**Brigham Young University International Law & Management Review**

Volume 6 | Issue 1 Article 3

1-15-2010

# Does Climate Change Justify Compulsory Licensing of Green Technology?

Robert Fair

# Does Climate Change Justify Compulsory Licensing of Green Technology?

*Robert Fair**

## I. INTRODUCTION

The impact of the developing world on global pollution has increased dramatically in recent years. China recently surpassed the United States as the largest producer of carbon dioxide ($CO_2$) in the world.[1] Chinese emissions accounted for two-thirds of the worldwide increase in $CO_2$ in 2007, and its pollution levels continue to rise.[2] India and Russia have also experienced dramatic increases. In 2007, India and Russia were each responsible for about ten percent of the increase in worldwide emissions.[3] In contrast, the European Union decreased its emission levels that year.[4]

Calls from the developed world for developing countries to reduce their increasing share of global pollution are somewhat hypocritical,[5] as many developed states, particularly those in Western Europe, went through a similar stage of development that was accompanied by harmful pollution.[6] In the nineteenth and early twentieth centuries, London was "bathed in smoke" so toxic that thousands of people died from it; yet air pollution received little attention until the 1950s.[7] It has been argued that

* University of Pennsylvania Law School, J.D. 2010; Vassar College, B.A. 2004. I would like to thank Professor Osagie Imasogie for his thoughtful comments and guidance on this Article.

1. John Vidal & David Adam, *China Overtakes U.S. as World's Biggest CO2 Emitter*, GUARDIAN, June 19, 2007, *available at* http://www.guardian.co.uk/environment/2007/jun/19/china.usnews; *see also* Neth. Envtl. Assessment Agency, *China Now No. 1 in CO2 emissions; USA in Second Position*, http://www.pbl.nl/en/dossiers/Climatechange/moreinfo/Chinanowno1inCO2emissionsUSAinsecondposition.html.

2. Nether. Envtl. Assessment Agency, *Global CO2 emissions: increase continued in 2007* (June 13, 2008), http://www.pbl.nl/en/publications/2008/GlobalCO2emissionsthrough2007.html.

3. *Id.*

4. *Id.*

5. *West Told to Stop Blaming Developing Countries for Pollution*, CHINA DAILY, Jun. 25, 2007, *available at* http://www2.chinadaily.com.cn/china/2007-06/25/content_901695.html.

6. Kelly McParland, *China Achieves Olympian Pollution Levels*, NAT'L POST, Jul. 9, 2008, *available at* http://network.nationalpost.com/np/blogs/posted/archive/2008/07/09/china-achieve-s-olympian-pollution-levels.aspx; Kevin D. Hill, *Smog, Science and the EPA*, 25 N. KY. L. REV. 1, 4–5 (1997).

7. Hill, *supra* note 6, at 4–5.

if the developed world was allowed to progress without regard to the harmful environmental consequences accompanying that development, states currently developing should not be denied the same opportunity. While this argument is not wholly without merit, developing states need not necessarily choose between economic development and pollution reduction. Instead, these states could "leap-frog" the stage of development that requires heavy pollution by implementing some of the existing and forthcoming technologies that promote sustainable and renewable forms of energy.[8]

However, the development of such innovative technology is costly. To offset these significant costs, most innovative firms and individuals seek to protect their inventions with patents, which give them a statutory monopoly over the use and dissemination of the technology for at least twenty years.[9] Strong intellectual property rights (IPR) are important for creating the economic incentives necessary for technology firms to devote time and money to developing innovative technology.[10] However, this strong protection also increases costs to consumers in the developing states that import these innovations,[11] and prevents polluters in these states from taking advantage of patented green technology without paying for a license.[12] States that understandably focus more on reducing poverty and increasing economic growth than reducing harmful emissions are unable or unwilling to pay for such licenses, and high start-up costs prevent them from entering the market themselves.[13] Thus, while strong intellectual property protections increase incentives to create innovative clean energy technology that may help reduce harmful

8. Deborah L. Cohen, *VC Group's Heesen Says Clean Tech Still Hot*, REUTERS, Jun. 2, 2009, *available at* http://www.reuters.com/article/smallBusinessNews/idUSTRE5516J620090602 (stating that energy technology investment has increased from two percent five years ago to fifteen percent of total venture capital).

9. Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 229, 33 I.L.M 1125, 1208 art. 31 (1994), *available at* http://www.wto.org/english/tratop_e/trips_e/t_agm0_e.htm [hereinafter TRIPS] (stating the period of patent protection shall be no less than twenty years); Tim Wilson, *Undermining Mitigation Technology: Compulsory Licensing, Patents and Tariffs*, Australian Institute of Public Affairs, Aug. 2008, 21/1, 4, *available at* http://www.apec.org.au/docs/08_IPAAASC_MT.pdf.

10. Grace K. Avedissian, Note, *Global Implications of a Potential U.S. Policy Shift Toward Compulsory Licensing of Medical Inventions in a New Era of "Super-Terrorism,"* 18 AM. U. INT'L L. REV. 237, 244–46 (2002).

11. Colleen Spring Zimmerman, *Overview: Intellectual Property—The New Global Currency*, *in* 1 INTELLECTUAL PROP. IN THE GLOBAL MARKETPLACE 0.1, 0.5 (Melvin Simensky et al. eds., 1999).

12. Jason Weiner, *Sharing Potential and the Potential for Sharing: Open Source Licensing as a Legal and Economic Modality for the Dissemination of Renewable Energy Technology*, 18 GEO. INT'L ENVTL. L. REV. 277, 278 (2006).

13. Wilson, *supra* note 9, at 4; Weiner, *supra* note 12, at 278.

emissions, those same protections may actually impede the diffusion of clean energy technology to the developing world, which is rapidly becoming the major source of those emissions.[14]

The response to this dilemma from developing states has been similar to their response to the issue of whether they have a right to pollute. Just as current developed states were great polluters while they developed, those same developed states also ignored intellectual property rights during their development.[15] Developing states see no valid reason prohibiting them from doing the same.[16] However, rather than supporting outright theft of patented energy-efficient technology, developing states have advocated for the temporary removal of patent protection for such technology.[17]

The concept of relaxing IPR with regards to green technology has considerable support, both in developing and developed states. U.S. President Barack Obama has opined that, "it's critical for us to lead by example by becoming more energy efficient [and by] shar[ing] scientific breakthroughs."[18] Even stronger statements have come from the developing world. The *2007 Joint Position Paper of Brazil, China, India, Mexico and South Africa Participating in the G-8 Summit*, stated:

> In order for developing countries to contribute to the efforts to address climate change, access to adequate technology is a key enabling condition. We need an agreement on transfer of technologies at affordable costs for accelerated mitigation efforts in developing countries, inter alia through increased use of renewable energy, including biofuels, and enhanced energy efficiency. Rewards for innovators needs to be balanced with common good for humankind.[19]

Bolivian President Evo Morales advocated the relaxation of IPR pertaining to climate change technology "so that all countries can access

14. Dr. Benjamin K. Sovacool, *Placing a Glove on the Invisible Hand: How Intellectual Property Rights May Impede Innovation in Energy Research and Development (R&D)*, 18 ALB. L.J. SCI. & TECH. 381, 387 (2008).

15. *See Battle of Ideas*, ECONOMIST, Apr. 23, 2009, *available at* http://www.economist.com/business/displaystory.cfm?story_id=13528318 (stating that the United States "was the great copyright and patent infringer when it was a developing country in the 18th century").

16. *Id.*

17. Wilson, *supra* note 9.

18. *Full Text of Barack Obama's Strasbourg Town Hall with Questions*, L.A. TIMES, Apr. 3, 2009, *available at* http://latimesblogs.latimes.com/washington/2009/04/full-text-of-barack-obama-in-strasbourg-town-hall.html.

19. Joint Position Paper of Brazil, China, India, Mexico and South Africa Participating in the G-8 Summit, June 8, 2007, *available at* http://pmindia.nic.in/visits/content.asp?id=155.

products already patented. . .free of cost."[20] Nigeria, Indonesia, and even the European Parliament have all made similar statements.[21]

While the notion of sharing energy efficient technology may be lofty, the economic and legal reality is that green technology has become big business. The corporations and inventors who create these innovations use the global IPR system to profit (sometimes greatly) from them for the entire length of the statutory monopoly granted by patents. When IPR have been threatened in the past, corporations have taken drastic measures in response.[22] It is unlikely that these corporations will give up these rights without resistance, especially given the recent increase in venture capital investment in renewable energy technology.[23] Therefore, any relaxation of IPR for green technology would have to come not from the patent owners themselves, but from the legal institutions that grant statutory monopolies to those patent owners. The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) allows for the issuance of compulsory licenses, which could, in theory, be used to address the problem posed by increased pollution by the developing world.[24]

TRIPS allows for compulsory licensing of patented technology without the authorization of the patent owner in times of "emergency."[25] Such licenses have typically been employed in the past for pharmaceutical products used to fight epidemics such as AIDS, but the scope of compulsory licensing has recently been widened to include long-term health problems such as heart disease and cancer.[26] With this in mind, some argue that environmental pollution may be considered a long-term health problem because it leads to the premature death of millions each year. There is currently no bar to granting compulsory licenses for green technology, and support for such use of compulsory licenses arguably exists in other provisions of TRIPS and in certain areas of patent law.[27]

However, the wide implementation of such a practice would have

20. Sidney A. Rosenzweig, *PFF on Cooling the World By Misappropriating Patent Rights*, Intellectual Property Watch, Apr. 1, 2009, http://www.ip-watch.org/weblog/2009/04/01/cooling-the-world-by-misappropriating-patent-rights/.

21. Wilson, *supra* note 9, at 5.

22. *See infra* notes 87–97.

23. Michael Hasper, *Green Technology in Developing Countries: Creating Accessibility Through a Global Exchange Forum*, DUKE L. & TECH. REV. 1, 4 (2009).

24. Andrew W. Torrance, *Patents to the Rescue: Disasters and Patent Law*, 10 DEPAUL J. HEALTH CARE L. 309, 327 (2007).

25. TRIPS, *supra* note 9, at art. 31.

26. *See infra* Section 3.2.

27. *See infra* Section 3.

serious negative ramifications. Increased use of compulsory licensing would almost certainly elicit a harmful backlash from the owners of the appropriated patents, as well as from their respective states. In addition, several key differences between the energy industry and the pharmaceutical industry make compulsory licensing far less appropriate in the former than in the latter. Finally, there are more effective methods of transferring energy-efficient technology to developing states, such as removing tariff and non-tariff trade barriers. Thus, while an argument can certainly be made for using compulsory licensing of green technology to help combat climate change, several drawbacks prevent this route from being the best option for effectively transferring green technology to developing states.

## II. COMPULSORY LICENSING UNDER TRIPS

Under TRIPS, all members of the World Trade Organization (WTO) must provide a minimum level of patent protection, which includes the right to exclude others from making, using, selling, or importing patented inventions for the term of the patent.[28] The intellectual property rights set forth in TRIPS are enforceable through the WTO's highly effective system of dispute resolution.[29] However, those rights are not absolute.

While the TRIPS agreement does not use the term "compulsory licensing," Article 31 clearly pertains to compulsory licensing and could be used to argue for such licensing of green technology.[30] Article 31 sets forth a procedural prior negotiation requirement between users and patent owners that must be met before the patents can be used without authorization. However, this requirement may be waived in the case of "national emergency, other circumstances of extreme urgency, and in cases of public non-commercial use."[31] Under such a scenario, a state may allow its citizens to produce the patented invention without giving notice to, or receiving authorization from the owner of the patent.[32] The 2001 Doha Declaration on TRIPS further encouraged states to take advantage of compulsory licensing by stating that "[e]ach Member has the right to grant compulsory licenses and the freedom to determine the

28. TRIPS, *supra* note 9, at arts. 27, 28, 31.

29. Cynthia M. Ho, *Patent Breaking of Balancing?: Separating Strands of Fact from Fiction Under TRIPS*, 34 N.C.J. INT'L L. & COM. REG. 371, 384 (2009).

30. Peggy B. Sherman & Ellwood F. Oakley, III, *Pandemics and Panaceas: The World Trade Organization's Efforts to Balance Pharmaceutical Patents and Access to AIDS Drugs*, 41 AM. BUS. L.J. 353, 369 (2004).

31. TRIPS, *supra* note 9, at art. 31.

32. Sherman, *supra* note 30, at 369.

grounds upon which [compulsory] licenses are granted."[33]

Once a compulsory license has been granted, a state may domestically produce the patented technology or import it from abroad, as the benefits of compulsory licensing during "national emergencies" are not limited to states that have the domestic manufacturing capability to produce the licensed product. The 2003 WTO decision entitled *Implementation of Paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health* authorizes a WTO member, under certain circumstances, to grant a compulsory license for exporting a pharmaceutical product to a state that faces a "national emergency" but lacks the manufacturing capacity necessary to produce that product.[34] The EU has adopted a similar regulation that permits compulsory licensing of pharmaceutical products for exportation to developing states with "public health problems."[35]

Compulsory licensing provisions exist in TRIPS and in many countries' intellectual property laws because they relate to one of the most basic purposes of patent law: to provide incentives to spur innovation, specifically for the good of the public that benefits from that innovation.[36] Generally, the practice of providing incentives for innovation by creating a proprietary interest in the resulting technology serves the public good. However, economic rewards and the public good occasionally conflict, particularly during times of emergency. During these times, the patent owner of a product desperately needed to help those affected by the emergency situation might keep prices high and production low.[37] Thus, compulsory licensing in emergency circumstances helps serve an underlying purpose of intellectual property law.

## III. PAST THREATS AND USES OF COMPULSORY LICENSING

While the U.S. Supreme Court observed that "[c]ompulsory

33. World Trade Organization, Declaration on the TRIPS Agreement and Public Health, WT/MIN(01)/DEC/W/2 , 41 I.L.M. 755, 755 (2002), [hereinafter Doha Declaration] http://www.who.int/medicines/areas/policy/tripshealth.pdf.

34. World Trade Organization, Implementation of Paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health, WT/L/540, 43 I.L.M. 509, 510 (2004) [hereinafter 2003 WTO Decision] http://www.wto.org/english/tratop_E/TRIPS_e/implem_para6_e.htm.

35. Council Regulation 816/20062006 O.J. (L 157) (May 17, 2006) [hereinafter 2006 Council Regulation],

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:157:0001:01:EN:HTML.

36. Giles S. Rich, *Foreword in* F. SCOTT KIEFF, ET AL., PRINCIPLES OF PATENT LAW: CASES AND MATERIALS iii, iii (4th ed. 2008).

37. Torrance, *supra* note 24, at 327.

licensing is a rarity in our patent system"[38] there is an established history of such licenses being threatened or issued, both in the United States and abroad. This Section first discusses governmental threats to ignore patent rights, and then considers incidences where governments have gone beyond threats and have granted compulsory licenses for certain technology.

### *A. Threats*

Often a threat by a government to ignore patent rights is enough for owners of those rights to lower the prices of their patented products.[39] After the 9/11 terrorist attacks, letters contaminated with anthrax entered the U.S. postal system, resulting in the death of five Americans.[40] The pharmaceutical company Bayer AG had a patent covering the antibiotic Cipro(R) that could be used to treat anthrax infections, but the company was unable to produce enough of the drug to keep up with the sudden spike in demand.[41] The U.S. Secretary of Health and Human Services started to pressure Bayer publicly about the price and supply of Cipro(R), and threatened to ignore the company's patent.[42] Bayer then agreed to lower its price by fifty-five percent and considerably increase its capacity for manufacturing the antibiotic.[43]

A similar situation arose in response to the global bird flu epidemic in 2005 and 2006.[44] Roche, a pharmaceutical company, owned the patent for Tamiflu(R), a potentially lifesaving drug, but was unable to deliver all its orders for the drug during the epidemic.[45] U.S. Senator Chuck Schumer denounced Roche for elevating profits above health concerns and demanded that the firm license its technology to other drug-makers

38. Dawson Chemical v. Rohm & Haas, 448 U.S. 176, 215 (1980).

39. Jennifer L. Rich, *Roche Reaches Accord on Drug with Brazil*, N.Y. TIMES, Sept. 1, 2001, at C1, *available at* http://www.nytimes.com/2001/09/01/business/roche-reaches-accord-on-drug-with-brazil.html (describing how Roche agreed to drop the price of an AIDS drug by more than forty percent in Brazil after such a threat).

40. FBI - Post-9/11 Amerithrax Investigation, http://www.fbi.gov/anthrax/amerithraxlinks.htm.

41. Anthony York, *Is It Time to Bust the Cipro Patent?*, SALON, Oct. 18, 2001, *available at* http://archive.salon.com/tech/feature/2001/10/18/cipro_patent/index.html.

42. Matt Fleischer-Black, *The Cipro Dilemma—In the Anthrax Crisis, Tommy Thompson Distorted Patent Law to Save Public Health. Good Move?*, 1 AM. LAWYER 53 Jan. 2002, *available at* http://www.cptech.org/ip/health/cl/cipro/americanlawyer012002.html.

43. Unmesh Kher, *Why Roche Released Tamiflu*, TIME, Oct. 19, 2005, *available at* http://www.time.com/time/business/article/0,8599,1120533,00.html.

44. Torrance, *supra* note 24, at 343.

45. Sebastian Mallaby, *A Double Dose of Failure*, WASH. POST, Nov. 7, 2005, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2005/11/06/AR2005110601013.html.

or face legislation compelling it to do so.[46] Other states went further. Taiwan, India, Thailand, and Argentina said they would completely ignore Roche's patent and manufacture their own versions of Tamiflu(R).[47] Roche eventually relented and entered into discussions to license the production of the drug at more favorable prices.[48]

### *B. Uses*

On occasion, governments have done more than merely threaten to invoke their compulsory licensing rights under TRIPS. In confronting an AIDS epidemic in 2005, Brazil followed through on its threat to break the patents owned by the drug manufacturer Abbott Laboratories. The Brazilian legislature approved a bill that suspended the patents and authorized local production of generic versions of all drugs used to treat HIV.[49] The Brazilian government claimed that this bill was compliant with its obligations under TRIPS, because it simply suspended these patents temporarily due to a health emergency.[50] Abbott Laboratories subsequently responded to the move by lowering the price it charged for a combination of anti-retroviral drugs used to treat HIV, saving Brazil an estimated $250 million.[51]

Similarly, in 2007, Thailand approved a compulsory license for the AIDS drug Kaletra after failing in its attempts to receive a price reduction on the drug.[52] The license allowed domestic drug makers to copy the patent holder's formula and sell the medicine domestically, saving thousands of lives.[53] The United States, although unhappy with this action, acknowledged Thailand's legal right to issue the license under TRIPS. Additionally, former U.S. President Bill Clinton endorsed the decision to grant a compulsory license.[54]

---

46. *Id.*

47. *Id.*; James Packard Love, Research Note, *Recent Examples of the Use of Compulsory Licenses on Patents*, KNOWLEDGE ECOLOGY INT'L 2 (Mar. 8, 2007), *available at* http://www.keionline.org/misc-docs/recent_cls.pdf.

48. Kher, *supra* note 43.

49. Mary Ann Liebert, *Brazil, Abbott Reach Tentative Deal on Kaletra*, 24 BIOTECH. L. REPORT 583, 583–84 (2005), *available at* http://www.itssd.org/References/Market/biotch%20law%20rptr%20-%2010-2005%20-%20ITSSD%20cited.pdf.

50. *Id.*

51. *Id.*

52. Keith Alcorn, *Abbott to Withhold New Drugs from Thailand in Retaliation for Kaletra Compulsory License*, AIDS Map News, Mar. 15, 2007, http://www.aidsmap.com/en/news/00C7641B-57F5-4AB8-8876-9040425D4464.asp.

53. Charles Collins-Chase, *The Case Against TRIPS-Plus Protection in Developing Countries Facing AIDS Epidemics*, 29 U. PA. J. INT'L L. 763, 788 (2008).

54. Celia Dugger, *Clinton Foundation Announces a Bargain on Generic AIDS Drugs*, N.Y.

Even states incapable of domestically manufacturing the licensed products have benefited from compulsory licensing. In 2007, Canada took advantage of the 2003 WTO Decision *Implementation of Paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health* by issuing a compulsory license for the production and export of an AIDS drug to Rwanda.[55] Compulsory licenses have also been granted by Eritrea, Ghana, Guinea, Malaysia, Swaziland, and Zimbabwe for the importation of AIDS medication from abroad.[56] While incidents of compulsory licensing may indeed be rare, they are becoming less so. Their use, or threatened use, to provide lower-priced medication to the developing world provides a helpful precedent supporting the argument that such licensing can be used for green technology.

## IV. MAKING THE CASE THAT CLIMATE CHANGE CONSTITUTES AN EMERGENCY FOR THE PURPOSES OF COMPULSORY LICENSING

As stated above, Article 31 of TRIPS permits compulsory licensing in the "case of national emergency" or for "public non-commercial use."[57] Issuing compulsory licenses for green technology is unlikely to be considered "public non-commercial use" because such technology will undoubtedly be attached to some sort of commercial enterprise. Yet a case can be made that environmental pollution is a "national emergency" in the developing world, and thus compulsory licensing of green technology should be permissible. Sixteen of the twenty most polluted cities in the world are in China.[58] Air pollution alone prematurely kills between two and three million people annually,[59] and about ninety percent of those deaths occur in the developing world.[60] This number is much higher than the combined number of deaths from Bird Flu and Anthrax,[61] and compulsory licenses were threatened for

TIMES, May 8, 2007, at A9, *available at* http://www.nytimes.com/2007/05/09/world/09aidsdrugs.html.

55. Watson, *supra* note 54, at 147.

56. Love, *supra* note 47, at 2.

57. TRIPS, *supra* note 9, at art. 31.

58. Rachel Oliver, *All About: Developing Cities and Pollution*, CNN, Mar. 11, 2008, http://www.cnn.com/2008/WORLD/asiapcf/03/09/eco.cities/index.html.

59. World Health Organization (WHO), *Estimated Deaths & DALYs Attributable to Selected Environmental Risk Factors, by WHO Member State* (2002), *available at* http://www.cleanairnet.org/caiasia/1412/article-71943.html.

60. Population Information Program, *Pollution and Health Risks*, *Population Reports* (2000), *available at* http://www.infoforhealth.org/pr/m15/m15chap2.html.

61. WHO, *Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1)* (Sept. 24, 2009), *available at* http://www.who.int/csr/disease/avian_influenza/country/cases_table_2009_09_24/en/index.html

each of those emergencies.

While in the past compulsory licensing has been used primarily for pharmaceutical products, Article 31 of TRIPS could conceivably be used by a state to

> force the patentee of an eco-friendly invention to allow its use by the state. For instance, if a country's government could not wait twenty. . .years before it wished to use the invention to reduce carbon emissions, Article 31(b) could be used. Similarly, if the patentee of a first eco-friendly invention refuses to grant a license to a second patentee of an improvement (the dependent patent) of this first invention, Article 31(l) could be used to force him to do so.[62]

Such compulsorily licensing of proprietary renewable energy technology would enable domestic firms to develop the capacity to produce and deploy clean energy technology.[63] While it does not appear that any state has attempted to use Article 31 of TRIPS in the context of environmental issues such as climate change,[64] there is no bar from doing so.

### *A. The Text of TRIPS and Patent Law History Support Compulsory Licensing of Environmentally Friendly Technology*

Although environmental issues are not specifically mentioned in Article 31 of TRIPS, there are no subject matter restrictions to the Article that prevent its use for green technology,[65] and environmental considerations are prevalent in other areas of the agreement. Paragraph 2 of Article 27 allows WTO member states to prohibit the patentability of inventions in order "to protect ordre public or morality, including. . .avoid[ing] serious prejudice to the environment."[66] No clear standard is provided for what is considered *ordre public* or what is considered serious prejudice to the environment,[67] but air pollution is

(counting 262 deaths from Bird Flu worldwide); WHO, *Anthrax in the United States* (Nov. 21, 2001), *available at* http://www.who.int/csr/don/2001_11_23/en/index.html (counting five deaths from anthrax in the United States).

62. Estelle Derclaye, *Intellectual Property Rights and Global Warming*, 12 MARQ. INTELL. PROP. L. REV. 263, 281 (2008).

63. Weiner, *supra* note 12, at 298.

64. Derclaye, *supra* note 63, at 274.

65. Ho, *supra* note 29, at 397.

66. TRIPS, *supra* note 9, at art. 27.

67. Carlos Correa, *Integrating Public Health Concerns into Patent Legislation in Developing Countries*, at 12 (2000), *available at* http://www.who.int/medicinedocs/pdf/h2963e/h2963e.pdf; Derclaye, *supra* note 63, at 274.

certainly harmful to the environment. While this provision pertains to requirements for patentability, not compulsory licensing, it could be used to support the notion that ignoring patent rights of green technology is necessary to "avoid serious prejudice to the environment."

In addition to the text of TRIPS and subsequent declarations, the effect of patents on the environment is one of the factors taken under consideration in other areas of patent law. There have been legal disputes on the patentability of inventions that have had or may have an effect on the environment, such as genetically modified animals or plants.[68] The Harvard/Onco Mouse decision, before the European Patent Office (EPO), involved the patentability of a genetically modified mouse designed to help find the cure for cancer. In this case, the court upheld the patent, weighing the "possible risks to the environment" against the "usefulness to mankind."[69] In a similar case with an opposite holding, the EPO refused a patent application for a mouse that was genetically modified to lose hair on the grounds that the harm to the animal was greater than the benefit of the invention.[70]

These decisions are distinguishable in that they concern the patentability of inventions that could potentially *harm* the environment, rather than the potential for ignoring patents on inventions that *help* the environment. Nonetheless, these decisions demonstrate that environmental impact is already considered during the application process.

A recent decision from the U.S. Court of Appeals for the Federal Circuit shows that courts can easily do the same in determining whether a compulsory license should be issued. In *Paice LLC v. Toyota Motor Corp*., the District Court issued an ongoing-royalty order that, like a compulsory license, allowed Toyota (the infringer) to continue to use the plaintiff's patented hybrid automobile technology in exchange for a twenty-five dollar royalty payment for every car that used the technology.[71] Toyota successfully argued that an injunction should not be issued against its use of the patented technology because doing so would be contrary to the public interest in reducing harmful emissions and dependence on foreign oil.[72] As set forth by the U.S. Supreme Court

68. Derclaye, *supra* note 63, at 274.

69. Harvard/Onco-Mouse, T 19/90 [1990] E.P.O.R. 501, 513; T 0315/03, Transgenic animals/HARVARD (July 6, 2004), http://legal.european-patent-office.org/dg3/pdf/t030315ex1.pdf; Derclaye, *supra* note 63, at 275.

70. Derclaye, *supra* note 63, at 275.

71. Paice LLC v. Toyota Motor Corp., 504 F.3d 1293, 1313 (Fed. Cir. 2007).

72. Paice LLC v. Toyota Motor Corp., No. 2:04-CV-211-DF, 2006 WL 2385139 at *3 (E.D. Tex. 2006) [hereinafter *Paice* District decision].

in *eBay v. MercExchange*, public interest is one of the four factors considered by courts in determining whether an injunction in patent infringement suits should be ordered.[73] While the Federal Circuit in *Paice* vacated and remanded the ongoing-royalty rate because it was not supported by any reason why twenty-five dollars was an appropriate royalty, it did not object to the District Court's decision to allow Toyota to continue to use the technology without the plaintiff's permission.[74] Thus, the text of TRIPS and patent case law involving both patentability and compulsory licensing can be used to support the compulsory licensing of green technology.

### *B. The Use of Compulsory Licensing Has Broadened in Scope*

Some argue that compulsory licensing for "emergencies" should not be applied to long-term environmental problems like climate change,[75] and should only be available for widespread epidemics where access to a particular drug is insufficient.[76] However, both the 2003 WTO Decision and the 2006 EU Regulation on Compulsory Licensing expressly state that no limits exist on the scope of diseases for which compulsory licenses may be granted.[77] While the use of compulsory licensing has been considerably more common for drugs that treat widespread epidemics like AIDS, there has been a recent shift toward using compulsory licensing for a wider spectrum of public health issues.[78]

For example, in 2007, Thailand became the first state to expand the scope of compulsory licensing to chronic diseases when it issued a compulsory license for the heart medication Plavix.[79] In 2008, Thailand went further by granting compulsory licenses for breast and lung cancer medicines,[80] and threatened to do the same for anti-cholesterol drugs.[81] Applications for compulsory licensing for several cancer drugs are also

73. eBay v. MercExchange, 547 U.S. 388, 391 (2006).

74. Paice LLC, 504 F.3d at 1315.

75. Roger Bate, Editorial, *Thailand's Patent Attack*, N.Y. SUN, Feb. 13, 2007, at Op. 9, *available at* http://www.nysun.com/opinion/thailands-patent-attack/48499/.

76. Tom Giovanetti, *Intellectual Property and the U.S Auto Industry*, IPI Policy Bytes, Feb. 4, 2009, *available at* http://www.policybytes.org/Blog/PolicyBytes.nsf/dx/intellectual-property-and-the-u.s.-auto-industry.htm.

77. 2003 WTO Decision, *supra* note 33, at 510; 2006 Council Regulation, *supra* note 34.

78. Simon Montlake, *Thailand Widens Scope of Generic Drugs*, CHRISTIAN SCI. MONITOR, Jan. 31, 2007, *available at* http://www.csmonitor.com/2007/0131/p07s02-woap.html?s=hns.

79. *Id*.

80. *Compulsory Licensing Will Continue, Says Minister*, BANGKOK POST, Aug. 15, 2008, *available at* http://www.bangkokpost.com/150808_News/15Aug2008_news96.php.

81. Bate, *supra* note 76.

being considered in India.[82]

While Thailand's broadened use of compulsory licensing has received significant criticism,[83] this use does not appear to violate any portion of TRIPS.[84] Widening the scope of compulsory licensing to include long-term public health issues such as breast cancer could potentially open the door for compulsory licensing of technology that can help reduce climate change, a problem that certainly impacts long-term public health.

## V. THE RAMIFICATIONS OF ISSUING COMPULSORY LICENSES FOR GREEN TECHNOLOGY

Despite the legal availability and initial appeal of compulsory licenses for green technology, such licensing would result in disadvantages for the licensing state and for innovation generally. Many criticisms of compulsory licensing in the pharmaceutical context, such as decreased incentives to innovate and potential economic backlash, apply with equal force in the context of energy-efficient technology. Moreover, key differences between the two fields make green technology a considerably less appropriate candidate for compulsory licensing.

### *A. Compulsory Licensing Creates Economic Backlashes*

Even if a developing state was convinced that it could legally grant compulsory licenses for a particular green technology, it would undoubtedly fear the international backlash that would likely follow. Such fears are not without good reason, as repercussions have occurred in the past. The United States in particular has dealt harshly with states that have attempted to issue compulsory licenses.[85]

Although a state's grant of a particular compulsory license may technically comply with TRIPS, and thus enjoy immunity from challenges through the WTO's dispute resolution system, the state may nonetheless suffer unilateral trade sanctions.[86] For example, after Thailand approved a compulsory license for the AIDS drug Kaletra, the

82. Khomba Singh, *NGO to Seek Compulsory Licensing of Cancer Drugs*, ECON. TIMES, Mar. 31, 2008, *available at* http://economictimes.indiatimes.com/News/News_By_Industry/Healthcare__Biotech/Pharmaceuticals/NGO_to_seek_compulsory_licensing_of_cancer_drugs/articleshow/2912621.cms.

83. Ho, *supra* note 29, at 421-24.

84. *Id*. at 442.

85. Joseph E. Stiglitz, *Economic Foundations of Intellectual Property Rights*, 57 DUKE L.J. 1693, 1717 (2008).

86. Ho, *supra* note 29, at 450.

United States elevated Thailand to its "priority watch list,"[87] a designation that heightens the possibility of trade sanctions against the state.[88] Similarly, in 2005 the Bush administration threatened sanctions against Brazil if it followed through on threats to issue compulsory licenses for AIDS drugs.[89]

The potential economic backlash accompanying the issuance of a compulsory license is not limited to governmental action, but may also include actions by private parties. Patent owners may retaliate to a state's grant of a compulsory license on one of their patented drugs by removing other drugs from that state's market.[90] After Thailand issued a compulsory license for Kaletra, the owner of the patent to the drug (Abbott Laboratories) subsequently announced that it would no longer sell some of its newest products in Thailand, including a different AIDS drug that would have been highly desirable locally.[91] Such conduct by pharmaceutical companies does not violate any international or domestic law, because there is no requirement that companies sell their patented technology in every state.[92]

A similar case arose after Egypt granted a compulsory license to a local company for the manufacture of Viagra in 2002.[93] Pfizer, the patent owner of Viagra, expressed great displeasure and subsequently cancelled plans to build a state-of-the-art production facility in Egypt, noting that many other states in the region were eager for such an investment.[94] Thus, the economic and social repercussions from both private and governmental sectors for a state that has granted a compulsory license may outweigh the costs saved by the issuance of the license itself.[95]

### *B. Strong Intellectual Property Rights Are Necessary for Long-Term Innovation and Diffusion of Energy Efficient Technology*

Innovative green technology firms require strong IPR to generate the

87. Watson, *supra* note 54, at 152.

88. David E. Miller, *Combating Copyright Infringement in Russia: A Comprehensive Approach for Western Plaintiffs*, 33 VAND. J. TRANSNAT'L L. 1203, 1214 (2000).

89. Reese Erlich, *Brazil's Grass-Roots Fight Against AIDS*, ST. PETERSBURG TIMES, Jan. 8, 2006, *available at* http://www.sptimes.com/2006/01/08/Perspective/Brazil_s_grass_roots_.shtml.

90. Ho, *supra* note 29, at 443-44.

91. Alcorn, *supra* note 52.

92. Ho, *supra* note 29, at 445.

93. Robert C. Bird, *Can Compulsory Licensing Improve Access to Essential Medicines?* (Univ. of Conn., Dept. of Marketing Working Paper Series, 2008) [hereinafter Bird, *Essential Medicines*], *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1124035.

94. *Id*.

95. Ho, *supra* note 29, at 447–48.

funds needed to operate and create new technology.[96] These firms require enormous amounts of capital, and the principal collateral for attracting funding comes from the proprietary interest they gain in the resulting technology.[97] Regarding such firms, one commentator stated that "patents are the foundation of their existence. Weaken that foundation and the house quickly crumbles."[98] Many renewable energy technologies are not profitable even with patents and receive significant government subsidies.[99] Without the promise of significant property rights in the subsequent technology, funding and subsidies will be much harder to acquire as the incentives to invest in and create innovative green technology may be diminished or eliminated.[100] While compulsory licensing might be attractive for the short-term diffusion of a particular energy-efficient technology, it decreases long-term investment in the creation of more innovative technology, and discourages the diffusion of technology for which compulsory licenses are not granted.

Joint ventures between multinational companies from developed states and local companies from developing states have proven effective as a method of transferring technology to those developing states.[101] However, a state's use of compulsory licensing for a particular technology decreases the incentive for other multinational companies to engage in joint ventures with local firms in that state, as the lack of protection serves as a warning to companies that the state may not respect their own patent protections if they choose to do business there.[102]

Such arguments against compulsory licensing are also raised in the pharmaceutical context as reasons for why the practice is detrimental, rather than beneficial to long-term public health.[103] The research and

96. Giovanetti, *supra* note 77.

97. Wilson, *supra* note 9, at 6–7; Rosenzweig, *supra* note 20.

98. Rosenzweig, *supra* note 20.

99. John H. Barton, *Patenting and Access to Clean Energy Technologies in Developing Countries*, WIPO MAG., Apr. 2009, at 12, *available a*t http://www.wipo.int/export/sites/www/wipo_magazine/en/pdf/2009/wipo_pub_121_2009_02.pdf.

100. Wilson, *supra* note 9, at 6-7.

101. INTERNATIONAL ENERGY AGENCY, TECHNOLOGY WITHOUT BORDERS: CASE STUDIES OF SUCCESSFUL TECHNOLOGY TRANSFER, United Nations Environment Program & Climate Technology Initiative 9–10 (2001), *available at* http://www.iea.org/textbase/nppdf/free/2000/ctifull2001.pdf; Wilson, *supra* note 9, at 6.

102. Cameron Hutchison, *Does TRIPS Facilitate or Impede Climate Change Technology Transfer into Developing Countries?*, 3 U. OTTAWA L. & TECH. J. 517, 529 (2006); Robert Bird & Daniel R. Cahoy, *The Impact of Compulsory Licensing on Foreign Direct Investment: A Collective Bargaining Approach*, 45 AM. BUS. L.J. 283, 297–98 (2008) [hereinafter Bird, *Impact of Compulsory Licensing*].

103. Avedissian, *supra* note 10, at 244–46.

development of pharmaceutical products is costly and time-consuming.[104] The process also involves a high chance of failure, creating great economic risk. Pharmaceutical companies use profits from successful products to both offset losses from previous failures and fund future research.[105] Critics of compulsory licensing argue that if the patent rights on those successful drugs are ignored in some states, the economic incentive to invest in future drug research is diminished even in those states where patent rights are upheld.[106]

While many of the same defenses of compulsory licensing in the pharmaceutical context may apply with equal force to green technology, there are key differences between the two fields. Although compulsory licensing might be appropriate in the pharmaceutical context, there are many reasons why the same course is not the most efficient method for the diffusion of green technology.

### *C. The Nature of the Green Technology Industry Is Not Appropriate for Compulsory Licensing*

Though the proponents of compulsory licensing emphasize certain benefits created by such a practice, those benefits are not applicable to green technology. For instance, proponents of compulsory licensing contend that while weak intellectual property protections seem to decrease economic incentives for transnational corporations to engage in joint ventures with local companies in developing states, other investment considerations play a much bigger role.[107] Some studies have shown that strong patent rights actually have no impact on attracting foreign investment to low income states.[108] This is likely because the markets of most poor states are not large or lucrative enough and are usually too geographically distant for a state's decision to strengthen IPR to influence a multinational corporation's decision of whether or not to invest in that state.[109]

However, such an argument is more relevant in the pharmaceutical context than in the context of green technology. While poor states may not benefit from stronger intellectual property protections, studies show that strong patent rights are positively correlated to attracting foreign

104. *Id*.
105. *Id*.
106. *Id*.
107. Hutchison, *supra* note 104, at 529.
108. *Id.*
109. Bird, *Impact of Compulsory Licensing*, *supra* note 104, at 299.

direct investment in middle-income states.[110] Granting compulsory licenses can lead to a huge loss of foreign investment to middle-income states,[111] a category that includes China, India and Russia, which are the major contributors to the increase in global pollution.[112] Such was the case after Egypt granted a compulsory license for Viagra in 2002.[113] After this occurred, foreign direct investment declined in Egypt, despite its cheap labor force and relatively educated populace.[114] Compulsory licensing of AIDS medications might not negatively affect the least developed states because their level of foreign direct investment is not related to the strength of their intellectual property protections.[115] However, the use of compulsory licensing of green technology by those middle-income states most responsible for the increase in global pollution will likely be accompanied by a drop in foreign investment .

Supporters of compulsory licensing also point out that while the proprietary interests created by strong IPR help create the incentives needed to develop truly innovative technology, strong IPR may also inhibit follow-on innovations,[116] since the technical capabilities of developing states are mainly focused on the adaptation and improvement of technologies from the developed world.[117] The current green technology patents are predominantly for minor, specific improvements on the prior art, and, as such, strong IPR may inhibit technological development of these sorts of innovations.[118]

However, the existence of a plethora of minor, specific improvements in energy-efficient technology means that compulsory licenses would have to be granted on a variety of innovations to effectively solve the environmental emergency because unlike one life-saving drug, there "will not be any one technology that will be necessary or sufficient on its own to solve climate change."[119] Moreover, market competition among manufacturers and sellers of these improvements already keeps prices down. In the pharmaceutical industry, most breakthrough drugs have no substitute and thus the patent owner has a

110. Hutchison, *supra* note 104, at 529.

111. Bird, *Impact of Compulsory Licensing*, *supra* note 104, at 330.

112. The World Bank, *Data & Statistics: Country Groups*, http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20421402~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html#Lower_middle_income.

113. Bird, *Essential Medicines*, supra note 94, at 5.

114. *Id*.

115. Hutchison, *supra* note 10, at 529.

116. *Id.* at 527–28.

117. *Id*.

118. *Id*.

119. Rosenzweig, *supra* note 19.

monopoly over the solution and can charge high prices for the duration of the patent.[120] However, because the basic technological solutions in the renewable energy sector are no longer patented and have become prior art,[121] the value added portion of the exclusive right of the patent owner as to each minor improvement of that technology is quite small.[122] These small improvements compete with each other, preventing the formation of a monopoly on the overall technology, which, in turn, keeps prices down.[123] While those prices might still not be low enough for developing states to take advantage of them, this is not a result of the monopolistic market imperfections common in the pharmaceutical industry. As such, the removal of patent protection may do little to lower prices.

In addition to problems with incentives, there are also problems with definitions. If compulsory licenses may be granted for energy-efficient technology, it will be difficult to identify what actually constitutes "green technology" suitable for such licenses.[124] Any patented technology that accomplishes its goal with a little more efficiency or with a slightly longer lifespan could be considered "green." Granting compulsory licenses for every technology that fits such a definition may effectively eliminate intellectual property rights on most innovative technologies and the incentives those rights create.[125]

Furthermore, inadequate manufacturing capabilities may impede the value of compulsory licensing in the context of green technology. Even if compulsory licenses for a particular product are granted in a certain state, such a license may be worthless if that state lacks the technological and manufacturing capabilities to produce that product. For example, if a state wishes to make effective use of a compulsory license on a pharmaceutical product, it must either have the manufacturing capacity to produce the drug domestically, or be able to import the products from a state (e.g., India) that is able and willing to do so.[126] Even though Thailand was able to grant compulsory licenses for AIDS drugs and heart medication, domestic production has proven to be too expensive, and

120. Barton, *supra* note 101, at para. 2.

121. *Id.*

122. Hasper, *supra* note 23, at 6.

123. Barton, *supra* note 101, at para. 2.

124. Rosenzweig, *supra* note 20.

125. *Id.*

126. Markus Nolff, *Paragraph 6 of the Declaration on the TRIPS Agreement and Public Health and the Decision of the WTO Regarding Its Implementation: An "Expeditious Solution"?,* 86 J. PAT. & TRADEMARK OFF. SOC'Y 291, 298 (2004).

access to these medicines has actually decreased.[127]

For states without technological and manufacturing capabilities, importation is the only available method to acquire green technology. The 2003 WTO Decision discussed above allows compulsory licenses for exports of "pharmaceutical product(s)" under certain conditions.[128] Canada took advantage of this provision when it used a compulsory license to export AIDS drugs to Rwanda.[129] However, using compulsory licensing to export patented products to developing states is much more feasible for products like pharmaceutical drugs (which are small) than it is for green technologies (which are sometimes massive).

Even if importation is feasible for a particular green technology, it is unclear whether the 2003 WTO Decision goes beyond pharmaceutical products and can be used in the context of green technology. The 2003 WTO Decision defines "pharmaceutical product" very broadly as "any patented product . . . needed to address public health problems"[130] and the 2001 Doha Declaration clearly states that "each [m]ember has the right to determine what constitutes a national emergency."[131] Consequently, the 2003 WTO Decision is meant to be broad in scope. However, it states that member obligations under Article 31(f) of the TRIPS agreement may be waived only "for the purposes of production [and export] of a pharmaceutical product."[132] A state trying to extend the scope of compulsory licensing beyond the realm of pharmaceutical products would risk violating the 2003 WTO Decision. Therefore, if a developing state lacks the technological capability to domestically produce the particular green technology for which a compulsory license is granted, and if it is either unfeasible or illegal (under WTO rules) to import such technology from abroad, then that compulsory license is essentially worthless. The state would be left without the benefits of the license, while still attracting the negative backlash discussed above.

### *D. More Efficient Methods Exist for the Diffusion of Green Technology*

The key differences between the green technology industry and the

127. Thompson Ayodele, *Failing Infrastructure Renders Compulsory Licensing Pointless*, THE NATION (Nig.), Apr. 25, 2008, *available at* http://www.thenationonlineng.com/dynamicpage.asp?id=49653.

128. 2003 WTO Decision, *supra* note 33, at 510–11.

129. Watson, *supra* note 54, at 147; *see also* text accompanying n.56.

130. 2003 WTO Decision, *supra* note 33, at 510; TRIPS, *supra* note 9, at art. 31(f).

131. Doha Declaration, *supra* note 37.

132. 2003 WTO Decision, *supra* note 33, at 510.

pharmaceutical industry not only make the former a less appropriate target for compulsory licensing, but also allow for alternative, more efficient methods for the diffusion of green technology. In contrast to pharmaceutical products, the large size of most energy-efficient products allows for the implementation of a tiered pricing system, sometimes called "equity pricing," where poorer states pay less than richer states for access to the same technology.[133] One of the main reasons pharmaceutical products are not sold at a significant discount in developing states is the fear of re-importation.[134] Large price differences among states inevitably lead to the re-importation of pharmaceutical products to developed states at lower prices than those sold legitimately.[135] Such parallel importation cannot be challenged, as the principle of exhaustion (similar to the first-sale doctrine of U.S. patent law) prevents this practice from violating TRIPS or any other WTO provision.[136] The risk of re-importation eliminates any altruistic or commercial incentive that pharmaceutical companies might have to offer lower prices on drugs to developing states.[137] However, such fears do not apply to green technology. While pharmaceutical products sold at a discount in a third state can be easily shipped back to their state of origin, "the solar farm installed in India [at a discount] will not be put on a midnight barge to the United States."[138] Tiered pricing is thus an option available to disburse innovative green technology to developing states without breaking patents.

Rather than relaxing IPR on green technology through compulsory licensing, it would be more beneficial to relax tariff and non-tariff trade barriers in general,[139] or at least specifically with regards to environmentally friendly industries.[140] The United States and Europe proposed this course of action at the UN Climate Conference in Bali in 2007, but India and Brazil rejected the proposal since it was not

133. For a detailed description of equity pricing, see Ellen Hoen & Suerie Moon, *Pills and Pocketbooks: Equity Pricing of Essential Medicines in Developing Countries*, MEDECINS SANS FRONTIERS, Apr. 2001, *available at* http://data.unaids.org/publications/IRC-pub05/pills-pocketbooks_en.pdf .

134. Rosenzweig, *supra* note 20.

135. Nolff, *supra* note 129, at 306.

136. Doha Declaration, *supra* note 37.

137. Watson, *supra* note 54, at 154.

138. Rosenzweig, *supra* note 20.

139. Wilson, *supra* note 9, at 8–9.

140. International Centre for Trade and Sustainable Development, *Links Between Patent Rules and Access to Green Technology Come Under Scrutiny*, BRIDGES TRADE BIORES, Dec. 18, 2007, http://ictsd.net/i/news/biores/9153/.

comprehensive enough and did not include bio-fuels such as ethanol.[141] The United States currently imposes a tariff on Brazilian ethanol, despite the fact that it is economically cheaper and less environmentally damaging than U.S. corn-based ethanol.[142] The World Bank estimates that a comprehensive effort to eliminate tariff and non-tariff barriers on the eighteen developing states that produce the greatest amount of greenhouse gases would increase the diffusion of green technology to those states by three to sixty-three percent, depending on the technology.[143] The key differences between green technology and pharmaceutical products make the former a considerably less appropriate candidate for compulsory licensing, and more efficient methods are available to effectively spread green technology to the developing world.

## VI. CONCLUSION

The continued global increase in environmental pollution, as well as the growing role of the developing world in that increase, is certainly troubling and is likely a "national emergency" under TRIPS. As such, the diffusion of existing and future energy-efficient technology to the developing world is critical to addressing this emergency. Given the emphasis of the Obama administration on green technology, the recent increase in funding for research in this area is likely to continue in the near future.[144] However, this increase in funding will likely be coupled with the desire for proprietary interests in the resulting technology. While a case can certainly be made for the right of developing countries to ignore those interests through the use of compulsory licensing, there are numerous downsides to taking that route, and there are alternative methods for effectively distributing green technology, such as tiered-pricing schemes and the relaxation of trade barriers between states. While patent protections may impede the diffusion of green technology to developing states, granting compulsory licenses is neither the most feasible nor the most effective means of solving the problem.

141. *Plan to Scrap Tariffs on Green Technology Falters in Bali*, CBC NEWS, Dec. 9, 2007, http://www.cbc.ca/world/story/2007/12/09/bali-tariffs.html.

142. Barton, *supra* note 101, at para. 11.

143. WORLD BANK, INTERNATIONAL TRADE AND CLIMATE CHANGE: ECONOMIC, LEGAL AND INSTITUTIONAL PERSPECTIVES, 53 (2007).

144. Zaher Karp, *Green Business Tracks the Stimulus Money Trail*, MATTERNETWORK, May 5, 2009, http://featured.matternetwork.com/2009/5/how-green-business-can-track.cfm.