigation*, 13 Alb. L. J. Sci. & Tech. 651 (2003).

93 *E.g.*, Eileen McDermott, *Flu Crisis Could Lead to Compulsory Licenses*, Managing Intell. Prop., May 3, 2009, http://www.managingip.com/Article/2193267/Search-Results/Flu-crisis-could-lead-to-compulsory-licences-full-version.html.

94 *E.g.*, The Ministry of Public Health and The National Health Security Office of Thailand, Facts and Evidences on the 10 Burning Issues Related to the Government Use of Patents on Three Patented Essential Drugs in Thailand (Feb. 2007); *and* The Ministry of Public Health and The National Health Security Office of Thailand, The 10 Burning Questions on the Government Use on the Four Anti-Cancer Drugs in Thailand (Feb. 2008).

95 TRIPS Agreement, *supra* note 8, at art. 31(f).

96 WTO, Ministerial Declaration of 12 November 2001, WT/MIN(01)/DEC/1, 41 I.L.M. 746 (2002) [hereinafter Doha Declaration].

enable cross-border compulsory licensing.[97] Sofar, this cross-border compulsory licensing option has been tested once for production and exports of generic HIV/AIDS medicines from Canada to Rwanda.[98]

b) For Climate Change?

Considering the public importance of climate change technology, it may be tempting to draw an analogy between public health and climate change for the purpose of dealing with IP issues. However, Abbott cautions that "[e]ven assuming *arguendo* that developing countries would support its transposition to the climate change arena, it would not seem adequate simply to declare [Article 31*bis* Amendment to TRIPS] to apply *mutatis mutandis*."[99] Indeed, while green technology transfer is key to the capacity of developing countries to address climate change, a number of considerations rather undermine the validity of the notion as such of a so-called Doha Declaration on Climate Change.

First, the role of IP protection in the pharmaceutical industry may be quite distinct from its role in the renewable energy sectors.[100] While a single non-substitutable patent can have significant impact in drugs by conferring strong market power to the patentee, the renewable energy sectors appear to experience a higher degree of competition and substitutability,[101] not only among patented products in the spe-

97 WTO General Council, Decision of 30 August 2003, WT/L/540 and Corr.1. *See also* TRIPS Agreement, *supra* note 8, at art. 31*bis*. *See also* WIPO, Committee on Development and Intellectual Property (CDIP) Fifth Session (Apr. 26-31, 2010), Patent Related Flexibilities in the Multilateral Legal Framework under Their Legislative Implementation at the National and Regional Levels, WIPO Doc. CDIP/5/4 (Mar. 1, 2010) and *as revised in* WIPO Doc. CDIP/5/4/Rev. (Aug. 18, 2010) (identifying countries which have implemented the outcome of this WTO General Council decision in national law, including Albania, Belgium, China, Croatia, France, Hungary, Iceland, India, Lithuania, the Netherlands, Norway, the Philippines, the Republic of Korea, Singapore, Switzerland, the former Yugoslav Republic of Macedonia and the United Kingdom).

98 WTO, TRIPS and Public Health: Dedicated Webpage for Notifications, http://www.wto.org/english/tratop_e/trips_e/public_health_e.htm.

99 Frederick M. Abbott, Innovation and Technology Transfer to Address Climate Change: Lessons from the Global Debate on Intellectual Property and Public Health 27 (ICTSD, 2009).

100 *E.g.*, John H. Barton, Intellectual Property and Access to Clean Energy Technologies in Developing Countries: An Analysis of Solar Photovoltaic, Biofuel and Wind Technologies 1 (ICTSD, 2007); *see also generally* Mark A. Lemley, Industry-Specific Antitrust Policy for Innovation (Stanford Law and Economics Olin Working Paper No. 397, 2010).

101 *Id*. at 13.

cific sector but also across traditional energy sectors and fungible alternate energy sources.[102]

Moreover, unlike the more matured pharmaceutical industry, the green technology industry is still in its early stages. Hence, its evolvement is perceived to be more comparable to "the semiconductor industry 35 years ago, or the biotechnology industry 25 years ago."[103] In this view, compulsory licensing at this early stage may hinder the green technology sectors from engaging in further innovation.[104]

Second, there are further differences from the area of medicines that are relevant to 'cross-border' compulsory licensing. Building wind farms or carbon capture storage facilities must cater to certain meteorological or geological conditions specific and sensitive to location. The challenge of efficient transportation of energy over long distance also burdens licensing schemes, although energy-delivering means such as smart grids are improving and increasingly attracting investment.[105] In this regard, more commoditized renewable energy products such as off-grid solar panels or certain components of wind turbines may be better candidates for international transactions. (As to solar panels, due in part to Chinese production, supply is expected to leapfrog demand.)[106]

Therefore, technology transfer programs in the form of turn-key construction projects (*e.g.*, a consortium between Gamesa and Iberdrola Ingenieria to build a wind farm in Kenya with financing from Spanish aid fund Fondos de Ayuda al Desarrollo),[107] foreign direct investment or joint ventures may offer more sustainable approaches for purposes of technology transfer.

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102 *E.g.*, Craig Waldman and Margaret Ward, *Antitrust Issues in Clean Technology*, The Antitrust Source (Apr. 2010), *available at* http://www.antitrustsource.com (observing that the enforcement agencies "will likely consider 'clean tech' as consisting of many markets whose contours will undoubtedly change as these sectors evolve over time"); *see also* Panasonic Corp. FTC Docket No. C-4274, File No. 091-0050, Jan. 6, 2010, *available at* http://www.ftc.gov/os/caselist/0910050.shtm (concerning the definition of a relevant market in the context of a merger investigation of cleantech companies).

103 Tim Wilson, *Undermining Mitigation Technology Compulsory Licensing, Patents and Tariffs* (Institute of Public Affairs IPA Backgrounder 2008), *at* http://www.apec.org.au/docs/08_IPAAASSC_MT.pdf.

104 *Id.*

105 *E.g.*, Scott Malone, *Google Joins $5 Billion US Offshore Wind Grid Project*, *Reuters*, Oct. 12, 2010, http://www.reuters.com/article/idUSTRE69B0ZA20101012.

106 *E.g.*, Press Release, IMS Research, Chinese Supplies Top IMS Research's PV Cell and Module Supplier Rankings in Q3, 10 (Jan. 4, 2011); Press Release, IMS Research, IMS Research's Solar Module Rankings: Suntech Reaches the Top in Q2 (Aug. 26, 2010); Press Release, IMS Research, First Solar Remains Largest Supplier in First Quarter (June 7, 2010); *see also* Renewable Energy Policy Network for the 21st Century (REN21), *Renewables 2010 Global Status Report*, 31 (2010).

107 *E.g.*, Ben Sills, *Iberdrola, Gamesa Win Wind Contract From Kenya Utility in $26 Million Deal*, Bloomberg, http://www.bloomberg.com/news/2011-01-07/iberdrola-gamesa-win-wind-contract-from-kenya-utility-in-26-million-deal.html.

Third, even if limited in scope, certain data on green technology IP owners' willingness to license are viewed as suggesting a generally positive outlook for green technology transfer, including to developing countries. A European Patent Office survey on green technology licensing activities strikes a positive note on the prospect of green technology transfer.[108] About half of respondents (private and public entities headquartered in developed countries plus some in countries such as China and South Africa) declared to have a 'significant or substantial' portion of clean energy patents in their patent portfolio. 73% of respondents believe it is important to seek opportunities to license out their technologies, and 82% of respondents view IP as vital to licensing transactions. 70% stated to be willing to consider more flexible or accommodating conditions, where such transactions involve developing countries.[109]

In conclusion, MEAs often contain some degree of technology transfer obligation, mostly subject to appropriate IP protection. Irrespective of the AWG-LCA proposal, WTO Members have the right to exercise the TRIPS flexibilities such as compulsory licensing, for example in national emergency conditions or for public non-commercial use. It appears as yet untested to what extent the climate change problem would meet such conditions. More relevant perhaps from a practical perspective however, the absence of enforceable proprietary rights in a country would not guarantee automatic technology transfer.[110]

108 EPO, UNEP, ICTSD and OECD, Patents and Clean Energy: Bridging the Gap Between Evidence and Policy: Final Report 50-61 (2010).
109 *Id.*
110 *E.g.*, *supra* note 6.

IV. Role of the Patent System

Many theories exist on the proper justification for the patent system. Patents have been recognized as an inventor's natural right, a reward for innovation to recoup the investment, an incentive to create, an exchange for a secret.[111] Patents can also be valued as the prospect or potential for future commercialization.[112] From the property rights theory perspective, the system of exclusive and assignable IP rights encourages owners to maximize innovation, efficiency and profits, in a way that is "also best for the society."[113] Thus, policymakers should "create and allocate entitlements to resources in the fashion that best enables people to fulfill [fundamental human] needs."[114] This chapter explores the role of the patent system in the context of climate change by looking at three components of the patent system: patent law, patent policy and, independent from patent policy, patent information.

A. Role of Patent Law

1. TRIPS Article 27(2) and Ordre Public

Whether or not patent law is 'neutral' in public purpose is a subject of ongoing debate.[115] Some argue that TRIPS Article 27(1) upholds the neutrality of patent law by providing that, "subject to the provisions of paragraphs 2 and 3, patents shall be available for any inventions, whether products or processes, in all fields of technology."[116] Others argue that patent law is not so neutral because the underlying justification for such exclusive rights is the utilitarian belief that technological

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111 From the comparative viewpoint, Machlup explains that compulsory licensing is usually granted to remedy "abuse" in England whereas it is granted to safeguard "public interest" in Germany. *See* Fritz Machlup, An Economic Review of the Patent System (U.S. Govt. Print. Off. 1958).

112 Edmund W. Kitch, *The Nature and Function of the Patent System*, 20(2) Journal of Law and Economics 265, 265-290 (Oct. 1977).

113 *See generally*, Michael Lehmann, *Property and Intellectual Property – Property Rights as Restrictions on Competition in Furtherance of Competition*, IIC (1989).

114 William Fisher, *Theories of Intellectual Property*, in New Essays in the Legal and Political Theory of Property (Stephen Munzer ed., Cambridge University Press 2001), *available at* http://www.tfisher.org.

115 *E.g.*, Nuno Pires de Carvalho, The TRIPS Regime of Patent Rights (Wolters Kluwer, 3rd ed. 2010) (commenting that "the reality is that the same patent system that promotes green technologies also promotes polluting technologies"); *see also* WIPO, *The Green Debate: IP Perspectives: What Color Is IP?*, WIPO Magazine (June 2010).

116 TRIPS Agreement, *supra* note 8, at art. 27(1).

progress benefits society.[117] According to the latter view, patent law can and must help to protect the environment, by the following mechanisms: negative (excluding polluting inventions from being patented), positive (giving preferential treatment to green inventions) and hybrid (combining both elements).[118]

In relation to the 'negative' approach, TRIPS Article 27(2) allows WTO Members to exclude from obtaining patents, "inventions, the prevention … of the commercial exploitation of which is necessary to protect *ordre public* or morality … or to avoid serious prejudice to the environment …."[119] Similarly, Article 53(a) of the European Patent Convention (EPC)[120] states that European patents shall not be granted in respect of inventions the commercial exploitation of which would be contrary to *ordre public* or morality. The European Patent Office (EPO) Boards of Appeal confirmed that, under EPC Article 53(a), inventions the exploitation of which is likely to seriously prejudice the environment are to be excluded from patentability as being contrary to *ordre public*.[121]

In practice, as patent examiners are not trained to evaluate aspects of ethics or risk,[122] this provision can be applied "only in rare and extreme cases"[123] and on an individual basis. Also, assessment of the Article 53(a) objection takes account not only of potential risks to the environment but also of the invention's potential benefits to society.[124] For instance, in the *Onco-Mouse* case,[125] the Board held that a "careful weighing up" of animal suffering and substantial medical benefit would be necessary.[126]

Some argue that patent law also contains a 'positive' mechanism favoring certain technical fields.[127] For instance, drugs have to obtain marketing approval with extensive clinical data. Since a lot of testing is executed after the patent issuance, the effective duration of patent protection for many drugs can be relatively short. As a result, a patent restoration mechanism supplementing the period lost due to the

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117 Estelle Derclaye, *Patent Law's Role in the Protection of the Environment – Re-Assessing Patent Law and Its Justification in the 21st Century*, IIC 249-273 (2009).

118 *Id.*

119 TRIPS Agreement, *supra* note 8, at art. 27(2); *see also supra* note 85 at 2.237-2.240.

120 Convention on the Grant of European Patents, *signed* Oct. 5, 1973 (*entered into force* Oct. 7, 1977), 1160 U.N.T.S. 231, 134 I.L.M. 270 (Oct. 5, 1973) [hereinafter EPC or European Patent Convention].

121 *Plant Genetic Systems N.V., et al. v. Greenpeace Ltd.*, T 0356/93 – 3.3.4, EPO Boards of Appeal (Feb. 21, 1995).

122 Rainer Moufang, *The Concept of "Ordre Public" and Morality in Patent Law*, *in* Patent Law, Ethics and Biotechnology (Geertrui Van Overwalle ed., Katholieke Universiteit Brussel 1998).

123 EPO, *Guidelines for Examination in the European Patent Office* Part C – Chapter IV 8 (2010).

124 Joseph Straus, *Biotechnology and Patents*, 54 Chimia No. 5, 293, 293-298 (2000).

125 *Harvard/Onco-Mouse*, T 0019/90 – 3.3.2 EPO Boards of Appeal (Oct. 3, 1990).

126 EPO, Case Law of the Boards of Appeal of the European Patent Office 39 (5th ed. 2006).

127 *Supra* note 117.

market approval proceedings has been adopted[128] to allow patent holders to recoup their investment and to promote further innovation.

However, such mechanisms would function more as a bridge between patent law and other regulatory regimes, than as a sub-component of patent law. Indeed, although applying for SPCs or patent term restoration under the Hatch-Waxman Act requires the existence of a basic patent, other types of market exclusivities available under the same law can be granted even in the absence of a patent. Coming back to the area of green technology, would green patents need a special term of protection? At this point, the answer is probably no. For one thing, as discussed earlier, green inventions by nature are not on an equal footing with pharmaceutical inventions. Generally, regulatory approval for environmental soundness is not (yet) as rigorous as marketing approval for drugs, making any reduction of the patent term as a result of regulatory proceedings less considerable.

A progressive example of the hybrid mechanism is the following: "it could be said that, *in order to be patented*, every process or product that emits GHG should emit 8% less than the product's emissions in 1990 (the target the EU agreed to respect in the context of the ratification of the Kyoto Protocol). If the invention emits even less than this target, it would *qualify to receive preferential treatment* (emphasis added)."[129] The idea is to integrate the concept of environmental soundness, or more precisely, greenhouse gas emission, into the body of patent law.

Although this model could serve as a strong motivation for going green, it would be controversial for patent law to embrace the concept of 'greenness' as an actual part of the patentability requirements. While patent law has gradually accommodated new technical developments in relation to patent eligibility for example of computer software, biotechnological inventions or business methods, the basic patentability requirements – novelty, inventive step, and industrial application (or novelty, non-obviousness, utility in case of the US) – have applied since as early as the 19th century.[130] Even allowing for the fundamental nature of environmental issues, it would be a challenge to justify why 'greenness' alone has to be considered as part of the patentability requirements, amongst other important issues the world is facing. In practical terms, without a standardized method of calculating carbon footprints or greenhouse gas emission, it does not seem plausible yet to apply such criteria universally to all technical fields.

128 Examples are the supplementary protection certifications (SPCs) in Europe and the patent term restoration under the so-called Hatch-Waxman Act in the US.
129 *Supra* note 117 at 273.
130 *Supra* note 111 at 12-14.

2. Business Method Patents: Bilski and Carbon Trading Inventions

Before taking a closer look at the mentioned core patenting criteria, this section addresses the patentable subject matter issue concerning business method patents in the context of green technology. From its experience in carbon financing, the World Bank has observed that although it is crucial to develop methodologies for determining project eligibility, measuring the baseline and emission, or overseeing emission reductions resulting from a project, there are no patents or other types of compensation to incentivize methodology developers.[131] One reason could be the legal uncertainty associated with business method patents, hotly debated in the *Bilski* case both at the US Court of Appeals for the Federal Circuit (the Federal Circuit) and the US Supreme Court.

The *Bilski* invention is a method for hedging risk-associated costs in a series of energy transactions involving energy producers and consumers. Risk-associated costs include costs such as price and demand fluctuations due to weather change,[132] for example:

> "[C]oal power plants (*i.e.*, the 'consumers') purchase coal to produce electricity and are averse to the risk of a spike in demand for coal since such a spike would increase the price and their costs. Conversely, coal-mining companies (*i.e.*, 'market participants') are averse to the risk of a sudden drop in demand for coal since such a drop would reduce their sales and depress prices. The claimed method envisions an intermediary, the 'commodity provider,' that sells coal to the power plants at a fixed price, thus isolating the power plants from the possibility of a spike in demand increasing the price of coal above the fixed price. The same provider buys coal from mining companies at a second fixed price, thereby isolating the mining companies from the possibility that a drop in demand would lower prices below that fixed price. And the provider has thus hedged risk; if demand and prices skyrocket, it has sold coal at a disadvantageous price but has bought coal at an advantageous price, and vice versa if demand and prices fall."[133]

Since the above invention is not limited to transactions involving actual commodities,[134] it could cover risk management in the carbon offsets market, in which market participants can buy and sell extra allowances to comply with greenhouse gas emission regulations under the CDM.[135] Without appropriate monitoring, some carbon offsets projects may not effectively reduce carbon emissions. On the other hand, if the regulatory monitoring and verification process becomes too strict, this may unduly increase transaction costs for compliance. Thus, finding a compromise

131 World Bank, 10 Years of Experience in Carbon Finance: Insights from Working with the Kyoto Mechanisms (2010), *available at* http://www.carbonfinance.org.
132 U.S. Patent Application No. 08/833,892 (rejected).
133 *In re* Bilski, 545 F.3d 943 (Fed. Cir. 2008) at 949-950.
134 *Id.*
135 Ronald M. Daignault, *Carbon Offsets and Patent Protection for Business Methods After In Re Bilski*, 1.1 Clean Tech Law & Business 101, 108 (2009).

between "an offset system's low transaction costs and highly-reliable emissions-reductions" is a growing challenge for the carbon offsets market.[136]

In addition to its aforementioned factual relevance to green technology, the *Bilski* decision provides practical lessons for innovative business methods needed for tackling climate change. The Federal Circuit upheld that "a claimed process is patent-eligible under Section 101 [of the U.S. Patent Act][137] if: (1) it is tied to a particular *machine* or apparatus, or (2) it *transforms* a particular article into a different state or thing. See Benson, 409 U.S. at 70 (emphasis added)."[138] Regarding this Machine-or-Transformation (MOT) test, the Federal Circuit elaborated that (i) it must not pre-empt substantially all uses of a fundamental principle (*i.e.*, abstract idea or natural phenomenon); and (ii) it must impose meaningful limits on the claim's scope and the transformation must be central to the purpose of the claimed process.[139]

On appeal, the Supreme Court found that the MOT is not the sole test for determining patent eligibility of a process under Section 101 and unanimously rejected the *Bilski* invention as it was "an abstract idea" lacking patent eligibility.[140] More generally, the majority held that at least in certain circumstances business methods are eligible for patenting, but the Court remained silent on the requirements for such patent eligibility.[141] Following the Supreme Court decision, the USPTO has released the Interim *Bilski* Guidelines for patent subject matter issues in process claims.[142] These Guidelines note that, although the MOT test remains "a useful investigative tool" amongst the non-exclusive factors to consider, "it would be improper to make a conclusion based on one factor while ignoring other factors."[143]

This development may have implications for patents in the area of carbon trading. The Chicago Climate Change (with the largest number of patents in carbon trading)[144] holds a patent, for example, on a computer-implemented method of "facilitating trade of emission allowances and offsets among participants, which includes establishing an emission reduction schedule for certain participants based on emission information provided by those participants and determining debits or credits for each certain participant in order to achieve the reduction schedule."[145] Under the current case law, it is not certain that a computer-implemented method like this

136 *Id.* at 103.
137 35 U.S.C. § 101.
138 *Supra* note 133.
139 *Id.*
140 Bilski v. Kappos, 130 S.Ct. 3218 (2010) at 3230-3231.
141 *Id.*
142 Interim Guidance for Determining Subject Matter Eligibility for Process Claims in View of *Bilski v. Kappos*, 75 Fed. Reg. 43922, 43925 (July 27, 2010).
143 *Id.*
144 Bill Eggertson, *Can Renewables Take the Credit?*, 9 Renewable Energy Focus 24, 24-25 (Nov. 2008).
145 U.S. Patent No. 7,343,341 (issued Mar. 11, 2008).

would be eligible for obtaining a patent.[146] On the other hand, new systems for trading emission reductions would appear to be more than an abstract idea, and it would be necessary to carefully weigh various factors under Section 101. Duffy concludes that the debate will turn from "the question *whether* business methods are patentable to the question *how* broad the scope of patentable subject matter should be for business methods (emphasis in the original)"[147] and that decision-makers should observe "the newly emerging science and engineering of business,"[148] such as carbon trading.

3. Novelty and 'Green' Indication of a Known Substance

In connection with certain renewable energy sectors, it has been observed that the basic or traditional solutions[149] for specific technological problems have long been "off-patent" and typically patented are specific improvements or features.[150] As green technology becomes a new focus of research, existing technologies may find new applications relevant to environmental benefits, raising the question to what extent such new use is patentable.[151]

An invention is deemed novel if it does not form part of the prior art (absolute novelty). For novelty of the new 'green' use of an existing technology, the legal developments on "second medical indication" under European patent law may perhaps provide some insight. According to Article 54(4) of the EPC, claims to the first medical indication normally confer product protection for the use of the respective substance or compound in all therapeutic or medical applications. EPC Article 54(5) further states that a substance or composition for any "specific" use in therapeutic or medical applications can be patented if such use is not found in the prior art.[152] Unlike a claim to the first medical indication, claims to subsequent medical indications are "purpose-limited" to the specific therapeutic or medical treatment disclosed and claimed in the patent.[153]

Might these principles also be relevant to green innovation? The *Science* journal published a study on an enzyme found in soybeans (which normally produces ammonia from nitrogen gas) which can turn carbon monoxide into ethane or propane

146 *Supra* note 135.
147 John F. Duffy, *Why Business Method Patents?* at 1 (forthcoming, on file with author).
148 *Id.*
149 *E.g.*, the first known windmill in history is described by Hero of Alexandria in his work *Pneumatics*, dating back to the 1st century B.C. or the 1st century A.D. *See* James Manwell, Jon McGowan and Anthony Rogers, Wind Energy Explained: Theory, Design and Application (John Wiley & Sons, Ltd. 2009).
150 *Supra* note 19.
151 *Supra* note 9.
152 *Id.*
153 *Id.*

gas fuel.[154] Although this enzyme is already known to scientists because of its economic importance in farming, the technology to extract, grow and store large quantities of the enzyme has developed only recently.[155] If the technique advances much further, cars might be partially powered on their own gas, or even draw fuel from the air itself.[156] Would the fact that the material exists in nature be *per se* novelty-destroying for subsequent inventions? The jurisprudence on second (or subsequent) indications is limited to methods for treatment by surgery, therapy or diagnosis for human and animal body.[157] Perhaps a basis exists for exploring the adoption of a similar approach in the context of green inventions.

4. Non-obviousness: KSR and Green Technology

In the US, it may be difficult for some green inventions to meet the non-obviousness standards after the *KSR* decision.[158] Before *KSR*, the test for non-obviousness was primarily based on *Graham v. John Deere*:[159] *i.e.*, (i) the scope and content of the prior art need to be determined; (ii) differences between the prior art and the claims of the invention need to be verified; (iii) obviousness to the person with ordinary skill in the art is reviewed by considering "teaching, suggestion, or motivation" (the TSM test) at the time of invention; and (iv) secondary considerations such as scepticism of experts, unexpected results, long-felt need, failure of others, commercial success can be taken into account.[160]

The *KSR* decision modified the non-obviousness standard by lifting the level of a person skilled in the art. The Supreme Court clarified that the Federal Circuit's TSM test should be a flexible test because an obviousness determination is not the result of a rigid formula dissociated from consideration of the facts of the case.[161] It further noted that "[t]he question is not whether the combination was obvious to the patentee, but whether the combination was obvious to persons with ordinary skill in the art."[162] Thus, the common sense of persons skilled in the art is the yardstick for determining why some combinations could have been obvious while others would not.[163] Importantly, following *KSR*, the Federal Circuit held in

154 Chi Chung Lee, Yilin Hu and Markus W. Ribbe, *Vanadium Nitrogenase Reduces CO*, 329 Science 642 (Aug. 6, 2010).
155 Eric Bland, *Gasoline From Thin Air?*, Discovery News, Aug. 5, 2010.
156 *Id.*
157 *Supra* note 120 at art. 53(c).
158 KSR International Co. v. Teleflex Inc., et al., 550 U.S. 398 (2007).
159 William T. Graham, et al. v. John Deere Co. of Kansas City, et al., 383 U.S. 1 (1966).
160 *Id. See also* Randall R. Rader, Chief Judge, U.S. Court of Appeals for the Federal Circuit, *Obviousness after KSR: Cases and Analysis* (on file with author).
161 *Supra* note 158.
162 *Id.*
163 *Id.* at 1739.

Leapfrog v. Fisher-Price that a person of ordinary skill in the art would have found it "obvious to combine the adaptation of an old idea with newer technology."[164]

In terms of the implications of *KSR*, since clean technologies often involve a "mosaicing of pre-existing technologies" (*i.e.*, combining more than one piece of prior art), it is important to draft patent claims so as to capture the integration of the several technologies in order to avoid an obviousness rejection under Section 103 of the U.S. Patent Act.[165]

5. 'Greenness' and Utility Requirements

The discussions so far do not suggest a special rule for green technology under patent law. If an invention has ecologically sound effects, what should be considered for patenting is simply whether or not such invention is novel, non-obvious and useful, rather than its green effects. Especially in relation to utility, one may wonder if perhaps environmental soundness is 'useful' in terms of patent law and therefore must be considered as part of patentability requirements. A clue to the answer might be found in the development of the utility requirement under U.S. patent law.[166]

Back in 1966, the Supreme Court in *Brenner v. Manson* held that usefulness is satisfied when "specific benefits exist in currently available form."[167] Meanwhile, the *Application of Anthony* decision held that safety in treating humans is not a question of patent validity within Section 101 of the U.S. Patent Act, but that it is for the U.S. Food and Drug Administration (FDA) to test the safety or efficacy of pharmaceutical products.[168] Rejecting a special rule for the utility of pharmaceutical inventions, *Application of Antony* represented a lower threshold for the utility requirement. *In re Fisher* found that there was no substantial utility in an invention unless and until a process is refined and developed to the point where specific benefit exists in currently available form and that utility must be such that a person

164 Leapfrog Enterprises, Inc. v. Fisher-Price, Inc., 485 F.3d 1157 (Fed. Cir. 2007). *See also* Rader, *supra* note 160.

165 Mark Sajewycz, Ogilvy Renault, *Patenting Clean Technologies: Trends, Issues and Strategies* (Jan. 21, 2010), *at* http://www.ogilvyrenault.com/en/resourceCentre_10025.htm.

166 *See generally* F. Scott Kieff, Lecture at the Munich Intellectual Property Law Center: Pharmaceuticals and IP (Summer 2010) (on file with author).

167 Brenner, Commissioner of Patents v. Manson, 383 U.S. 519 (1966).

168 *In re* Application of Anthony, 414 F.2d 1383 (C.C.P.A. 1969) (noting that the safety question may be an issue under the enablement requirement in Section 112 of the U.S. Patent Act. Enablement matters if the disclosure includes an element on safety or effectiveness for treating humans, but it is the FDA that has to verify such safety or effectiveness.).

skilled in the art can use a claimed invention to provide some immediate benefit to the public.[169]

In short, the issue of safety or efficacy of drugs is beyond the scope of patent law and a matter for the FDA to verify. Likewise, it may be argued that 'greenness', such as the extent of reduction of greenhouse gas emissions or energy efficiency, rather than being mixed into legal patenting criteria should as a matter of policy be reviewed by specialized environmental agencies. Here, it may be noted that for example, Canada, the EU, Japan, Korea, the Philippines and the US run environmental technology verification programs to provide data for commercially viable environmental technologies for the benefit of related parties and the public.[170]

B. Role of Patent Policy

What is and should be the role of patent policy for stimulating green innovation and technology transfer? One discernible principle of the patent system is "transparency,"[171] resulting from disclosure as the *quid pro quo* of patent exclusivity. Patent information enables policymakers to track developments in important areas of technology and to use such data as an information base for stimulating innovation and diffusion of technology.[172] Another important component of patent policy is the active provision of procedures within the granting system tailored to certain perceived public goals. National offices increasingly provide supplementary services or preferential treatment accommodating green technology. Patent offices including those of Japan, Korea, the UK, the US and others have adopted so-called 'fast-tracking' of green technology, in which green inventions can be processed with priority in patent examination, so as to stimulate innovators' interest. As another source of stimulus, it has been suggested that "patenting behaviour is responsive to fee variations."[173]

To help explore the scope for patent policy, this part outlines and examines related activities by WIPO and selected national IP offices, in particular forms of preferential treatment for green technology. This part furthermore explores, in a green context, opportunities offered by the information function of patents.

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169 *In re* Fisher, 421 F.3d 1365 (Fed. Cir. 2005) (*cf.* Judge Rader's dissenting opinion argues that research tools such as expressed sequence tags are 'useful' because they help researchers identify and understand a previously unknown and invisible structure and advance science).

170 EPA, Fact Sheet: EPA's Environmental Technology Verification Program (Oct. 2008), *at* http://www.epa.gov/nrmrl/std/etv/pubs/600f08012.pdf.

171 *Supra* note 5 at 5.

172 *Id.*

173 *Supra* note 4. *See also generally* WIPO Standing Committee on the Law of Patents 2nd Session, Information Concerning Fee Reductions by the Offices, Apr. 12-23, 1999, WIPO Doc. SCP/2/6 (Mar. 17, 1999).

1. Activities by WIPO and Patent Offices

a) World Intellectual Property Organization

As a specialized UN agency responsible for international cooperation in the field of IP and for assuring efficiency and balance in the global IP system, WIPO provides an intergovernmental forum for addressing the interface between IP, innovation and global public policy issues.[174] Some of its activities concerning green technology are set forth below.

(1) Patent Cooperation Treaty

In early 2010, the International Authorities for searching and preliminary examining under the Patent Cooperation Treaty[175] discussed measures to be taken within the PCT system to give preferential treatment to international applications regarding green technology.[176] The following options had been prepared: (i) limited accelerated processing by receiving Offices, International Searching Authorities and International Preliminary Examining Authorities as well as the International Bureau (WIPO); (ii) fee-related incentives; and (iii) specifically indicating and/or drawing attention to published 'green' international applications to facilitate licensing and commercialization.[177]

However, participants raised concerns about the "difficulty to determine which applications indeed related to green technologies, noting the absence of an agreed definition" and the reliance on simple self-certification by applicants for the claimed environmental effects.[178] One Authority observed that "only 10% of applications in respect of which accelerated processing had been requested under its scheme had been indeed found to be related to such technologies."[179] In relation to the proposed fee reduction, it was pointed out that "no such fee reduction was offered by any Office for applications relating to, for example, public health or food security."[180] Authorities endorsed "making licensing information available in respect of any application, irrespective of the field of technology, for which applicant

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174 WIPO, Medium Term Strategic Plan 2010-15: Revised Draft (July 29, 2010), *at* http://www.wipo.int/export/sites/www/about-wipo/en/pdf/mtsp_rev_en.pdf.

175 Patent Cooperation Treaty, June 19, 1970, 28 U.S.T. 7645, 1160 U.N.T.S. 231 [hereinafter PCT].

176 WIPO, Meeting of International Authorities under the PCT 17th Session, Agenda Item: Preferential Treatment for International Applications Relating to "Green" Technologies, WIPO Doc. PCT/MIA/17/5 (Jan. 21, 2010).

177 *Id.*

178 WIPO, Report of the 17th Session, WIPO Doc. PCT/MIA/17/12 (Feb. 11, 2010).

179 *Id.*

180 *Id.*

had made a request to that effect,"[181] which may be worth exploring further for green innovation.

(2) Patent Classification: Catchword Index for Environmentally Sound Technology

In 2009, WIPO's International Patent Classification (IPC) Revision Working Group launched a project on ESTs (Project C456). It was initiated from the UK's proposal to create a new stand-alone indexing scheme for ESTs in the IPC.[182] This proposal was opposed because the IPC was not meant to assess alleged effects or benefits (*i.e.*, no judgement on "good" and "bad" technologies).[183] As an alternative, the US proposed to create a list of entries in the Catchword Index[184] under the term EST.[185] To this end, a "concordance" list is being compiled under the following seven major headings: alternative energy production; nuclear power generation; transportation; energy conservation; waste management; agriculture/forestry; and administrative, regulatory or design aspects of ESTs.[186] In the process, the Working Group generally defined, without formal adoption, ESTs as "technologies conducive to sustainable development or to the mitigation of climate change."[187] In addition, the possibility is under discussion to align the IPC's proposed list of ESTs with the UNFCCC's ongoing climate change technology classification scheme.

(3) WIPO Development Agenda and Climate Change

The Development Agenda for WIPO, adopted in 2007, is another basis for WIPO's role in stimulating innovation and technology transfer for climate change. WIPO has been tasked to provide, within its mandate, technical assistance and capacity building support for developing countries and LDCs to protect creation, innovation and inventions and to develop domestic infrastructure for science and technology.

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181 *Id.*

182 WIPO, IPC E-Forum Project C456, *available at* http://www.wipo.int/ipc-ief, at Annex 1 (Apr. 17, 2009).

183 *E.g.*, Lutz Mailänder, WIPO, *IPC – a "Sound" Tool for Environmentally Sound Technologies?*, Presentation at the WIPO IPC Workshop, WIPO Doc. IPC/WK/GE/10 (Feb. 9, 2010).

184 The Official Catchword Index provides some 20,000 entries containing brief technical terms or keywords which can assist users to identify a starting point in the classification scheme by going through a list of catchwords. This list is available at http:www.wipo.int/classifications/ipc/ipc8/?lang=en.

185 *Supra* note 182 at Annex 4 (June 4, 2009).

186 *Supra* note 182 at Annex 2 (June 14, 2010).

187 *Id.* (*cf.* on the other hand, Japan argued that "the determination of what technologies should belong to EST is beyond the mandate given to the IPC community and WIPO").

Particular attention is thereby to be given to small and medium-sized enterprises (SMEs), scientific research institutions, and cultural industries.[188] For related norm-setting on public policy issues, WIPO should address such matters as links between IP and competition, IP-related technology transfer, and exceptions and limitations to exclusive rights.[189] Further, WIPO may explore measures for transfer and dissemination of technology to developing countries.[190] More directly, WIPO offers support services, upon request from Member States, *e.g.*, in relation to "capacity building, legislative assistance, practical technology licensing models, and arbitration and mediation services."[191]

b) Fast-tracking Services

(1) UK Intellectual Property Office: Green Channel

In May 2009, the UK Intellectual Property Office (UKIPO) launched its so-called Green Channel, allowing patent applicants "to request accelerated processing of their applications if the invention relates to a 'green' or environmentally-friendly technology."[192] Under this scheme, patents can be granted, in theory, in less than twelve months.[193] There are three shortened routes to a patent: (i) combined search and examination (which makes it possible to receive the search and examination results within four months from the request); (ii) early publication; or (iii) accelerated search and/or examination subject to the applicant's showing that the invention relates to 'green' technology or other reasons justifying fast-tracking.[194] In this third option, UKIPO can accept the fast-tracking request if the applicant demonstrates the need for accelerated processing because of potential infringers or likely investors.[195]

In June 2010, UKIPO launched a Green Channel Patent Applications database,[196] which regularly compiles published patent applications being processed under the Green Channel initiative. With a view to facilitating technology

188 WIPO, The 45 Adopted Recommendations under the WIPO Development Agenda, *available at* http://www.wipo.int/ip-development/en/agenda/recommendations.html (last visited Aug. 10, 2010).
189 *Id.*
190 *Id*.
191 *Supra* note 174.
192 UKIPO, *Green Channel for Patent Applications*, *at* http://www.ipo.gov.uk/p-pn-green.html (last visited Aug. 10, 2010).
193 UKIPO, *Patents Fast Grant Guidance*, *at* http://www.ipo.gov.uk/p-fastgrantguide.pdf (last visited Aug. 10, 2010).
194 *Id.*
195 *Id*. (*cf*. for options (i) and (ii), it is not necessary to state reasons for the request).
196 Press Release, UKIPO, Green Patent Database Launched (June 4, 2010), *at* http://ipo.gov.uk/about/press/press-release/press-release-2010/press-release-20100604.html.

transfer, it contains the patent applicant's name, filing date, patent application title and IPC classification. As of early August 2010, some 120 publications have been posted.[197]

(2) USPTO: Green Technology Pilot Program

In December 2009, the USPTO launched a pilot program to accept 3,000 petitions for accelerated examination of green technologies, *i.e.*, applications related to "environmental quality, energy conservation, development of renewable energy resources or greenhouse gas emission reduction."[198] To be eligible, claims must be designed for an invention that significantly improves the quality of the environment or that materially contributes to: "(1) the discovery or development of renewable energy sources; (2) the more efficient utilization and conservation of energy resources; or (3) greenhouse gas emission reduction", with an explanation satisfying the special status.[199] Mere speculation on possible use of the invention to achieve the above effects does not suffice.

Initially, there was a requirement that applications must belong in one of the U.S. patent classifications: alternative energy production, energy conservation, environmentally-friendly farming, or environmental purification, protection or remediation.[200] However, in May 2010, the USPTO announced removal of this restriction because "this requirement was causing the denial of petitions for applications that are drawn to green technologies" and the workload of examiners has been adjusted by other means.[201] According to a USPTO report of July 26, 2010, some 650 petitions have been granted out of 1,400 requests submitted.[202]

(3) Preferential Treatment for Patenting Green Inventions

(a) Benefits of Early Patenting

First, early patenting is a useful enforcement tool when there is an urgent and compelling need to assert rights against potential infringers or competitors. Even before

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197 UKIPO, *Green Channel Patent Applications*, *at* http://www.ipo.gov.uk/types/patent/p-os/p-gcp.htm (last visited Aug. 11, 2010).

198 Pilot Program for Green Technologies Including Greenhouse Gas Reduction, 74 Fed. Reg. 64666, 64666 (Dec. 8, 2009).

199 *Id.* at 64667.

200 *Id.* at 64668-64669.

201 Elimination of Classification Requirement in the Green Technology Pilot Program, 75 Fed. Reg. 28554, 28555 (May 21, 2010).

202 USPTO, *Green Petition Report Summary* (updated Aug. 2, 2010 and reported July 26, 2010), *at* http://www.uspto.gov/patents/init_events/green_tech.jsp.

patent grant, published patent applications are entitled to some degree of reasonable compensation against infringement.[203] On the other hand, a fast grant (especially if accompanied by early publication) is not always good for patentees. For nascent technologies, a slower pace in the granting procedure can be advantageous because it gives time to gauge commercial viability and to develop marketing plans while the patent application is still pending.

Second, a strong IP position helps start-ups to secure investment and one way to strengthen the firm's IP position is to secure patents in advance so that investors are convinced about the company's core assets for growth. This is about more than the timing of patenting; a strong IP position also relates to, for example, the strength of individual patents or the value of the overall patent portfolio.

Third, as a policy matter, early patenting helps speed up the development and deployment of technology, generate more jobs and stimulate competitiveness in business. The USPTO describes the higher-level purpose of prioritizing a specific technical field like green technology as re-organizing the patenting process in order to improve patent quality and timeliness. Importantly, reduced pendency in a chosen area helps bring new technologies into the market early.

Fourth, from an economic viewpoint, the first mover's advantage in the rapidly growing green technology market appears to stimulate early patenting in this field. For example, an economic analysis suggests that Europe's leadership in the wind turbine industry is partially driven by this type of advantage.[204] When the economy turns low-carbon through mandatory implementation of renewable energy generation, European turbine makers with advanced technologies are well-positioned to benefit from such regulatory change. On the other hand, increasing competition (including with actors in developing countries) and political uncertainty in the climate change negotiations may diminish such advantages.

Incentivizing early patenting can be beneficial to society. As Duffy argues, the race for a patent implies not only rivalry to claim exclusive rights, but also competition to end monopolies sooner.[205] In addition, embryonic technology can be commercially exploited at a much later stage of the patent term.[206] Therefore, the social benefit of early patenting is that it has the effect of reducing the actual monopoly period, *i.e.*, the time between commercial exploitation and patent expiration.

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203 EPC, *supra* note 120 at art. 67.

204 *See generally* Urs Steiner Brandt and Gert Tinggaard Svendsen, *Switch Point and First Mover Advantage: The Case of the Wind Turbine Industry* (Aarhus School of Business, Working Paper 04-2 ISSN1397-4831).

205 John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. Chi. L. Rev. 439, 494 (2004).

206 *Id.*

(b) Non-discrimination under TRIPS Article 27(1)

Opponents to preferential treatment of green technology might ask why green technology should be treated differently. There is a concern whether such treatment complies with TRIPS Article 27(1), which provides that, subject to certain TRIPS provisions, "patents shall be available for any inventions in all fields of technology …. and patent rights [shall be] enjoyable …. without discrimination as to the field of technology."[207] WTO Members are neither to exclude a particular technical field from patent grant nor to restrict patent rights, for example by shortening patent terms or conferring unjustified exceptions and limitations.[208]

However, WTO Members may employ different treatments for some technologies in order to level uneven playing fields, and TRIPS Article 27 does not prohibit such *bona fide* exceptions to deal with specific problems that exist only in certain areas.[209] For biological inventions, a deposit of biological material such as microorganisms is permissible as an alternative to fulfil written descriptions (which otherwise could not be met).[210] Such treatment is not *per se* discrimination. Rather, it is a different treatment to achieve the common goal of patenting.

Would the preferential treatment of green technology amount to discrimination under Article 27(1)? WTO Members "claiming *de facto* discrimination should be required to demonstrate some element over and above those required to establish *de jure* discrimination, and …. [WTO Members] defending an exclusion should be permitted to rebut a showing of disparate treatment by demonstrating a legitimate purpose."[211] One may defend that preferential treatment should be distinguished from discriminatory treatment, the latter typically involving exclusion of a particular technical field from granting a patent. The green technology preferential treatment sofar does not involve such exclusionary conduct, but merely prioritizes the handling of green patent applications in the patenting process.

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207 *Cf.* TRIPS Article 27(1) also prohibits discrimination against the place of invention and against the location of products. TRIPS Agreement, *supra* note 8. at art. 27(1).

208 Carvalho, *supra* note 115 at 279.

209 Panel Report, Canada—Patent Protection of Pharmaceutical Products, Para. 7.94, WT/DS114/R.

210 EPC, *supra* note 120 at Rule 31. Also such deposit of microorganisms can be mutually recognized among Members of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure, Apr. 28, 1977, 17 I.L.M. 285 (1978) [hereinafter Budapest Treaty].

211 Graeme B. Dinwoodie and Rochelle C. Dreyfuss, *Diversifying Without Discriminating: Complying with the Mandates of the TRIPS Agreement*, 13 Mich. Telecomm. Tech. L. Rev. 445, 445-456 (2007); *see also supra* note 85 at 2.249 (suggesting that "governments are permitted to adopt different rules relating to technological development, transfer and dissemination for particular product areas or locations of production, provided that the differences are adopted for *bona fide* purposes and that such measures are not inconsistent with the other provisions of TRIPS").

However, the concern is that such preferential treatment could strengthen the perception that those inventions on preferential treatment are more important than other technical fields, which is what Article 27(1) would appear intended to prevent.

In any event, if a special treatment that "acknowledges different situations and aims to equalize them"[212] has to be justified, it would be necessary to verify whether green technology patent applications are being adversely affected by the overall delays in patent processing. In the absence of consensus on what belongs to green technology, it is difficult to trace pendency issues specifically detrimental to green technology.

The more serious issue is major backlogs that some patent offices experience generally and, for them, tackling backlogs is a matter of urgency.[213] Meanwhile, green technology is increasingly seen as one of the technical priorities of society. Without backlogs, there would likely be less need to prioritize certain technologies over others. However, within the limited resources of patent offices, prioritizing one field inevitably results in delays in other areas. If necessary, it might be permissible to prioritize the review of some patent applications on request, regardless of technical fields, as this would not discriminate against a specific technology but universally apply to all technical fields.[214] To alleviate the pendency problem, some patent offices collaborate with one another by information and work sharing (*e.g.*, Patent Prosecution Highway, PPH) or harmonization of certain aspects of patent processing practices.

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212 Carvalho, *supra* note 115.

213 *See generally* UKIPO, Patent Backlogs and Mutual Recognition: An Economic Study by London Economics (2010) (analyzing the pendency and handling capacity of selected patent offices in terms of the number of pending patent applications, the number of patent examiners and other factors).

214 *E.g.*, Japan Patent Office (JPO), JPO Annual Report 2009, 40 (2009) (explaining that the JPO conducts accelerated examination in response to the submission of an explanation of circumstances with respect to (a) applications relating to inventions that have already been put into practice or planned to be put into practice within two years (working related applications); (b) applications which have foreign patent families (internationally filed applications); (c) applications filed by SMEs and venture businesses which are low in funds; or (d) applications filed by universities and public research institutes which are expected to return their fruits to society). Recently, the JPO also allowed accelerated examination for green technology applications. *See also* Fa Ming Zhuan Li Shen Qing Ti Qian Shen Cha De Zan Xing Guan Li Ban Fa [Interim Administrative Measures for Early Examination of Invention Patent Applications], Section II: Reasons for Applying Expedited Examination; *also* Interview with Chen Xi, Examiner, State Intellectual Property Office of the People's Republic of China (SIPO) (Sept. 11, 2010) (on file with author) (explaining that in China, fast-tracking of patenting is generally possible if the applicant provides credible reasons that (i) the invention is of great interest to society or the nation; or (ii) after publication of the patent application, the legitimate interest of the applicant is likely to be impaired if competitors reduce the invention to practice earlier than the applicant; or (iii) the application concerns the fundamental intangible asset of a large-scale investment project. Green technology inventions may satisfy the above condition (i) and obtain the fast-tracking advantage for expedited examination).

(c) Alternative: Verifying 'Greenness' Independent from Patent Grant

Another problem with the verification of environmental soundness in patenting is, as noted earlier, that patent examiners are hardly equipped to review *ordre public* issues.[215] Moreover, green patent applications tend to rely on patent applicants' self-certified assertions on environmental effects without independent verification mechanisms. Would an inaccurate statement on environmental impact disqualify the fast-tracking request or even the entire patent application? If the alleged environmental effect is not proven, does it amount to fraud or inequitable conduct? To what extent the patenting process should integrate environmental judgement is a sensitive issue.

In terms of verifying environmental soundness, the reasonable approach for patent offices would probably be not to mix it into patenting criteria. If patent applicants wish to obtain some kind of certification on green effects of their inventions, patent offices, subject to availability of resources, might consider adopting an independent procedure for this purpose (*i.e.*, without decisive impact on patentability itself). Under such a procedure, patent applicants or patent holders could perhaps request an appraisal or expert opinion (*inter-partes* or *ex-parte*) on the likely environmental impact of their invention. It could be considered to adapt WIPO's expert determination mechanism model[216] to such a need, with experts possessing relevant specialization available for a consensual, flexible and efficient procedure.

c) Information Services

In addition to optimizing filing options and granting patents, patent offices focus on improving the public information function of the patent system, "bridging the gap between evidence and policy."[217] This is based on the assumption that, when processed in context, the collection of patent data can serve as a valuable tool for policymakers.[218]

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215 *Supra* note 122.

216 WIPO, WIPO Expert Determination, *at* http://www.wipo.int/amc/en/expert-determination/ (last visited Aug. 11, 2010).

217 EPO, Patents and Clean Energy, *at* http://www.epo.org/topics/issue/clean-energy.html (last visited Sept. 6, 2010).

218 Benoît Battistelli, Director General, EPO, The Patent System and the Climate Change Challenge, Geistiges Eigentum im Gespräch: Klimawandel und "grüne Technologien" - Herausforderung für das Patentsystem [*the Conference on Intellectual Property in Discussion: Climate Change and "Green Technology" – Challenge for the Patent System*], DPMA (July 22, 2010) (Ger.).

(1) European Patent Office

(a) Patents and Clean Energy Project

To help provide empirical data for climate change policy-making, the EPO with the OECD, UNEP, and ICTSD have jointly carried out a research project on the role of patents in clean technology development. The research consisted of technology mapping, patent landscaping and analysis, and a licensing practices survey. At the outset, ICTSD commissioned technology-mapping studies to spot commercially available technologies, goods and R&D in the renewable energy supply, building, transportation and industry and agriculture sectors.[219] Based on the information gathered from the technology-mapping studies, the EPO retrieved relevant patents, *inter alia*, in renewable energy covering wind, hydro/marine, solar, geothermal, biofuels, clean coal and their respective subcategories. The OECD then conducted statistical analysis on these patent data. The initial findings show that patenting in renewable energy, carbon capture and storage technologies has significantly increased, in particular in France, Germany, Japan, Korea, the UK and the US.[220]

In addition, a survey has been conducted on renewable energy related licensing practices of some 150 companies, organizations and government agencies in France, Germany, Japan, the Netherlands, the UK and the US. Approximately 50% of participants declared to have a "significant or substantial" number of clean energy patents in their patent portfolio.[221] Among different forms of IP cooperation, R&D collaboration was the most invoked business strategy, followed by patent/technology licensing, consulting services, joint ventures, spinouts and others.

In relation to cooperation with developing countries, 58% of respondents answered that they have "never" entered into licensing agreements with licensees from developing countries over the past three years, 25% "rarely," 12% "occasionally," and 5% "frequently."[222] When making a decision on licensing or collaboration with a party in a developing country, 25% of participants consider IP protection as a "compelling reason", 29% as a "significantly attractive condition", 28% as a "basic precondition" and 18% as "not a factor."[223] In addition, half of the respondents answered that licensing terms and conditions with licensees from developing countries could be "more flexible" and 20% "more or substantially more accommodat-

219 ICTSD, Accelerating Trade in Climate-friendly Goods and Services, *at* http://www.ictsd.org/climate-change/accelerating-trade-and-diffusion-of-climate-friendly-goods -and-services (last visited Aug. 12, 2010).

220 *Supra* note 217.

221 Ahmed Abdel Latif, ICTSD, Patents and Clean Energy Project Overview and Licensing Survey Results, Presentation at the Patents and Clean Energy Side Event in Bonn, UNFCCC (June 9, 2010) (on file with author).

222 *Id.*

223 *Id.*

ing."[224] The survey results further suggest that the key beneficiary countries of green technology licensing are, in alphabetical order, Brazil, China, India and Russia.[225]

(b) Classification Scheme for Clean Energy Technologies

The EPO has established a new classification scheme for "technical attributes of technologies that can be loosely referred to as clean energy technologies"[226] to serve "as an interface between the vast amount of technical knowledge contained in the patent documentation and the information needs of society."[227] Unlike the usual classification sorted by technical field, the new scheme is similar to a tagging system. Working with the existing classifications, the new scheme marks climate change mitigation technologies by a code Y02, which is sub-divided into coding for "greenhouse gases – capture or storage/sequestration or disposal" and "greenhouse gases – emission reduction technologies related to energy generation, transmission or distribution."[228]

(2) Opportunities Provided by Patent Information

Patents have derived functions such as supporting R&D performance measurement, technology databases and strategic planning.[229] Also, to an extent, patent information has become an indicator for innovation and technology transfer,[230] and the transparency of the patent system provides an empirical information basis for policy-making.[231]

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224 *Id.*
225 *Supra* note 217.
226 EPO, *Classification Scheme for Clean Energy Technologies, at* http://www.epo.org/topics/issues/clean-energy/classification.html (last visited Sept. 7, 2010).
227 *Supra* note 218.
228 *Supra* note 226; *see also* Press Release, EPO, Tagging Clean Energy Patents (June 11, 2010), *at* http://www.epo.org/topics/news/2010/20100611.html.
229 *E.g.*, Karin Hoisl, Lecture at the Munich Intellectual Property Law Center: Intangible Asset Valuation (May 2010) (unpublished manuscript) (on file with author).
230 *Cf.* Nick Johnstone, Ivan Haščič, David Popp, Renewable Energy Policies and Technological Innovation: Evidence Based on Patent Counts 138 (Springer 2009) (pointing out that, although patents reflect the technological innovative performance, they are an imperfect measure because *inter alia* "the use of unweighted patent counts would attribute the same importance to patents for which there were no successful commercial applications [as to] those which are highly profitable").
231 *Supra* note 5 at 5.

For the patent information system to be able to serve as a "global technology library,"[232] numerous challenges must be overcome.[233] Among these, the language barrier is perceived as an increasing hindrance to accessing knowledge produced in the 'local' languages. While more systematic data on the geographical scope of patent protection for green technology would still be necessary,[234] a substantial degree of general patenting activities occurs in China, Japan and Korea. Gurry points out that the Western world may be underestimating this ongoing shift of innovation activity towards Asia and the increasing amount of patent and technology information available only in the corresponding local languages.[235]

Citing the need for technology databases supporting the resolution of public policy issues such as climate change, WIPO envisages as one long-term option "a comprehensive platform of patent and other proprietary information … through an open innovation model … that would accelerate product development in … climate change" via partnership with interested parties.[236] Another type may be a Wikipedia-like open knowledge-sharing database for off-patent technologies or traditional knowledge in the public domain relevant to climate change adaptation and mitigation.

(3) Licensing Best Practices

As a further contribution to patent information policy, many ponder the concept of a collection of data on green technology licensing best practices. Publicly available information on IP cooperation such as licensing, patent pools and cross-licensing tends to be in short supply. This is in part because no uniform reporting requirements are imposed by environmental or IP authorities, and such transactions are typically confidential.[237] One proposed solution is "an escrow service, provided by a trusted third party, through which private sector data are pooled and shared on an anonymous basis on the open market to set bench marks."[238]

An experimental example, though not necessarily focused on green technology, of a licensing collection is the Patent Licensing Database managed by the National Center for Industrial Property Information and Training (INPIT) in Japan.[239] Ac-

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232 *Supra* note 4.
233 *See generally* WIPO Standing Committee on the Law of Patents 14th Session, Technical Solutions to Improve Access to, and Dissemination of, Patent Information, Jan. 25-29, 2010, WIPO Doc. SCP/14/3 (Dec. 18, 2009).
234 WTO, Trade and Climate Change: WTO-UNEP Report 44 (2009).
235 *Supra* note 4.
236 *Supra* note 174.
237 *Supra* note 24.
238 *Id.*
239 INPIT, *Patent Licensing Database*, *at* http://www.ryutu.inpit.go.jp/en/db/index.html (last visited Aug. 13, 2010).

cording to its explanation, this is an open system where interested potential licensors can register their technology, provided they hold Japanese patents or patent applications for such technology.[240] For each registration, information regarding technical content, technical experience of the patentee and supply conditions is available, with an option to communicate directly with the potential licensor by email.[241] The supply conditions contain detailed licensing terms such as preferred payment options or the availability of technical assistance and consulting.[242]

240 *Id.*
241 *Id.*
242 *Id.*

Figure 1: Green Technology Policies of Selected Major Patent Offices (Hee-Eun Kim, September 2010)

	Fast-tracking generally (including PPH and IP5)	**Fast-tracking for green technology inventions**	**Green patent mapping or landscaping**	**Green patent database**	**Other notable services for green technology**	**Backlog:** number of pending applications* (in 2007)	**Reported average pendency**** (in 2007 except indicated otherwise)
EPO	Y (the PACE program)	N	Y (jointly with OECD on clean energy)	New tagging scheme (Y02)	N/A	550,079	23 – 45 months
DPMA	Y (accelerated processing available on request)	N	Y (included in annual reports in 2008 and 2009 on selected fields *e.g.*, renewable energy)	N	Conference on green technology and the role of the patent system (July 2010)	257,913	For 63.5% of applications with examination request, first office action is issued within 10 months (in 2009)
IP Australia	Y (expedited examination)	Y (expedited examination)	N	N	N	72,664	Approx. 50 months estimated as period between priority and publication dates (in 2008)
JPO	Y	Y	Y (included in annual technology trend research)	N (but JIPA proposal)	N (but JIPA proposal)	888,198	25 – 32 months
KIPO	Y	Y	Y (on product designs)	N/A	IP management consulting services for SMEs	445,944	10 – 15 months

	Fast-tracking generally (including PPH and IP5)	**Fast-tracking for green technology inventions**	**Green patent mapping or landscaping**	**Green patent database**	**Other notable services for green technology**	**Backlog:** number of pending applications* (in 2007)	**Reported average pendency**** (in 2007 except indicated otherwise)
SIPO	Y	Y (eligible under the general fast-tracking procedure)	N	N	Financial support available from local or provincial offices	60,000 (estimate)	Total pendency 26 months
UKIPO	Y	Y (the Green Channel initiative)	Y (on energy from waste, recycling and separation technologies)	Y	N/A	46,138	Approx. 36 months estimated as period between priority and publication dates (in 2008)
USPTO	Y (examination support documents required)	Y (Green Technology Pilot Program)	Planned	Planned	Funding research on green technology innovation and diffusion	1,178,090	26 – 32 months (in 2008)
WIPO	Y (*e.g.*, the Trilateral PCT-PPH)	N (concerning PCT)	Y (on alternative energy technology)	PATENTSCOPE® Technology Focus: Alternative Energy	Capacity-building, conference on climate change and IP (2011), dispute resolution services, etc.	N/A	N/A

Compilation from various sources including publicly available reports from patent offices, WIPO Statistics Database and London Economics (2010), and author correspondence with some patent offices

*A pending application is defined as an application for which the patent office has not made a decision on whether or not to grant patent rights.

** Pendency varies significantly across patent offices due to the differences in systems, procedures or capacity. Where a range is given, it indicates the average pendency to first office action (first action pendency) and the pendency to patent grant (total pendency).

V. Green Technology Transfer and IP

Is technology transfer for climate change different from technology transfer for other public causes? Taubman observes the following distinctive characteristics of green technology transfer: (i) green technologies are highly diverse in character unlike *e.g.*, essential medicines; (ii) countries have specific legal obligations under the Kyoto Protocol depending on economic power;[243] and (iii) climate change policies, rules and systems are still mostly national, thus causing tensions between decision-making processes at the domestic level and those at the international level.[244]

Noting these unique features, a number of voluntary mechanisms to enhance green technology innovation and diffusion have been conceived,[245] such as green technology patent pools, global clean technology venture capital funds, Eco-Patent Commons, technology prizes, and favourable tax treatment in developed countries for private sector R&D performed in developing countries.[246] Without delving into details, Chapter V briefly introduces selected initiatives by IP communities and illustrates certain related IP issues.[247]

A. Initiatives by IP Communities

1. Eco-Patent Commons

In January 2008, the World Business Council for Sustainable Development (WBCSD) launched "Eco-Patent Commons", a collection of patents which "directly or indirectly protect the environment" and which companies have pledged

243 Antony Taubman, WIPO, The Climate of IP and the IP of Climate: an Overview of the Policy Issues, Speech at the Side Event UNFCCC COP 14 (Poznan, Dec. 1-12, 2008).

244 U.N., Chapter V Technology Transfer and Climate Change *in* World Economic and Social Survey 123-150 (2009).

245 *Id.*

246 *E.g.*, government tax policies can play a role not only in the development of inventions but also in the spread of technology. *See e.g.,* Saber Paik, Assistant General Counsel in IP Law, IBM Asia Pacific, Green Technology and Intellectual Property Strategy, Open Forum at the International Patent Licensing Seminar, INPIT in Japan (Jan. 25, 2010).

247 *See generally* WIPO Standing Committee on the Law of Patents 14th Session, Transfer of Technology, Jan. 25-29, 2010, WIPO Doc. SCP/14/4 (Dec. 11, 2009).

to offer to the public free of charge.[248] A patent can join the Commons if it belongs to one of the IPC classes acceptable to WBCSD's Eco-Patent Classification List and is accompanied by a statement describing environmental benefits. Except the so-called "defensive termination" discussed below, a pledger shall not assert the pledged patents against an implementer for making, using, selling and importing machines, manufactures, processes, or compositions of matter that alone, or when in a larger product or service, achieve environmentally beneficial results.[249] The non-assertion pledge survives and remains in force even after the pledger withdraws from the Commons. Pledgers may provide technical support, but are not obliged to do so.

The defensive termination option allows a patent pledger of the Commons to terminate its pledge towards a specific implementer when confronted with either of two scenarios: (i) one pledger asserts infringement of a pledged patent against another pledger; or (ii) a non-member of the Commons challenges a pledged or non-pledged patent of a member of the Commons.[250]

As of August 2010, eleven companies had pledged some 100 patents. One criticism of this scheme has been that participants in the Commons "were not pledging their bread-and-butter patents."[251] Inclusion in the Commons is flexible as long as patents satisfy the aforementioned requirements, and no mechanism currently exists to measure the usefulness of pledged patents; for example, beneficiaries of pledged patents are not required to report their usage.[252]

2. Japan Intellectual Property Association Proposal

Established in 1938, the Japan Intellectual Property Association (JIPA) represents Japanese IP creators and users and presents recommendations on important IP issues. As an alternative to compulsory licensing and an attempt to make transfer of ESTs beneficial to licensors and licensees, JIPA has proposed the so-called Green Technology Package Program (GTPP).[253]

The proposal discerns certain potential challenges of a licensing negotiation with developing countries: *e.g.*, difficulties of negotiation, concerns over payment and

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248 *See generally* WBCSD, Eco-Patent Commons, *at* http://www.wbcsd.org/web/epc/. *Cf.* although pledgers are free to let pledged patents lapse, pledgers nonetheless may choose to maintain pledged patents intact and at the same time keep the defensive termination option available.

249 *Id.*

250 *Id.*

251 Stephen Mulrenan, *Eco-Patent Commons Responds to Critics*, AIPPI Congress News, Sept. 10, 2008, *available at* http://www.managingip.com.

252 *Id.*

253 JIPA, *Proposal of Green Technology Package Program (Executive Summary)*, *at* http://www.jipa.or.jp/english/opinion/pdf/GTPP.pdf (last visited July 17, 2010).

contractual compliance, and the need for technical assistance from the licensor for implementation of the licensed technology. Developing countries wishing to assess the options for introducing environmental technologies cannot always access the basic information concerning a possible license deal. Sometimes the decision-maker for introducing a new technology is not a patent expert, and the patent specification itself is insufficient for deciding the technology's attractiveness.[254] In addition, details on licensing terms, competitive advantages of the licensed technology *vis-à-vis* alternatives, or the availability of technical assistance are not always publicly disclosed. Thus, it is difficult to use the patent lists themselves as technology transfer tools.[255]

To help developing countries find the necessary information, the GTPP would offer an online-managed database where rightholders, confidentially if they so wish, may post information on the features of their green technology, the patents involved, comparison with competing technologies, and available licensing terms. For successful implementation of ESTs, the GTPP scheme encourages licensors to provide a 'green technology package' including such business requisites as patents, know-how, technical assistance and consulting, and parts and materials supply.[256] Licensors can pre-determine modes of commercialization (assignment, exclusive or non-exclusive license, etc.) and transaction prices. The elements of a standard license agreement under this scheme should be fair and reasonable.[257] As a further transfer incentive, the GTPP contemplates an insurance program for the event of IP infringement.[258]

3. Open Innovation: GreenXchange

The GreenXchange is an online open innovation platform where participants can share IP to develop sustainable business models and innovation.[259] Created as a result of "brainstorming" at the World Economic Forum in Davos, Switzerland involving Nike, Yahoo! and other companies,[260] the GreenXchange aims to offer information on participating companies, patents and licensing conditions as well as a members' forum for collaboration and exchange.

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254 Hideo Doi, *Japan's Green Technology Plan*, 196 Managing Intell. Prop. 125, 125-144 (2010).
255 *Supra* note 253.
256 *Id.*
257 *Supra* note 254.
258 *Id.*
259 GreenXchange (beta), http://greenxchange.force.com (last visited Aug. 14, 2010).
260 Don Tapscott, *Davos: Nike and Partners Launch the GreenXchange*, Businessweek, Jan. 27, 2010, *available at* http://www.businessweek.com.

This open innovation[261] model differs from the Eco-Patent Commons in certain ways. Implementers can use the offered patents free of charge, but are obliged to grant back a license to the donor on the same conditions with regard to any improvements created as a result of their use of the offered patents.[262]

B. IP Issues in Green Technology Transfer

According to a patent licensing survey, one in five European companies and one in four Japanese companies licenses patents to non-affiliated parties.[263] Major motivations for companies to license are to: (i) earn revenue; (ii) enter into cross-licensing or technology sharing (*e.g.*, open innovation); (iii) establish their technology as a *de facto* standard; (iv) outsource manufacturing; or (iv) stop infringement of their patents.[264] While comprehensive illustration of the various licensing principles would exceed the scope of this paper, set out below are a few specific considerations in the context of innovation and transfer of green technology.

1. Effects of Non-assertion Commitments

A non-assertion commitment such as in Eco-Patent Commons is comparable to non-exclusive, royalty-free licenses to any potential licensees. From a competition law perspective, non-assertion can be procompetitive because it reduces transaction costs (by avoiding costly litigation), stimulates information exchange, and prevents patent holdup.[265]

However, the scope and duration of non-assertion may create legal uncertainty. Under what circumstances can the patent pledger revoke or terminate its non-assertion commitment? A dispute between IBM and a French open source software company illustrates the issue. IBM warned the French company that it would defend its patents against any unauthorized use.[266] However, it turned out that in relation to at least two of the patents that IBM argued likely to be infringed, IBM had

261 *See generally* Henry William Chesbrough, Open Innovation: The New Imperative for Creating and Profiting from Technology (Harvard Business School Press 2003); *see also* InnoCentive's website *at* http://www.innocentive.com (last visited Aug. 16, 2010).

262 *Supra* note 260.

263 Maria Pluvia Zuniga and Dominique Guellec, *Who Licenses Out Patents and Why? Lessons from a Business Survey* 3-7 (OECD Directorate for Science, Technology and Industry, Working Paper No. 2009/5 DSTI/DOC(2009)5, 2009).

264 *Id.*

265 *See* U.S. Dep't of Justice & Fed. Trade Comm'n, Antitrust Enforcement and Intellectual Property Rights: Promoting Innovation and Competition 89-90 (Spring 2007), *at* www.usdoj.gov/atr/public/hearings/ip/222655.pdf.

266 Letter from Mark S. Anzani, VP and Chief Technology Officer, IBM, to TurboHercules SAS (Mar. 10, 2010), *available at* http://www.turbohercules.com/TH_IBM_Letters.

previously committed to non-assertion.[267] Although IBM reserves the right to terminate such commitment,[268] the conditions are not very clear. The European Commission is currently investigating any competition law violation by IBM.[269]

As a matter of patent policy, challenging patent validity can be desirable when it improves overall patent quality and diminishes the adverse impact of exclusive rights.[270] However, if, as a result of good-faith non-assertion commitments, such pledged patents are more prone to challenge, this may discourage companies from engaging in such commitments. Therefore, balancing the different interests is crucial.

Transfer of technology is thought to work best when potential adopters are capable of implementing such technology themselves. However, developing countries are not always in a position to do so and may require a more comprehensive form of technology transfer. This creates scope for the availability of a wide range of technology transfer options including technical consultancy agreements combined with know-how transfer, turn-key contracts, franchising structures and R&D joint ventures.[271]

2. IP Ownership in R&D Collaboration

Much of green technology innovation involves R&D collaboration among universities and research institutions, industries and governments. A key and internationally complex issue in this context is IP ownership, which can be subject to diverging national norms. Here, the German model is briefly discussed.

Ownership of employee inventions in Germany is traditionally governed by the German Employees Invention Act (ArbErfG). Under this law, the employee inventor must notify the employer of every service invention he or she makes. The employer can then choose to acquire the invention, in which case it must seek patent protection.[272] Prior to 2002, professors were exempted from this obligation and free to assign or otherwise dispose of their title to inventions (so-called professors' privilege). However, since the abolition of this privilege, university technology

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267 Press Release, IBM, IBM Pledges 500 U.S. Patents to Open Source in Support of Innovation and Open Standards (Jan. 11, 2005). The patents-at-issue are U.S. Patent Nos. 5,613,086 (issued Mar. 18, 1997) and 5,220,669 (issued June 15, 1993).

268 *Id.*

269 Press Release, European Commission, Antitrust: Commission Initiates Formal Investigations against IBM in Two Cases of Suspected Abuse of Dominant Market Position (July 26, 2010).

270 *Supra* note 265, at 90-91.

271 *E.g.*, Stanisław Sołtysiński, Lecture at the Munich Intellectual Property Law Center: License Contract Drafting (June 22-25, 2010) (on file with author).

272 *See generally* Michael Trimborn, Employees' Inventions in Germany: A Handbook for International Business (Carl Heymanns Verlag 2008).

transfer offices now have the option of claiming ownership of professorial inventions, which has added a new dimension to R&D collaboration. To streamline the situation, academia and industry, in collaboration with the government, have developed several model agreements on R&D, such as "the Berlin Agreements" and "the BMWi Model Agreements" clarifying ownership issues in R&D.[273] If similar models could be used to cater to R&D collaboration between private sectors in developed countries and public or private counterparts in developing countries, that could help provide legal certainty and practical guidance to parties.

3. Financing Innovation and Patenting Costs

Complementary incentives[274] and pull programs[275] are increasingly considered as a catalyst for green innovation. Examples include "H-prize" to promote the transition to a hydrogen economy, "the Automotive X Prize" for more efficient vehicles, advanced purchasing commitments targeting energy consumption, and carbon trading.[276] Kremer notes that these climate change-related pull mechanisms can provide potential benefits to countries with limited capacities.[277]

Funding patenting costs can also be an effective policy since patenting decisions are observed to be sensitive to fee variations.[278] For example, KIPO offers a 50% reduction of application fees for SME applicants (which also cover the cost for

273 Meital Werner and Heinz Goddar, *Technology Transfer between Academy and Industry – a Comparison of the Situation in Germany and the United Kingdom*, Les Nouvelles 198, 200 (Sept. 2009) (explaining the mechanism in the model agreements as follows: "[t]he model agreements are creating a direct contractual obligation between the university professors and the industry partner. Through this contractual obligation, rights of university professors can be surrendered by them with no legal conflict concerning the employer-employee relationship between the university and university professors. The abolition of the professor's negative freedom to publish is specified explicitly in the agreement by the professor's obligation to surrender his right to negative publish under § 42(2) in respect of all research results. The professor's freedom of research and teaching is also renounced by the parties' commitment to perform the work to their best ability and to provide each other with the necessary information for the performance of the work. The industry partner's concern in regard to inventor's right to file patent applications in those countries where the employer does not wish to file was overcome by the parties' consent that the decision to file any additional foreign applications remains entirely at the discretion of the industrial partner, and will be filed under his name only, as well as the decision to surrender patents in individual countries").

274 *E.g.*, *supra* note 24.

275 Michael Kremer and Heidi Williams, Promoting Innovation to Solve Global Challenges: Opportunities for R&D in Agriculture, Climate Change, and Health 3 (The German Marshall Fund of the United States 2008).

276 *Id*. at 14.

277 *Id.*

278 *Supra* note 4.

examination and the first year registration fee).[279] In Germany, applicants are entitled to reduction of annual fees if they are willing to grant a license to anyone wishing to use the invention in return for reasonable compensation.[280] Such policies could also be employed as incentives for private sector participation in green technology transfer programs.[281]

279 WIPO, KIPO Activities Targeted at the SMEs Sector, *at* http://www.wipo.int/sme/en/best_practices/kipo.htm (last visited Aug. 16, 2010).
280 Article 23(1) of the German Patent Act.
281 *Supra* note 246.

VI. Balancing IP and Competition

Competition law can facilitate innovation and technology transfer by promoting 'static' efficiency through *e.g.*, competition in price and, more importantly, by encouraging 'dynamic' efficiency for the future.[282] Like patent policy, competition law can contribute to green technology development and diffusion, but they need to be balanced with each other.[283]

Given the infancy of the technical field, competition law has not yet played a dominant role in green technology.[284] So far, the idea of limiting the exclusivity conferred by IP rights is driven mainly by the special nature of green technology as public goods, rather than by any abusive behaviour of market participants. However, this is likely to change as the market develops to maturity. In fact, balancing issues will probably soon play out in industrialized countries, where the green IP and competition stakes are rising rapidly.

The first part of Chapter VI mentions the case of a US wind turbine patent at the heart of a prolonged legal battle for access to the US market by some foreign wind energy companies. Based in part on observed parallels with the semiconductor industry, likely applicable developments are identified, such as patent thicket, holdup and business method patents. In relation to the broader issue of international trade, the rise of China in this area, too, is flagged.

The second part of Chapter VI discusses the potential of standards or patent pools as balancing means. IP policies in this area seem to have improved from the past experience of abuse cases; yet, certain issues remain.

A. Patent Litigation and Developments in Law and Practices

1. GE's '039 Patent

U.S. Patent No. 5,083,039 was issued in 1992 (the '039 patent). Its 138 patent claims basically concern a wind turbine mechanism operating at variable speed under different wind conditions to convert wind energy into AC electrical pow-

282 *E.g.*, Josef Drexl, Seminar at the Munich Intellectual Property Law Center: Intellectual Property and Competition Law (Summer 2010) (on file with author).
283 *Supra* note 265.
284 Craig Waldman and Margaret Ward, *Antitrust Issues in Clean Technology*, The Antitrust Source (Apr. 2010), *available at* http://www.antitrustsource.com.

er.[285] At that time, electricity companies in the United States had to deliver power to their customers at a standard fixed frequency (60Hz), requiring the frequency of the power generated by a wind turbine to be constantly adjusted to this standard.[286]

The then-owner of the patent was U.S. Windpower, a California-based company specialized in this area,[287] which in 1993 changed its name to Kenentech.[288] Kenentech initiated a Section 337 proceeding before the US International Trade Commission (ITC) against Enercon, a German wind energy company, for patent infringement to prevent Enercon from entering the US market. Soon after Kenentech filed for bankruptcy in May 1996, the ITC in August 1996 found infringement by Enercon and issued an order excluding the latter's variable wind turbines from the US market until expiry of the '039 patent in 2011.[289] While Enercon appealed before the Federal Circuit, the '039 patent and Kenentech's other IP rights were acquired by Zond Energy Systems, which in 1997 became a subsidiary of Enron Wind.[290] In 1998, the Federal Circuit affirmed the ITC's decision. It appears that the '039 patent was reexamined between 1998 and 1999 and that the patentability of claims was confirmed without amendment. As part of bankruptcy proceedings, the '039 patent and other Enron Wind assets in 2002 ended up in the hands of GE, the largest in wind power in the United States.

A second set of proceedings commenced in 2008 when GE claimed before the ITC against Mitsubishi, a Japanese wind turbine maker, alleging infringement of patents that included the '039 patent.[291] The next year, GE sued Mitsubishi before the Southern District of Texas for infringement of the same patents.[292] Although the ITC's initial finding was favorable to GE, eventually, in January 2010, the ITC found no infringement.[293] In February 2010, GE also pursued Mitsubishi in the Northern District of Texas, requesting an injunction preventing it from using its allegedly infringing technology.[294]

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285 U.S. Patent No. 5,083,039 (issued Jan. 21, 1992).
286 Enercon GmbH v. ITC, 151 F3d 1365 (Fed. Cir. 1998).
287 *E.g.*, Paul Gipe, Wind Energy Comes of Age 3 (John Wiley & Sons, May 1995).
288 *Id.*
289 Pursuant to 35 U.S.C. § 154(a), for patent applications that were pending on June 8, 1995 and for patents that were still in force on June 8, 1995, the applicable patent term is the longer of (i) 17 years from the patent grant, or (ii) 20 years from the filing date of the earliest US or international (PCT) application to which priority is claimed.
290 *Enron Acquires Zond, A Major Wind-Power Company*, N.Y. Times, Jan. 7, 1997, *at* http://www.nytimes.com/1997/01/07/business/enron-acquires-zond-a-major-wind-power-company.html.
291 In the Matter of Certain Variable Speed Wind Turbines and Components Thereof, USITC Inv. No. 337-TA-641 (Mar. 2008), at 2009 ITC LEXIS 510.
292 General Electric Company v. Mitsubishi Heavy Industries, Ltd. et al., No. 2:2009 CV 00229 (S.D. Tex. filed Sept. 3, 2009).
293 *Id*.
294 General Electric Company v. Mitsubishi Heavy Industries, Ltd. et al., No. 3: 2010 CV 00276-F (N.D. Tex. filed Feb. 11, 2010).

Mitsubishi in turn in May 2010 filed a complaint with the Western District of Arkansas accusing GE of "violation of the antitrust laws" in the market of variable speed wind turbines. Mitsubishi argued that the '039 patent and other patents were obtained through fraud because the patentee had failed to disclose material prior art to the USPTO. Meanwhile, Mitsubishi filed a further patent infringement suit against GE with the Middle District of Florida.[295]

2. Patent Law and Practices

The GE cases exemplify what some consider to be "the beginning of an arms race" for IP in the clean energy industry.[296] The wind and other clean energy sectors have been compared to the semiconductor industry in that their products assemble numerous components from different manufacturers.[297] The GE litigation, which demonstrated "the substantial power of a quality patent,"[298] is considered to have given rise to a significant increase in wind energy patent filing. It is worth noting that certain types of practices developed for example with regard to semiconductor patents are often viewed as eroding the patent system: patent thickets, holdup, non-practicing entities, and damages considered excessive.

It is not yet clear whether and how such recent developments in patents will affect this emerging industry. As a general example, will an injunction still be a viable option after *eBay v. MercExchange*? More specific to the industry, will non-practicing entities build green patent portfolios? Little has emerged about intentions of non-practicing entities in this area of technology, although it is known, for example, that Intellectual Ventures operates a subsidiary concerned with the development of nuclear energy.[299] Policies of national patent offices favoring the patenting of green technology might also render this sector susceptible to the aforementioned more controversial patent practices.

In another development, business method patents are becoming more important in this sector, for instance, in relation to emissions trading. As noted, the Chicago Climate Change has the largest number of patents in carbon trading in the United States.[300] By way of illustration, one of these covers a computer-implemented method of "facilitating trade of emission allowances and offsets among participants, which includes establishing an emission reduction schedule for certain par-

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295 Mitsubishi Heavy Industries, Ltd. v. General Electric Co. No. 6:10 CV 00812-JA-KRS (M.D. Florida. filed May 20, 2010).

296 *Id.*

297 *Id.*

298 *E.g.*, James R. Klaiber and Michael T. Nguyen, Panel Discussion at the 2010 AIPLA Annual Meeting (Oct. 21-23, 2010), Predicting the Future of Patent Enforcement in the Renewable Energy Field (unpublished manuscript), *available at* http://www.aipla.org.

299 TerraPower, http://www.terrapower.com.

300 *E.g.*, Eggertson, *supra* note 144; *also generally* Daignault, *supra* note 135.

ticipants based on emission information provided by those participants and determining debits or credits for each certain participant in order to achieve the reduction schedule."[301]

While much of the impetus for these developments comes from actors in the United States, they also involve a growing number of non-American participants in the clean energy sector, such as the emerging Chinese producers; China's green technology trade surplus keeps expanding.[302] Especially at a time when important early patents are to expire, such as GE's '039 patent, international trade disputes look set to encompass the green technology sector as well.

B. Standardization and Patent Pooling

1. Green Technology Standards and Patent Pools

Whereas traditionally, environmental standards primarily aimed to assure safety or prevent direct pollution, new standards in the area of climate change mitigation are now emerging.[303] This trend will likely also impact the emergence of patent pools.

Standardization generally enables industry to achieve interoperability between products provided by different companies and thus to multiply consumer choice while reducing overall costs. Patent pools can also be beneficial in reducing coordination problems amongst licensors, licensees and other participants. They are frequently used in the telecommunication and consumer electronics industries where interoperability is key to performance. A more recent development is humanitarian patent pooling. For example, UNITAID, an international entity tasked with facilitating access to treatment for HIV/AIDS, Malaria and Tuberculosis, is in the process of establishing a patent pool for essential medicines.[304] The "Eco-Patent Commons" is a more loosely defined pool launched by the World Business Council for Sustainable Development (WBCSD).[305] Through a pledge of non-assertion, participants offer their patents free of charge, without prejudice to the possibility of defensive termination.

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301 U.S. Patent No. 7,343,341 (issued Mar. 11, 2008).

302 *E.g.*, Bettina Weiss, *Global PV Competition Creates Increased International Disputes*, *at* http://www.pvgroup.org/NewsArchive/ctr_041594 (last visited Jan 13, 2011).

303 *E.g.*, International Energy Agency (IEA) and International Organization for Standardization (ISO), *International Standards to Develop and Promote Energy Efficiency and Renewable Energy Sources: A Common Position Paper* 2 (June 2007).

304 *See* UNITAID Executive Board Special Session on Patent Pool, Patent Pool Implementation Plan, UNITAID Doc. EB11/SSPP/2010/R1 (Feb. 5, 2010), *available at* http://www.unitaid.eu/en.

305 *See generally*, WBCSD, Eco-Patent Commons, *at* http://www.wbcsd.org/web/epc.

As to possible green patent pools, experts point out that the dispersed nature of green technology across technical fields makes it challenging to set industry-wide standards.[306] Yet, as is the case for telecommunications and consumer electronics, interoperability is increasingly important to certain aspects of green technology, for example, the functioning of smart grids and other means of energy transportation.[307] Both foundational technologies and commoditized applications (*e.g.*, small-scale solar panels) also present opportunities for standardization.[308]

2. The Unocal Case: Abuse in Law of Environmental Standards

In December 1990, the Union Oil Company of California ("Unocal") filed for a US patent on environment-friendly gasoline fuel.[309] Meanwhile, the California Air Resources Board (CARB) was developing standards for clean reformulated gasoline in collaboration with interested parties that included Unocal. November 1991 saw the launch of new compulsory programs that adopted those standards, which would enter into force five years later.[310] In 1994, the USPTO granted Unocal's patent application (the '393 patent).[311] As the CARB standards covered the '393 patent claims, implementation of the standards by other companies effectively implied infringement of Unocal's rights.[312]

When Unocal subsequently announced a licensing plan involving royalties, its competitors responded by initiating declaratory judgment suits.[313] The competitors lost and a split panel of the Federal Circuit affirmed the judgment on appeal. In 2003, the competitors filed a complaint with the US Federal Trade Commission (FTC), arguing that Unocal "gained monopoly power by defrauding" the CARB and industry groups during the gasoline rule-making in the early 1990s.[314] Even-

306 Roger Ross, Via Licensing, Panel Discussion at the University of San Francisco School of Law Cleantech Symposium: Clean Technology and the Law (Oct. 1, 2010), Intellectual Property Mechanisms for the Development and Dissemination of Clean Technologies in the US (unpublished manuscript).

307 *Id.*

308 *Id.*

309 U.S. Patent Application No. 628,488 (filed Dec. 13, 1990) (the specification states that "by controlling one or more properties of a gasoline fuel suitable for combustion in automobiles, the emissions of NOx, CO and/or hydrocarbons can be reduced").

310 *Id.*

311 U.S. Patent No. 5,288,393 (issued Feb. 22, 1994).

312 Janice M. Mueller, *Patent Misuse Through the Capture of Industry Standards*, 17 Berkeley Tech. L. J. 623, 623-625 (2002).

313 Union Oil Co. of Cal. v. Chevron U.S.A. Inc., 34 F.Supp.2d 1222 (C.D. Cal. 1998).

314 Press Release, FTC, FTC Charges Unocal with Anticompetitive Conduct Related to Reformulated Gasoline, FTC Docket No. 9305 (Mar. 4, 2009).

tually, in 2005, just prior to merging with Chevron, Unocal agreed to release the relevant patents.[315]

In cases of "abusive" standards capture – intentional or willful non-disclosure of IP by a standard-setting participant who later refuses to grant a license at reasonable and non-discriminatory terms[316] – remedies may be available under patent law and on other legal bases. For example, in addition to patent misuse, US courts have applied antitrust,[317] deception,[318] equitable estoppel, fraud,[319] and implied license principles.[320] Courts also have highlighted the importance of clear IP directions by Standard-Setting Organizations (SSOs), whose policy role is further discussed below.

3. Green Technology Standards and IP Policies

A 2002 study on IP policies of SSOs[321] found that while most (36 out of 47) of the selected SSOs in the field of telecommunications and computer-networks operated policies governing IP ownership, their disclosure requirements varied significantly.[322] Many SSOs required the disclosure of issued patents, but not of pending applications.[323] Furthermore, some SSOs allowed members to own IP rights in a standard, subject to conditions on use such as royalty-free licensing.[324] Other SSOs prohibited or at least discouraged ownership.[325] Only a limited number of SSOs required a member to search its files or broader literature to identify relevant IP rights.[326] While "reasonable and nondiscriminatory licensing" was the majority rule for royalty-bearing licensing of essential patents, few SSOs explained what those terms meant or how licensing disputes would be resolved.[327]

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315 Press Release, FTC, Dual Consent Orders Resolve Competitive Concerns about Chevron's $18 Billion Purchase of Unocal, FTC's 2003 Complaint against Unocal (June 10, 2005).
316 Mueller, *supra* note 312.
317 *E.g.*, United States v. Dell Corp. 1998 FTC LEXIS 30 (1998); *and* Rambus Inc. v. FTC No. 07-1086 (D.C. Cir. 2008).
318 *E.g.*, 15 U.S.C. § 45(1) (Section 5(1) of the Federal Trade Commission Act).
319 *E.g.*, Rambus Inc. v. Infineon AG, 318 F3d 1081 (Fed. Cir. 2003).
320 Mueller, *supra* note 312.
321 *See* Mark A. Lemley, *Intellectual Property Rights and Standard-Setting Organizations*, 90 Cal. L. Rev. 1889, 1904-1907 (2002).
322 *Id.*
323 *Id.*
324 *Id.*
325 *Id.*
326 *Id.*
327 *Id.*

The dispersed nature of clean technology complicates IP policy review of SSOs with regard to green standards as a whole. Figure 2 makes only a partial attempt by considering selected SSOs in relation to photovoltaic and wind energy standards.[328]

328 Selection of SSOs is based on the following sources: Liang Ji, Underwriters Laboratories Inc (UL), *Introduction to PV Standard Organizations* (2009); IHS Consulting, *Selected Wind Energy Standards & Documents* (2008), *at* http://engineers.ihs.com/news/standards/wind-energy.htm; Photovoltaic Standards (2011), *at* http://www.pvresources.com/en/standards.php.

Figure 2. IP Policies of Selected Green Technology Standard-Setting Organizations

(Note: Questions originate from Prof. Lemley in his article, Intellectual Property Rights and Standard-Setting Organizations, 90 CAL. L. REV. 1889, 1973-1975 (2002) and are here applied by Hee-Eun Kim to SSOs with green technology standards.)

SSOs	Committee on PV or wind energy	Patent Policy	Disclosure?	Search?	Patent declaration/ letter of assurance publicly available on SSO website	Licensing Provisions
ANSI[329]		ANSI Patent Policy 3.1 as revised in 2008[330]	Y (not only patent holder but also any participant; pending applications)	ANSI is not responsible for identifying patents for which a license may be required	N	Under reasonable terms and conditions that are demonstrably free of any unfair discrimination; ANSI's Board of Standard Review will evaluate whether the terms and conditions are "reasonable" and/or "free of any unfair discrimination"
ASTM[331]	E44 for solar, geothermal and other alternative energy sources	Section 15 of the Regulations Governing ASTM Technical Committees[332]	Y (but the committee shall make an initial determination that a patented item is required for inclusion in a draft standard; make efforts to consider alternatives	ASTM is not responsible for identifying patents for which a license may be required	N	Same as ANSI
AWEA[333]	AWEA Small Wind Turbine Performance and Safety Standard[334]	N/A	N/A	N/A	N/A	N/A
CEN/ CENELEC [335]	N/A	CEN/CENELEC Guide 8 "Guidelines for implementation of the common IPR policy"[336] (edited in January 2010)	Y, including pending applications either their own or of others	N/A	Y	Royalty-free or fair, reasonable and non-discriminatory terms and conditions

329 American National Standards Institute (ANSI).
330 ANSI Patent Policy, *at* http://publicaa.ansi.org/sites/apdl/ANSI%20Patent%20Policy.doc.
331 American Society for Testing and Materials (ASTM).

SSOs	Committee on PV or wind energy	Patent Policy	Disclosure?	Search?	Patent declaration/ letter of assurance publicly available on SSO website	Licensing Provisions
IEC[337]	TC82 for PV / TC88 for wind turbines	ITU-T/ITU-R/ISO/ IEC Common Patent Policy[338] (adopted in 2007)	Y, including pending applications	N/A	Y	Royalty-free or fair, reasonable and non-discriminatory terms and conditions
IEEE[339]	SCC21 on fuel cells, PVs, dispersed generation, energy storage	IEEE-SA Standards Boards Bylaws[340] (as approved in December 2010)	Y, any potential Essential Patent Claims personally aware, anyone's	No duty to perform a patent search	N	No enforcement or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination
ISO	TC 180 on solar energy; TC 255 on biogas; TC 85 on nuclear energy	ITU-T/ITU-R/ISO/ IEC Common Patent Policy[341] (adopted in 2007)	Y, including pending applications	N/A	Y	Royalty-free or fair, reasonable and non-discriminatory terms and conditions
SAC[342]	TC90 on PV (corresponding to IEC's TC82)	Draft Regulations on the Administration of Formulating and Revising National Standards Including Patents[343] (as of November 2009)	Y (patent proprietors who are either involved in developing a standard or aware that a standard under development relates to a patent they hold are obliged to disclose their patents; failure to do so results in a royalty-free license; intentional concealment will cause unspecified liability)		N/A	Either a royalty-free license or a license that bears a royalty that is 'significantly lower than the normal licensing fee'; silence as to what are the factors determining 'normal licensing fee'

332 ASTM, Regulations Governing ASTM Technical Committees (issued Oct. 2010), *at* http://www.astm.org/COMMIT/Reg.pdf.

333 American Wind Energy Association (AWEA).

SSOs	Committee on PV or wind energy	Patent Policy	Disclosure?	Search?	Patent declaration/ letter of assurance publicly available on SSO website	Licensing Provisions
SEMI[344]	SEMI PV1-0709, SEMI PV2-0708 focusing on materials, wafers, cells and equipment (rather than on modules and systems)	Section 15 of SEMI Standards Regulations[345] (as of March 2, 2010)	Y (any participants, any non-confidential patented technology or copyrighted information, including issued patents and published patent applications)	N	N/A	Reasonable and non-discriminatory terms and conditions
UL	UL1703, UL1741, UL8703 on PVs	Section 8 of UL's Standards Development and Maintenance Program[346] (issued in October 2007)	Same as ANSI	UL is not responsible for identifying patents for which a license may be required	N	Same as ANSI

334 AWEA, Small Wind Turbine Performance and Safety Standard (AWEA Standard 9.1 – 2009) (2009), *available at* http://www.awea.org.

335 European Committee for Electrotechnical Standardization (CENELEC).

Overall, the above data suggest some progress in governance on IP in standards on the part of these particular SSOs. Most have IP policies in place requiring the disclosure of issued patents, pending applications and other non-confidential information. For this purpose, standard-setting participants are provided with procedures for submitting a patent declaration or a letter of assurance. Some SSOs make these submissions available on their website, publicly showing which, if any, patents have been declared with respect to a particular standard.[347]

Under these SSOs' policies, licensing is usually available under reasonable and non-discriminatory terms. The precise meaning of these conditions will take account of the circumstances of each case and involves fine-tuning the balance between IP rights and access. Comparable in this respect to certain other areas, in green technology, standardization can facilitate the creation of physical networks and help more affordable technology to reach emerging economies. On the other hand, the infancy of the green technology market may cause reluctance on the part of companies to commit to certain licensing terms and conditions in early stages of commercialization.

Finally, affecting participants regardless of their provenance, the above-mentioned Chinese SSO's Regulations on mandatory licensing in case of non-disclosure and on the level of licensing fees appear to deviate to an extent from more regular international practice.

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336 CEN/CENELEC, CEN/CENELEC Guide 8: CEN-CENELEC Guidelines for Implementation of the Common IPR Policy (Patents and Other Statutory Intellectual Property Rights Based on Inventions), Jan. 2010, *at* http://ftp.cenorm.be/BOSS/Reference/Guides/CEN_CLC/CEN_CLC_8.pdf.

337 International Electrotechnical Council (IEC).

338 ITU-T, ITU-R, ISO, IEC, Guidelines for Implementation of the Common Patent Policy for ITU-T/ ITU-R/ ISO/ IEC, *available at* http://www.iec.ch/tctools/patent-guidelines.htm.

339 Institute of Electrical and Electronics Engineers (IEEE).

340 IEEE, IEEE-SA Standards Boards Bylaws, *at* http://standards.ieee.org/develop/policies/bylaws/sb_bylaws.pdf.

341 ITU-T *et al*., *supra* note 338.

342 Standardization Administration of the People's Republic of China (SAC).

343 http://www.sac.gov.cn/templet/default/ShowArticle.jsp?id=5298.

344 Semiconductor Equipment and Materials International (SEMI).

345 Governing SEMI Standards Committees, Regulations (issued Mar. 2, 2010), *at* http://www.semi.org/cms/groups/public/documents/web_content/p041894.pdf.

346 UL, The Standard for Safety UL's Standards Development and Maintenance Program (issued Oct. 15, 2007).

347 *E.g*., IEC, List of IEC Patent Declarations Received by IEC, *at* http://www.patents.iec.ch (last visited Jan. 17, 2011).

VII. Conclusion

General discussion of the role of IP in the context of climate change tends to focus on several proposals made during the international climate change negotiations. However, the present review of the international environmental regime, the patent system including patent law, patent policy and patent information, private initiatives for technology transfer, and aspects of competition law suggests a richer scope for experimentation on the broad potential of IP for helping to resolve the climate change problem. Within the structured and comprehensive approach which this paper attempts to take, a number of specific issues appear of particular interest to the opportunities and limitations of IP in this context. These issues include controversial aspects of patent offices' actual or contemplated preferential treatment of green technology inventions, in terms of technical fields, patenting criteria and environmental influence; the role of IP information; and competition law concerns.

For IP to fulfil its potential in addressing the climate change issue, a multifaceted approach is needed. Solutions can come not only from the law as such but from a range of government policies and private initiatives locally and internationally stimulating innovation. As every approach has its own limitations, it is important not to exclude but to combine options. No matter how these options are combined, this paper suggests that a core function of the IP system in the climate change context is the optimization of information provision to technology users. Emerging collaborative initiatives for knowledge-sharing mechanisms can be emulated and used as a starting point for further multilateral efforts.[348] Human survival, we are often reminded, depends on the improvement of environmental technology and technology sharing[349] – putting a high premium on an optimally functional IP system in the broadest sense.

348 *Supra* note 24.

349 Christiana Figueres, Executive Secretary, UNFCCC, Interview at the Ministerial Meeting convened by the Swiss and Mexican Governments on Climate Change Finance (Sept. 3, 2010).

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