Access to Environmentally Sound Technology in the Developing World: A Proposed Alternative to Compulsory Licensing

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INTRODUCTION

In 2008, a report published by McKinsey & Co. predicted that a successful program of action on climate change would require the reduction of greenhouse gas emissions by seventy-six percent by the year 2050.[1] The report recognized that in order to achieve this seemingly daunting target, the transfer of environmentally sound technologies ("ESTs") from the developed to the developing world was an urgent necessity.[2] The report cited other sources to acknowledge that such technology transfer was unlikely to be achieved, even by a combination of market incentives and funding from developed-world governments.[3]

If market-oriented means that are supported by governments do not suffice to achieve the deployment of ESTs in the developing world, what steps might be necessary to facilitate such technology transfers? A resolution adopted by the European Parliament in 2007 spells out one significant method—compulsory licensing—i.e., legally compelling patent holders to allow the use of their patents by other producers for a specified fee, irrespective of whether the patent holder actually wishes to grant such a license. Specifically, the Parliament recommended changes to the World Trade Organization ("WTO") Agreement on Trade Related Aspects of Intellectual Property Rights ("TRIPS"), the major international agreement governing the compulsory licensing of patents, "in order to allow for the compulsory licensing of environmentally necessary technologies . . . ."[4]

Support for compulsory licensing as a means of ensuring the

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1. MCKINSEY & CO., THE CARBON PRODUCTIVITY CHALLENGE: CURBING CLIMATE CHANGE AND SUSTAINING ECONOMIC GROWTH 9–10 (2008), *available at* http://www.mckinsey.com/mgi/publications/ Carbon_Productivity/index.asp.

2. *See id.* at 34–35.

3. *Id.* at 35 (citing WORLD BANK, GLOBAL ECONOMIC PROSPECTS 2008: TECHNOLOGY DIFFUSION IN THE DEVELOPING WORLD (2008), *available at* http://siteresources.worldbank.org/INTGEP2008/Resources/ complete-report.pdf.

4. Resolution on Trade and Climate Change, PARL. EUR. DOC. A6-0409 (2007), *available at* http://www.europarl.europa.eu/sides/getDoc.do?Type=TA&Reference=P6-TA-20070576 &language=EN.

deployment of ESTs through the developing world has increased in various quarters, some very different from the European Parliament. Martin Khor, the prominent civil society activist, recently went so far as to say, "the fact that a country requires a product or technology in order to meet its objectives or responsibilities to mitigate climate change or to adapt to climate change is a most valid ground for compulsory licensing."[5]

The disparate nature of the sources cited above—a prominent private firm, a supra-national legislature dominated by developed countries, and a leading activist from the developing world—indicate the breadth of the growing support for compulsory licensing as a means of ensuring the deployment of ESTs through the developing world.[6] Entities ranging from governments to private firms are now considering, if not actively encouraging, the use of a solution that may significantly disrupt a patent holder's control over its intellectual property. In support of this position, civil society activists, as well as the governments of a number of developing nations, point to the Doha Declaration on the TRIPS Agreement and Public Health on the compulsory licensing of certain life-saving pharmaceuticals as a suitable precedent.[7]

For the leading developing nations, the Doha compromise on pharmaceuticals could serve as a blueprint for a future deal on ESTs. Their demands derive added force from Articles 4.3 and 4.7 of the United Nations Framework Convention on Climate Change ("UNFCCC"),[8] which require developed nations to use their best efforts to transfer technology to the developing world and expressly link the obligations of developing nations to the adequate transfer of technology and financial resources.[9]

The compulsory licensing debate represents an important issue for corporations, innovators, venture capitalists, and financial institutions, all of whom hold valuable intellectual property rights

5. Martin Khor, Note on Access to Technology, IPR and Climate Change (May 15, 2008), http://www.epo.org/about-us/events/archive/2008/epf2008/forum-1/details1/kohr.html.

6. The views above are merely a sampling. Developing-country governments have also been strong supporters of compulsory licensing as a means of technology transfer. For one prominent example, see Celso Amorim, Minister of Foreign Relations for Braz., Address at the Plenary of the Bali Climate Conference (Dec. 12, 2007) (citing the compulsory licensing of pharmaceuticals as "a source of inspiration" in dealing with climate change).

7. *See infra* notes 46–51 and accompanying text.

8. United Nations Framework Convention on Climate Change, U.N. Doc. A/AC.237/18 (1992), *reprinted in* 31 I.L.M. 849 (1992), at art. 2 [hereinafter UNFCCC].

9. *See infra* notes 18–20 and accompanying text.

in ESTs.[10] Owing to the quality and monetary potential of the property rights at stake, any attempt to compulsorily license ESTs may be met with fierce opposition by a range of sources.

This Note argues that compulsory licensing is not the best way to ensure access to ESTs for the developing world, and it suggests a possible alternative to compulsory licensing—one that may be more sensitive to the voluntary nature of global cooperation on climate change. Part II of this Note provides a brief overview of the two major international regulatory frameworks that bear on the compulsory licensing of ESTs. First, it provides a brief account of the international regulatory regime on climate change and the regulatory preferences it embodies. This is followed by a description of TRIPS, the major international agreement governing the compulsory licensing of patents. This description of the two principal international regulatory frameworks seeks to discern a set of regulatory preferences which might help give shape to a solution allowing ESTs to be diffused through the developing world. In Part III, two lines of argument are used to resist the idea of compulsory licensing. In the least-developed countries, compulsory licensing of ESTs will probably fail because it is, when taken by itself, an inadequate measure. By contrast, in the leading developing countries, compulsory licensing is unnecessary. ESTs, this Note argues, are sufficiently different from pharmaceuticals that Doha is not applicable precedent. In this part, the Note will focus primarily on three kinds of ESTs: photovoltaic (solar), wind, and biofuels.

An alternative to compulsory licensing is then presented in two distinct parts. Part IV provides a brief account of the regulatory choices or aspects of regulatory design that should shape solutions in this area. Part V then provides a solution based on the regulatory principles identified in Part IV. This solution may be preferable, both politically and economically, to compulsory licensing. However, another virtue of the proposed solution might be its harmony with the underlying principles of the existing international regime on climate change and with the general structure of international law.

10. To provide just one example, almost $22 billion was invested in renewable energy capacity during 2003—nearly four times as much as in 1995. *See* Eric Martinot, *Indicators of Investment and Capacity for Renewable Energy*, RENEWABLE ENERGY WORLD, Sept.–Oct. 2004, at 35, 35.

I. MAPPING THE INTERNATIONAL REGULATORY LANDSCAPE

A. The International Regulation of Climate Change

Although the international regulation of climate change often appears to take place through a confusing network of agreements, there are two principal mechanisms for global regulation. At the most general level, the UNFCCC acts as the foundational document for the international regulation of climate change,[11] while the Kyoto Protocol to the UNFCCC imposes more specific obligations that elaborate on the UNFCCC.[12] As its name suggests, the UNFCCC merely serves as a basic framework for further international action and cooperation on the issue of climate change.[13] In order to achieve its stated aim of stabilizing the emission of greenhouse gases, the UNFCCC provides various commitments ranging from the implementation of national plans to mitigate climate change to international cooperation in scientific research and technology transfer.[14] Of equal importance, however, are the principles that the UNFCCC sets out in seeking to reach this goal. Prominent amongst these is the principle of common but differentiated responsibilities, discussed immediately below.

1. Common but Differentiated Responsibilities

The principle of common but differentiated responsibilities and respective capabilities is a recurrent theme of both the UNFCCC and its subsidiary legal instruments. This principle is essentially the acknowledgment of a historical truth—namely that developed countries are both principally responsible for the accumulation of greenhouse gases in the atmosphere, and, as a result of their developed status, have a greater capacity to take action against climate change. Accordingly, under the UNFCCC, state parties are divided into Annex 1 countries, which are developed countries, and non-Annex 1 countries, which are almost entirely developing countries.[15] Annex 1 countries are required to adopt national

11. *See generally* UNFCCC, *supra* note 8.

12. Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 2303 U.N.T.S. 148 [hereinafter Kyoto Protocol].

13. *See* UNFCCC, *supra* note 8, at art. 3.

14. *See infra* notes 18–20 and accompanying text.

15. In 1992, when the UNFCCC was opened for signature, the question of whether

policies aimed at mitigating climate change,[16] but this, as with the UNFCCC generally, is now recognized to be a "soft" or non-binding obligation.[17]

This principle of common but differentiated responsibilities serves to link progress on climate change to actions by developed countries. The emphasis on differentiated responsibility is evident in provisions of the UNFCCC, which require that:

> [(i)] [Developed countries] shall also provide such financial resources . . . needed by [developing countries] to meet the agreed full incremental costs of implementing measures[;][18]

> (ii) developed [countries] . . . shall take all practicable steps to promote, facilitate and finance . . . the transfer of, or access to, environmentally sound technologies and know-how to [developing countries] . . . and shall support the development and enhancement of endogenous capacities and technologies of [developing countries;][19]

> and most importantly (iii) the extent to which [developing countries] will effectively implement their commitments . . . will depend on effective implementation by [developed countries] of their commitments . . . related to financial resources and transfer of technology.[20]

The principle of common but differentiated responsibility has been justified as a political necessity to ensure the participation of the developing world in the UNFCCC;[21] yet vocal critics charge that the principle does not go as far as it should. These critics, among them prominent U.S. senators,[22] argue that while the UNFCCC acknowledges the historical role of the developed world in creating the climate change crisis, it does not sufficiently account for future projections that identify major developing nations such as India and China as leading sources of greenhouse gas emissions.[23] This

certain post-Communist countries of Eastern Europe should be treated as developed or developing was unclear. Most of these, however, are treated as non-Annex 1 countries today.

16. UNFCCC, *supra* note 8, at art. 4, ¶ 2.

17. Sarah A. Peay, *Joining the Asia-Pacific Partnership: The Environmentally Sound Decision?*, 18 COLO. J. INT'L ENVTL. L &. POL'Y 477, 490 (2007).

18. UNFCCC, *supra* note 8, at art. 4, ¶ 3.

19. *Id.* at art. 4, ¶ 5.

20. *Id.* at art. 4, ¶ 7.

21. Daniel Bodansky, *The United Nations Framework Convention on Climate Change: A Commentary*, 18 YALE J. INT'L L. 451, 510 (1993).

22. For the discussion on the Byrd-Hagel Resolution, see *infra* note 24.

23. *See, e.g.*, *Implementation of Environmental Treaties: Joint Hearing Before the S. Comm. on Env. & Public Works and S. Comm. on Foreign Relations*, 107th Cong. 78–79 (2002) (opening statement of Neb. Sen. Chuck Hagel, Member, S. Comm. on Foreign Relations), *available at* http://www.access.gpo.gov/congress/senate/pdf/107hrg/83718.pdf.

tension between the UNFCCC's assignment of responsibility based on historic roles and its silence on future emission projections has sometimes been seen as a major failure in the attempt to create an international regulatory structure for climate change and has been blamed, in part, for the United States' reluctance to ratify the Kyoto Protocol.[24] Others, however, see the need to bring in leading developing world emitters such as China and India as a significant future opportunity to expand the scope of the UNFCCC and the Kyoto Protocol.[25]

Notwithstanding these unresolved questions, the UNFCCC posits the principle of common but differentiated responsibility as one that must be central to the global fight against climate change. Any attempt to craft a solution to the issue of the equitable transfer of ESTs to the developing world should hew as closely as possible to this fundamental principle because such adherence would ensure that any new bargain reflects principles on which consensus already exists. As such, this close adherence to the existing regime would be not only more likely to share the legitimacy enjoyed by the regime but also less likely to disturb settled state expectations relating to the existing regime.

2. Market Mechanisms

The Kyoto Protocol to the UNFCCC[26] puts into operation the general commitments given by parties to the UNFCCC, such as the principle of common but differentiated responsibilities. To this end, the Protocol specifies limits on the quantities of greenhouse gases that the Annex 1 parties are permitted to emit, although no such emission limits are imposed on developing countries—the non-Annex 1 parties.

Although the emission limits specified in the Kyoto Protocol are binding obligations on Annex 1 parties, the Protocol has clearly introduced flexible, market-oriented means by which to enforce

24. Consider, for instance, the resolution sponsored by Sens. Robert Byrd (D-WV) and Chuck Hagel (R-NE) and passed nearly unanimously by the U.S. Senate which directs the government not to enter into any agreements under the UNFCCC that would "mandate new commitments to limit or reduce greenhouse gas emissions for the Annex 1 Parties, unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period . . . ." S. Res. 98, 105th Cong., 143 CONG. REC. S8138–39 (1997). The Byrd-Hagel resolution was passed by a margin of 95–0 and has yet to be formally reversed.

25. David G. Victor, *How to Slow Global Warming*, 349 NATURE 451, 452 (1991).

26. Kyoto Protocol, *supra* note 12.

these emission limits.[27] The adoption of market mechanisms over measures with more coercive effect, such as the imposition of sanctions,[28] may have lent valuable flexibility to the Kyoto Protocol. This flexibility hastened the Protocol's acceptance by the overwhelming majority of developed countries, despite strong opposition from developing countries and NGOs.[29]

What emerges from this brief overview of the structure of international climate change regulation is a regime that seeks to allocate responsibility based on both conduct and capacity, although opinions diverge as to whether responsibilities should be allocated solely on the basis of past conduct or with additional reference to projected future conduct. Furthermore, the existing regulatory structure prefers market-based solutions to the imposition of sanctions. One ideal may be that future regulatory developments in the area remain consistent with these overarching themes so as to maintain the settled consensus represented in the Kyoto Procol.

B. TRIPS, Compulsory Licensing, and Doha

The other pertinent element of the regulatory landscape bearing on compulsory licensing of ESTs is provided by the TRIPS Agreement, one of the several treaties administered by the WTO.[30]

27. For some prominent examples of how extensively some developed and developing countries rely on the market mechanisms, see Craig Hart et al., *East Asia Clean Development Mechanism: Engaging East Asian Countries in Sustainable Development and Climate Regulation Through the CDM*, 20 GEO. INT'L ENVTL. L. REV. 645, 680 (2008). A significant volume of scholarship has focused on the Protocol's Clean Development Mechanism, which has been commended for "its ability to bring developing and developed countries, as well as the public and the private sectors, together to reduce GHG emissions at a lower cost." Rolf H. Weber & Aline Darbellay, *Regulation and Financial Intermediation in the Kyoto Protocol's Clean Development Mechanism*, 22 GEO. INT'L ENVTL. L. REV. 271, 276 (2010). For other grounds on which the Protocol has been praised, see Andrew Schatz, Note, *Discounting the Clean Development Mechanism*, 20 GEO. INT'L ENVTL. L. REV. 703 (2008) (criticizing host countries under the Clean Development Mechanism for misusing it).

28. Axel Michaelowa, *The Kyoto Protocol and its Flexibility Mechanisms*, *in* INTERNATIONAL SOCIETY FOR ECOLOGICAL ECONOMICS INTERNET ENCYCLOPAEDIA OF ECOLOGICAL ECONOMICS (Eric Neumayer ed., 2003), *available at* http://www.ecoeco.org/pdf/kyotoandflex.pdf (discussing mechanisms that allow for transboundary cooperation in meeting Kyoto Protocol emissions targets).

29. This certainly seems to have been the case with the United States. For further details, see Amy Royden, *U.S. Climate Change Policy Under President Clinton: A Look Back*, 32 GOLDEN GATE U. L. REV. 415, 440–45 (2002).

30. 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, 33 I.L.M. 81 (1994) [hereinafter TRIPS

TRIPS represents the prevailing international consensus on patent rights and provides detailed provisions on situations where compulsory licensing[31] of patents is allowed and the methods by which such compulsory licensing is to be carried out.

Under Article 28 of TRIPS, a patent confers the exclusive rights to make, use, sell, and import patented products.[32] TRIPS limits these rights in certain situations, but limitations must be applied so as not to discriminate on the basis of: (1) the product's place of invention, (2) the field of technology in which it applies, or (3) whether the product(s) in question "are imported or locally produced."[33] Article 7 of TRIPS declares that patent protections should be "conducive to social and economic welfare" and should contribute, *inter alia*, to a balance of "rights and obligations."[34]

Article 30 of TRIPS provides guidance for situations where exclusive rights conferred by the Agreement are sought to be set aside.[35] Member-states may provide for limited exceptions so long as these 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."[36] This very general, almost deliberately ambiguous formulation is given shape in the immediately following article, which provides specific guidance on cases where the compulsory licensing of patents is permissible.[37]

Through a compulsory license under Article 31, a third party—including a government—may use the subject matter of a patent without the patent-holder's authorization. In general, before compulsory licensing is allowed, the proposed user must have unsuccessfully attempted to obtain the patent from the holder on reasonable commercial terms.[38] However, this requirement of such a prior attempt to secure the patent on commercial terms may be waived in cases of "national emergency or other circumstances of

Agreement].

31. By compulsory licensing, I mean "[a] statutorily created license that allows certain people to pay a royalty and use an invention without the patentee's permission." BLACK'S LAW DICTIONARY 938 (8th ed. 2004). The term is undefined in TRIPS.

32. TRIPS Agreement, *supra* note 30, at art. 28.

33. *Id.* at art. 27.1.

34. *Id.* at art. 7.

35. *Id.* at art. 30.

36. *Id.*

37. *Id.* at art. 31.

38. *Id.* at art. 31(b).

extreme urgency."[39]

The use of a compulsory license imposes several requirements on a licensee. The licensee may only use the license on a non-exclusive basis and only for the purpose for which it was authorized.[40] The licensee cannot assign the use of the subject matter of the patent to another party and the use shall be predominantly for the supply of the domestic market of the member authorizing such use.[41] Most importantly, the patent holder continues to be "adequately" remunerated for the use of the patent based on the economic value of the authorization granted.[42] The idea of "adequate remuneration," however, is not spelled out in TRIPS—in particular, it is unclear whether adequate remuneration must be at a level that allows the patent-holder to recoup his costs.

One major motivation for compulsory licensing often arises from extraction concerns. Extraction is a "form of private taxation that aims to raise revenue,"[43] and it ensures compliance with such demands for revenue by an implicit threat of exclusion.[44] Thus, since a patent confers a limited monopoly on a patent-holder, the patent-holder usually expects to extract a monopoly premium by controlling the use of the patent and the supply of the relevant product. Compulsory licensing aims to increase access to the desired products by eliminating the patent-holder's ability to extract a monopoly premium. Following compulsory licensing, the patent-holder can generally expect to receive only a very limited return on invested capital.

These provisions on compulsory licensing gained global prominence following the Ministerial Declaration of November 14, 2001 ("the Doha Declaration").[45] In the run-up to the Doha

39. *Id.*

40. *Id.* at art. 31(c)–(d).

41. *Id.* at art. 31(f).

42. *Id.* at art. 31(h).

43. C. Scott Hemphill, *Network Neutrality and the False Promise of Zero-Price Regulation*, 25 YALE J. ON REG. 135, 138 (2008).

44. *Id.*

45. World Trade Organization, Ministerial Declaration of 14 November 2001, WT/MIN(01)/DEC/2, 41 I.L.M. 755 (2002) [hereinafter Doha Declaration], *available at* http://www.wto.org/english/theWTO_e/minist_e/min01_e/mindecl_trips_e.htm. Paragraphs 4, 5, and 6 of the Declaration are central to the issue of compulsory licensing and provide, in relevant part, that:

> 4. The TRIPS Agreement does not and should not prevent Members from taking measures to protect public health. Accordingly, while reiterating our commitment to the TRIPS Agreement, we affirm that the Agreement can and should be interpreted and

Declaration, various international organizations, governments, and corporations had been faced with a range of civil-society demands relating to public access to patented medicine in countries with high incidence of diseases such as AIDS.[46] Recognizing the legitimacy of the underlying needs, the Declaration noted that the terms of the TRIPS Agreement were sufficiently flexible to address public-health emergencies and that member-states could interpret the agreement so as to promote public access to essential medicines.[47]

Doha also marked an important advance on the existing text of the TRIPS provisions on compulsory licensing in its recognition of the varying abilities of TRIPS member-states. Even amongst the various member-states from the developing world, some countries were clearly better than others in their ability to work patents, to use technology, and to produce pharmaceuticals. Accordingly, the Doha Declaration stated that it recognized that "WTO members with insufficient or no manufacturing capacities in the pharmaceutical sector could face difficulties in making effective use of compulsory licensing under the TRIPS Agreement. We instruct the Council for TRIPS to find an expeditious solution to this problem."[48]

Expeditiously or not, a solution was put in place nineteen months later. On August 30, 2003, the WTO General Council adopted the

> implemented in a manner supportive of WTO Members' right to protect public health and, in particular, to promote access to medicines for all.
> In this connection, we reaffirm the right of WTO Members to use, to the full, the provisions in the TRIPS Agreement, which provide flexibility for this purpose.
> 5. . . . (b) Each Member has the right to grant compulsory licences and the freedom to determine the grounds upon which such licences are granted.
> (c) Each Member has the right to determine what constitutes a national emergency or other circumstances of extreme urgency, it being understood that public health crises, including those relating to HIV/AIDS, tuberculosis, malaria and other epidemics, can represent a national emergency or other circumstances of extreme urgency.
> . . . .
> 6. We recognize that WTO Members with insufficient or no manufacturing capacities in the pharmaceutical sector could face difficulties in making effective use of compulsory licensing under the TRIPS Agreement. We instruct the Council for TRIPS to find an expeditious solution to this problem and to report to the General Council before the end of 2002.

46. For an account of the strategies used, see Amy Kapczynski & Jonathan Berger, *The Story of the* TAC *Case: The Potential and Limits of Socio-economic Rights Litigation in South Africa*, *in* HUMAN RIGHTS ADVOCACY STORIES 43 (Deena R. Hurwitz, Margaret L. Satterthwaite & Douglas B. Ford eds., 2008).

47. Doha Declaration, *supra* note 45, ¶ 4.

48. *Id.* ¶ 6.

Decision on the Implementation of Paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health.[49] Since it was negotiated against the backdrop of a number of raging public health emergencies in South Africa and elsewhere, the WTO Decision encompassed any "pharmaceutical product" and provided three temporary waivers.[50] The cumulative effect of the waivers was to allow WTO member-states to grant compulsory licenses, either acting individually or in groups, and to export pharmaceuticals manufactured under such licenses to countries that had inadequate manufacturing capacity. Most importantly, the holder of the underlying patent would receive remuneration only once (i.e., payment for using the compulsory license would be made by either the exporting *or* the importing country).[51] This temporary waiver was made permanent on December 6, 2005. Thus, following the WTO Decision, Article 31(f) of the TRIPS Agreement, which required that the compulsory license be used to predominantly supply the domestic market of the Member granting the license, has essentially been eclipsed for pharmaceutical products.

The dramatic nature of the developing world's victory at Doha cannot be underestimated. Precisely because of their success in Doha, it is possible that developing nations and civil society groups will see Doha as the paradigmatic case for struggles over intellectual property for the future. Indeed, there is existing academic writing to suggest that the Doha Declaration and the WTO Decision were viewed by a number of civil-society groups as not only major victories in the effort to secure access to medicines but also vital steps in the quest to fundamentally reshape ideas of intellectual property.[52] Without questioning the validity of this broader claim, this Note suggests only that whatever else Doha and the WTO Decision may represent, they do not serve as appropriate models by which to secure the flow of ESTs to the developing world. This is partly because the market for ESTs is radically different from the market for pharmaceutical products.[53] More importantly, the nature of the market for ESTs has important

49. Decision of the General Council of 30 August 2003, *Implementation of Paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health*, WT/L/540 (Aug. 30, 2003), *available at* http://www.wto.org/english/tratop_E/TRIPS_e/implem_para6_e.htm.

50. *Id.* ¶¶ 1(a), 2(a)–(c).

51. *Id.* ¶ 3.

52. *See* Amy Kapczynski, *The Access to Knowledge Mobilization and the New Politics of Intellectual Property Law*, 117 YALE L.J. 804, 806 (2008).

53. *See infra* Part III.2.

political consequences that are likely to prevent international negotiations on EST transfers arriving at an outcome similar to that of the Doha Declaration. To insist on compulsory licensing for ESTs would therefore be both inappropriate and inefficient.

II. WHY COMPULSORY LICENSING WON'T WORK

A. Divisions in the Developing World: A Background Fact

In order to argue that compulsory licensing is an inappropriate means of facilitating technology transfer from the developed to the developing world, it is first necessary to recognize the widely disparate technical and scientific capabilities of the many nations that comprise the developing world. As recent scholarship suggests, there are certain developing nations that enjoy appreciable levels of "technological proficiency,"[54] although their abilities to innovate may be more limited than that of developed nations.[55]

This diversity has been recognized by a report released in 2002 by the Commission on Intellectual Property Rights, which noted:

> China and India, along with several other smaller developing countries, have world class capacity in a number of scientific and technological areas including, for instance, space, nuclear energy, computing, biotechnology, pharmaceuticals, software development and aviation. By contrast, 25% of poor people live in Sub-Saharan Africa (excluding South Africa), mainly in countries with relatively weak technical capacity.[56]

Moreover, the inquiry need not be restricted to the question of relative technological proficiency. A variety of other factors significantly impact a nation's ability to use, modify, or acquire new technology, which range from per capita incomes and GDP growth rates to "softer" factors such as education levels. Two scholars have suggested that some developing countries—such as Russia, China, India, Brazil, Mexico, Turkey, and Chile—may be classified as Technologically Proficient Developing Countries ("TPDCs") based on two factors: (i) the share of medium or high level technology

54. Shamnad Basheer & Annalisa Primi, *The WIPO Development Agenda: Factoring in the "Technologically Proficient" Developing Countries*, *in* IMPLEMENTING WIPO'S DEVELOPMENT AGENDA 100, 101–02 (Jeremy DeBeer ed., 2009).

55. *Id.* at 102.

56. JOHN H. BARTON ET AL., THE COMM'N ON INTELLECTUAL PROP. RIGHTS, INTEGRATING INTELLECTUAL PROPERTY RIGHTS AND DEVELOPMENT POLICY 2 (2002).

products in total manufacturing value added, and (ii) research and development expenditure as a percentage of GDP.[57]

Whether or not this classification is recognized as being inherently valuable, it does point to the remarkable technological heterogeneity of the developing world. Acknowledging such heterogeneity allows the argument against compulsory licensing to be nuanced so that the inappropriateness of compulsory licensing is addressed at two distinct levels: one for TPDCs and one for other developing nations with markedly lower levels of technological proficiency. Based on this classification, compulsory licensing is not required in TPDCs, while for other developing countries which do not qualify as TPDCs, compulsory licensing is insufficient to ensure the flow of technology. Some existing scholarship on the issue, by contrast, advocates the use of compulsory licensing in an uncritical manner without acknowledging the various difficulties that compulsory licensing may encounter across a range of countries.[58]

B. The Ineffectiveness of Compulsory Licensing in TPDCs

Compulsory licensing is likely to be unnecessary in TPDCs because the nature of the market for ESTs is substantially different from that of the market for pharmaceuticals. Further, differences in the technical abilities and possible political inclinations of the players also make it unlikely that compulsory licensing will be seen as a necessary, or even a feasible, solution.

1. Lower Costs of Intellectual Property for ESTs

The grant of a patent on a pharmaceutical product is essentially a grant of a limited monopoly—a drug may therefore have no functional substitutes for the term of the patent.[59] In such situations, the owner of the pharmaceutical patent is strongly placed and may seek to extract monopoly rents.[60] The extraction of monopoly rents may be particularly detrimental to national

57. Basheer & Primi, *supra* note 54, at 105.

58. *See, e.g.*, Estelle M. Derclaye, *Intellectual Property Rights and Global Warming*, 12 MARQ. INTELL. PROP. L. REV. 263, 279–83 (2008) (acknowledging the often onerous conditions which govern the grant of compulsory licenses but nevertheless viewing compulsory licenses as being an appropriate instrument for ESTs).

59. JOHN H. BARTON, INT'L CTR. FOR TRADE & SUSTAINABLE DEV., INTELLECTUAL PROPERTY AND ACCESS TO CLEAN ENERGY TECHNOLOGIES IN DEVELOPING COUNTRIES viii (2007).

60. *Id.*

interests when it occurs during a public health emergency.[61]

However, the situation for ESTs is substantially different from that of pharmaceutical products in three key respects, namely (i) the level of patent protection and intellectual property costs, (ii) the existence of competing products between and across EST sectors, and (iii) the relatively lower barriers to entry for EST markets. In three EST sectors, the basic processes are not subject to patent. Photovoltaic (solar), biofuels, and wind technology each exhibit relatively few intellectual property concerns. For instance, most established solar firms use a somewhat different patented technology, each geared towards the same end—harnessing photovoltaic energy.[62] Similarly, for biofuels, the underlying intellectual property rights are not a significant concern since several relevant technologies are traditional and are not subject to patent.[63] In both the biofuel and photovoltaic sectors, the existence of a number of competing firms within the markets indicates that licenses may likely be obtained on reasonable terms, driving down the costs of acquiring intellectual property.[64]

Wind energy differs because the industry is comparatively more concentrated and key patents do exist. Nevertheless, licenses are regularly granted, and firms from at least two TPDCs—India and China—have succeeded in entering the market alongside older firms. Existing data suggest that the major barrier to acquiring intellectual property may be a small royalty.[65]

These sector-specific findings illustrate a more general truth: ESTs are mature technologies, and in many cases, even previously patented technologies are no longer subject to protection. In this sense, the market is very different from the market for pharmaceuticals, where the boundaries of basic research continue to shift rapidly.

2. Competition Between and Across Sectors

Apart from the comparatively lower costs of intellectual property, the EST market is also remarkably dissimilar from the pharmaceutical market in that products compete against other

61. For one example of how this has played out in South Africa, see Kapczynski & Berger, *supra* note 46.

62. BARTON, *supra* note 59, at 10.

63. *Id.* at 12–14.

64. *Id.* at 10, 13.

65. *Id.* at 18.

products both within their own sector and from other sectors.[66] A major solar producer will aim not only to produce solar energy more cheaply than its competitors but also to ensure that its prices are competitive against local wind and biofuel producers. Such inter-sectoral competition makes it less likely that EST producers enjoy monopoly positions from which high rents may be extracted.[67]

These two general observations also provide valuable clues as to two other crucial respects in which the market for ESTs operates significantly differently from the market for pharmaceuticals.

3. Relatively Lower Market Concentrations and Barriers to Entry

The relatively lower costs of intellectual property for EST markets may also have contributed to lowering the costs of entry to these markets. The lower barriers to entry, in turn, have ensured that the markets are not considered highly concentrated in terms of an antitrust analysis. Even the market for wind energy—the most concentrated of the three EST markets—has seen the entry of several Chinese firms and at least one major Indian firm over the last decade.[68] This is not to suggest that barriers to entry are entirely absent in EST markets or that ESTs are always cheaply deployable. For instance, acquiring land and avoiding land-use restrictions may significantly drive up the costs of wind energy production.[69] The fact that the costs of intellectual property are low in EST markets does, however, seriously weaken the argument for compulsory licensing as a solution to the difficulties of technology diffusion.

Once again, the lower costs of intellectual property serve to distinguish the EST market from markets for pharmaceuticals. Once a pharmaceutical product has received a patent, it may effectively prevent competitors from producing competing products until the term of the patent is over, or it may permit such production only upon the payment of monopoly rents in the form of license fees. Since the basic intellectual property is often

66. *Id.* at viii.

67. *Id.*

68. *Id.* at 17.

69. *See* AMERICAN WIND ENERGY ASS'N, TEN STEPS TO DEVELOPING A WIND FARM (2009), *available at* http://www.awea.org/pubs/factsheets/Ten_Steps.pdf. *See generally* Thijs Westerbeek van Eerten, *Big Companies Keen on Wind Energy*, RADIO NETHERLANDS WORLDWIDE INTERNET ARCHIVE, Jan. 9, 2008, *available at* http://static.rnw.nl/migratie/www.radionetherlands.nl/currentaffairs/region/netherlands/080901-wind-energy-mc-redirected.

unprotected for ESTs, EST producers are unable to extract such monopoly rents and the licensing of such patents is quite common.

4. The Importance of Government-funded Research

The expenses and uncertainty involved in the early stages of research into ESTs has often resulted in government intervention to support such research, both in developed countries and in TPDCs.[70] Such government support has certainly contributed to driving down the costs of intellectual property, at least in the domestic context. Governments will often be legally bound to ensure that licenses for government-held technologies be granted on non-discriminatory terms. State research facilities, and even state-owned corporations, are also unlikely to be driven by the same profit motives as private actors, and are thus more likely to grant licenses to domestic corporations.

On the other hand, government ownership of intellectual property may also make it harder for foreign firms to acquire such intellectual property within that state's jurisdiction.[71] Governments may simply have a policy of favoring domestic producers or may decline to allow licensing by foreign firms on grounds of national security. However, this is quite unlike a private pharmaceutical firm's refusal to grant a license on reasonable terms; a private firm seeks to extract a monopoly rent for the license, whereas the government may be motivated by a range of other concerns and may decline a foreign firm's license application regardless of the price offered.

The two issues examined above—markets that have relatively low intellectual property barriers and government support for investment by private firms—also have a crucial political consequence which might serve to show why an equivalent of the Doha Declaration is unlikely to take place for the EST sector.

5. The Political Consequences of Ownership of Intellectual Property by TPDC Firms

Countries such as India were prominent supporters of the Doha Declaration for reasons that were not entirely altruistic. As major producers of generic drugs, India and Indian firms stood to gain

70. Eric Martinot et al., *Renewable Energy Markets in Developing Countries*, 27 ANN. REV. ENERGY & ENV'T 309, 330 (2002); BARTON, *supra* note 59, at 20.

71. *See* BARTON, *supra* note 59, at 20.

substantially from the grant of a right to operate compulsory licenses to produce generic versions of patented drugs.[72] The nature of the market for ESTs may ensure that this scenario is not repeated.

The comparatively lower intellectual property barriers to entry to EST markets have resulted in the substantial participation of TPDC firms in the EST markets—particularly in the photovoltaic and wind sectors. India's Suzlon, for instance, is a major producer of wind energy and has consolidated that position following its 2007 acquisition of Germany's REPower.[73] As of 2007, the combined market share of the two firms stood at over ten percent of the wind-energy market.[74] Similarly, major Chinese players in the wind and photovoltaic sectors, such as Goldwind and Suntech, may have already acquired a substantial amount of intellectual property, some of it, like Suzlon, by the acquisition of competitor firms.[75]

The fact that these TPDC firms hold appreciable quantities of intellectual property makes it increasingly unlikely that such TPDCs will collaborate in any future Doha-style compromise that requires the compulsory licensing of ESTs. In this respect, the situation is considerably different from Doha, where India, as a major manufacturer of generic drugs, stood to lose little from a decision to require compulsory licensing.

C. The Inadequacy of Compulsory Licensing in Other Developing Countries

If compulsory licensing is unnecessary in TPDCs, it is inappropriate as a solution to the technical problems of other developing countries for entirely different reasons. Compulsory licensing fails as a strategy in the least developed countries primarily because it is an inadequate remedy. Least-developed countries that seek to use compulsory licensing to achieve climate change objectives are likely to be disappointed by its limited effects. Given the low purchasing power and poor business prospects in many such least developed countries, prominent EST

72. ROBERT GO & RUTH GIVEN, DELOITTE TOUCHE TOHMATSU, INDIA MEETS DOHA—CHANGING PATENT PROTECTION: CHALLENGES AND OPPORTUNITIES FACING INDIA'S PHARMACEUTICAL INDUSTRY 2 (2005).

73. *Suzlon Energy Acquires REpower*, THE HINDU, May 26, 2007, *available at* http://www.thehindu.com/2007/05/26/stories/2007052603101702.htm.

74. BARTON, *supra* note 59, at 15.

75. *Id.* at 11, 17.

manufacturers may avoid conflicts arising out of compulsory licensing by simply deciding not to register a patent within the least developed country.[76] Thus, the least developed countries that seek to compulsorily license patents may not have any patents to license in the first place.

Even where a patent exists and is compulsorily licensed by the least developed countries, increased production may not follow. The operation of various "hard" technologies represented by the patents may require considerable "soft" technologies in the form of know-how.[77] Both soft and hard technologies are likely to be in short supply in the least developed countries. Licensees in the least developed countries who seek to avail themselves of the compulsory license may also be intimidated by the prospect of having to compete with an established brand name that has significant experience in the relevant market (i.e., the original patent-holder), and, therefore, these licensees may be deterred from market entry.[78]

In response to this apparent bind, proponents of compulsory licensing could once again reach for their experiences in Doha as a guide. They might urge the merits of a Doha-style solution where TPDCs obtain compulsory licenses to manufacture and export ESTs to the least developed countries.[79] In this scenario, TPDCs such as China might have an interest in seeking the compulsory licensing of certain ESTs for export to the least developed countries. The simplicity of importing the Doha framework, however, is belied in this case by the particular complexities that characterize markets for ESTs.

First, it is worth noting again that the existing intellectual property framework specifically disallows compulsory licensing for the purposes of export. Article 31(f) of TRIPS specifically states that the use of a compulsory license shall be "authorized predominantly for the supply of the domestic market of the

76. CYNTHIA CANNADY, INT'L CTR. FOR TRADE & SUSTAINABLE DEV., ACCESS TO CLIMATE CHANGE TECHNOLOGY BY DEVELOPING COUNTRIES: A PRACTICAL STRATEGY 4–5 (2009).

77. *See* Carlos M. Correa, *Can the TRIPS Agreement Foster Technology Transfer to Developing Countries?*, *in* INTERNATIONAL PUBLIC GOODS AND TRANSFER OF TECHNOLOGY UNDER A GLOBALIZED INTELLECTUAL PROPERTY REGIME 227, 229–30 (Keith E. Maskus & Jerome H. Reichman eds., 2005).

78. *See id.*

79. For a discussion of the "framing effects," which the Doha compromise might induce, see *infra* note 122 and accompanying text.

Member authorizing such use."[80] The exception created by the Doha Declaration to Article 31(f) was limited to the specific case of pharmaceuticals. In other words, compulsory licensing for the purpose of exporting to the least developed countries would require the negotiation of yet another industry-specific exemption to TRIPS, this time in favor of ESTs.

As mentioned above, the political prospect of yet another Doha-style deal on ESTs is unlikely. On the one hand, TPDCs own intellectual property in the form of EST patents. This form of ownership sets the situation apart from Doha, where TPDCs were primarily engaged in the manufacture of generic drugs. If TPDCs did allow the compulsory licensing of EST patents for export to the least developed countries, it is quite likely that firms in developed countries would retaliate by seeking to compulsorily license patents held by TPDCs for similar exports. There is something resembling a prisoner's dilemma here that might compel TPDCs to forego such export opportunities in order to protect their intellectual property.[81]

On the other hand, it is certainly possible that some TPDC firms may be willing to run the risk of retaliatory compulsory licensing. They may reason that their own holdings of intellectual property are sufficiently low and that the opportunity represented by lost export earnings is sufficiently high to run the risk of retaliation. The decision to create an EST exemption to the TRIPS Agreement will not, however, be left to firms. Instead, it will be a decision taken by nation states for the benefit of their EST industries in general, not for specific firms.

Leading TPDCs, such as China and India, have firms that acquired technology from abroad, which they will seek to protect.[82]

80. TRIPS Agreement, *supra* note 30, at art. 31(f).

81. The prisoner's dilemma is a fundamental problem in game theory identifying situations where parties may not cooperate to produce an optimal solution even where their lack of cooperation may lead to sub-optimal outcomes for each party. For further details on how the situation was first developed as an exercise in game theory, see WILLIAM POUNDSTONE, THE PRISONER'S DILEMMA 8 (1992). The compulsory licensing situation resembles the prisoner's dilemma somewhat imperfectly. Some TPDCs, which have comparatively fewer patents or whose patents are less valuable, will fear fewer attempts to compulsorily license these patents by developed nations. Accordingly, they may be more aggressive in seeking to license developed country patents. Other TPDCs may have more, or more valuable, patents and may therefore shy away from compulsorily licensing developed country patents. The optimal solution might be for both parties to desist from any compulsory licensing of each other's products but the comparative of TPDCs to control each other's decisions may make it difficult to arrive at a Pareto-optimal outcome for all TPDCs.

82. *See* Barton, *supra* note 59, at 63–65.

Further, TPDCs may see a compulsory licensing framework as inhibiting research investments by their member-firms over the long term. As leading TPDC firms consolidate their presence in the market, research investments will go up and more intellectual property is likely to be generated. It is therefore unlikely that leading TPDCs will agree to any general commitment which will have the effect of rendering vulnerable the research advances made by member-firms in the EST industry over an indefinite period of time.

A final factor that might discourage pressure on compulsory licensing from TPDCs is the comparatively more remote and uncertain nature of the harms. While the prospect of major climate change is undoubtedly a reality, the precise range of the harms it poses for specific countries is not yet completely clear. In this sense, the situation is also different from the crisis that precipitated the Doha Declaration.

At the beginning of the 1990s, HIV infection rates rose to significant levels in India, and by 2006 the infection incidence was estimated at approximately 2.5 million people.[83] In other words, the harms arising from the public health crisis in developing countries were real and present by 1999 and allowed TPDCs to take a considered position on the compulsory licensing debate. The climate change situation, while grave, has fortunately not yet begun to affect directly similar numbers in developing countries in as visible a way. Resultantly, TPDCs may respond more slowly to the situation. TPDCs may also express reluctance to take the significant step of allowing compulsory licensing.

III. ASSESSING THE FEATURES OF AN ALTERNATIVE REGULATORY MECHANISM

If compulsory licensing is not the solution, is there an alternative proposal which would facilitate the flow of technology to the developing world? The immediate aim here is to produce a plan that is superior to compulsory licensing; however, this requires knowledge of the elements of the optimal legal framework. For instance, we might seek some degree of fidelity to the existing regulatory framework of climate change law since this would display adherence to the existing international consensus and thus

83. NAT'L AIDS CONTROL ORG., MINISTRY OF HEALTH AND FAM. WELFARE, INDIA HIV ESTIMATES—2006 11 (2007).

add legitimacy to the plan. We might want a plan that comports with values of efficiency and fairness. We might, however, have to unpack these values further to assess more precisely what we would expect our alternative plan to do.

In addition to these general requirements for a preferred regulatory framework, we might also seek a solution that works well within the structure of international law and is sensitive to the mechanisms and participants who create and comply with international law. In particular, an ideal solution should recognize the fact the international legal system generally operates on consensus and that the players within the system are sovereign nations that can be openly coerced only in extreme circumstances.

We might also have to choose from between general kinds of regulatory instruments, each with its own set of incentives or disincentives. Thus, for instance, we might use *conduct instruments*, i.e., regulations specifying technology or performance standards or design standards or other forms of command-and-control rules. Alternatively, we might prefer to employ *price instruments* which do not explicitly permit or prohibit various forms of conduct but instead choose to encourage or discourage them by levying a price on activities based on their perceived social costs or benefits. We could also use *quantity instruments*, a species of property rule which allocate entitlements to generate or be free from external harms—tradable carbon allowances, for instance.[84] Of course, the choice of any one of these instruments is not to the exclusion of the other; they are often used in combination.

A. The Nature of the Challenges Posed by Climate Change

An alternative proposal would also have to consider the factors that make climate change a particularly difficult problem for international cooperation. These factors are not necessarily unique to climate change—they are present across a range of global environmental problems such as trans-boundary pollution. However, climate change does represent a particularly extreme example of a global collective action problem that is compounded by three factors.[85]

First, like other global environmental problems, climate change

84. *See* Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 677, 705 (1999) (discussing classification and definitions of these various instruments).

85. *See id.* at 689–700.

will have global impacts. Extensive abatement efforts by one nation or a small group of nations will benefit the global collective, thus creating a free-rider problem. Causality is also complicated by the fact that a nation's efforts, no matter how extensive, will not necessarily benefit itself to the exclusion of others. In this sense, a stable climate is a universal good that no nation can exclude others from enjoying.

Second, climate change arises from a variety of mobile sources that are distributed globally. This phenomenon may give rise to "leakage" problems where sub-global regulation simply prompts the problem to locate itself outside the regulatory umbrella.[86] Thus, if the United States were to impose emission limits on industries located within its territorial borders, industries might react by relocating to a jurisdiction that poses no such regulatory costs. The problem of leakage can only be addressed by a solution that does not allow for such regulatory arbitrage.

Third, although carbon-emitting sources are distributed all over the world (with marked concentrations in highly industrialized countries), the costs of abatement vary widely and may often be highest in countries that contribute relatively little to the problem. Differences in industrial and technical capacity and developmental factors will often lead to major differences in the ability to abate the effects of climate change and the costs of such abatement.[87]

Just as the ability to abate diverges widely across nations, so various nations stand to gain very differently from such abatement exercises. For instance, countries with vast stretches of tundra might believe that they stand to gain more arable land from climate change. Others may view the costs of abatement as unjustified by the level of benefit expected from preventing climate change.[88]

Given the wide disparities in the costs and benefits of abatement, a global regulatory instrument must be cost-efficient across countries and must seek to distribute benefits as evenly as possible across countries.

86. *See* Hilary Sigman, *Legal Liability as Climate Change Policy*, 155 U. PA. L. REV. 1953, 1956 (2007) (discussing the problem of leakage).

87. Wiener, *supra* note 84, at 697.

88. At one point, some statistics suggested that the United States might be a minor loser from climate change and that other countries such as China or Russia would similarly stand to lose very little or even gain. It was speculated that this might serve to fuel further opposition to the Kyoto Protocol. Cass R. Sunstein, *Of Montreal and Kyoto: A Tale of Two Protocols*, 31 HARV. ENVTL. L. REV. 1, 29–36, 48 (2007).

B. Existing Regulatory Frameworks

The existing regulatory framework for climate change, as represented by the UNFCCC and the Kyoto Protocol, displays specific preferences in terms of regulatory structures and policy goals. For instance, as shown earlier, these international agreements use market structures (price or quantity instruments) in combination with command-and-control regulations. The Kyoto Protocol does not forbid a nation from emitting carbon above a certain level; instead, it merely requires that nations compensate for excess emissions in specified ways, such as by purchasing credits or implementing offset programs.[89] The UNFCCC and the Kyoto Protocol also represent a global consensus on the position that climate change imposes common but differentiated responsibilities and that developed nations must bear abatement costs in some relation to their history of high emissions.[90]

A regulatory instrument which hews closely to these two positions will derive legitimacy from the degree to which it represents principles arrived at by consensus. Similarly, an instrument that generally honors intellectual property and free trade will accord with the trade obligations undertaken by a number of nations under the WTO framework. Regulatory instruments that comport with such trade obligations are less vulnerable to charges that they require nations to violate pre-existing commitments.

C. The Structure of International Law

The choice of regulatory instrument must also account for the peculiar character of the international legal framework within which it operates. Domestic instruments may be issued by a unitary fiat that compels obedience; international law works quite differently. The economist James Buchanan once observed that economists tend to proffer policy advice "as if they were employed by a benevolent despot."[91] This assumption does not survive scrutiny as a matter of public international law.

The international legal structure generally operates on the principle of *pacta sunt servanda*—agreements must be kept in good

89. Michaelowa, *supra* note 28.

90. *See supra* notes 15–16, 18–20 and accompanying text.

91. James M. Buchanan, *The Constitution of Economic Policy*, 77 AM. ECON. REV. 243, 243 (1987).

faith.[92] In general, nations will voluntarily assume the obligations that they wish to honor. There are certainly extreme exceptions: for instance, nations are obliged to refrain from genocide or slavery, irrespective of their choice in these matters. In most cases, however, international law operates on the basis of free consent.[93] This voluntary nature of international law has two major consequences for the choice of a global regulatory instrument to facilitate technology transfer.

First, regulatory instruments that would have been efficient under conditions of unitary fiat may no longer be efficient under a voluntary regime. Thus, nations operating under the framework of international law will simply refuse to join an arrangement that imposes heavy taxes on them.[94]

Second, since consent is the basis of international law, global regulatory instruments must attain participatory efficiency—i.e., nations must believe that participation in the international regime yields more benefits than it costs.[95] Further, participation in an international agreement by the sources of the negative externality must be attracted rather than coerced. Jonathan Wiener therefore suggests, albeit in a different context, that a global regulatory instrument that is arrived at through processes of international treaty-making should operate on a "Beneficiaries Pay Principle."[96] Nations which benefit from an international agreement will make side payments to those nations which do not benefit to induce them to join an international agreement. However, there are some important limitations which apply to the Beneficiaries Pay Principle in the context of EST transfers.

As noted earlier, a few nations may actually benefit from climate change, for instance, through increased agricultural productivity. Alternatively, some nations may stand to lose so little from climate change that they may not think it beneficial to engage in EST transfer on any but the most profitable terms. These two kinds of nations are the non-beneficiaries from EST transfer, and since technology transfer regulation requires global coverage, both must

92. Sir Gerald Fitzmaurice, *The Law and Procedure of the International Court of Justice, 1954–9: General Principles and Sources of International Law*, 35 BRIT. Y.B. INT'L L. 183, 195–96 (1959) (recognizing *pacta sunt servanda* as a *jus cogens* norm in international law).

93. Lord McNair, THE LAW OF TREATIES 162 (1961) (on the primacy of the need for state consent).

94. Wiener, *supra* note 84, at 752.

95. *Id.*

96. *Id.*

somehow be induced to join an international regulatory framework or agreement. In the Beneficiaries Pay framework, the inducements to join should flow from those nations that stand to benefit most significantly from EST transfer. Alternatively, beneficiaries of EST transfers may seek to impose costs on non-beneficiaries if they will not join an international agreement to transfer ESTs on relatively favorable terms.

In reality, however, the Beneficiaries Pay framework does not apply quite so clearly. The major beneficiaries of EST transfer are clearly the poorest nations, since such nations would otherwise be the greatest losers from climate change[97] and ESTs would help developing countries prevent such drastic climate change or to mitigate its effects. Under the existing international agreements governing climate change, developed nations have an affirmative obligation to supply them with technology.[98] The poorest nations might rightfully balk at making further payments to secure what they have already been promised on broadly favorable terms under international law. More importantly, these poorest nations simply may not be able to make side payments to induce the flow of ESTs from the developed world, and the Kyoto Protocol's principle of "common but differentiated responsibilities" requires that their relative incapacity be understood and accommodated by the developed world.

This does not imply that developed nation firms have no right to recoup their costs and even profit from EST transfers to the developing world. The obligations of developed countries do not necessarily translate to the individual obligations of private firms within such developed countries.[99] An alternative solution might therefore involve casting the burden of providing the profits from EST transfers to the private firms in developed countries instead of developing ones.

What emerges, then, is a situation where the Beneficiaries Pay

97. For an extensive discussion of the particular vulnerabilities of developing nations, see UNFCCC, CLIMATE CHANGE: IMPACTS, VULNERABILITIES AND ADAPTATION IN DEVELOPING COUNTRIES (2007).

98. UNFCCC, *supra* note 8, at art. 4, ¶ 3.

99. Although exceptions certainly exist and are rapidly increasing in number, international law traditionally addresses itself to states and binds only states. *See* Carlos M. Vazquez, *Direct vs. Indirect Obligations of Corporations Under International Law*, 43 COLUM. J. TRANSNAT'L L. 927, 931 (2005). However, the endorsement of private acts may amount to their adoption by states as the International Court of Justice recognized in *United States Diplomatic and Consular Staff in Tehran* (U.S. v. Iran), 1980 I.C.J. 3 (May 24).

Principle no longer directly applies, because the basic negotiations are already over. Under existing international climate change regulations, developed nations have already committed to facilitate EST transfer to developing nations. As a result, they can no longer insist on side payments for facilitating these transfers. At the same time, an alternative regulatory framework must nevertheless create some incentive for nations to join an instrument that promotes the funding of EST transfer to the developing world instead of allowing the present ad hoc approach to continue. What follows is one suggestion for an international regulatory mechanism that might accommodate the structure of international law, existing international climate laws, and the global character of the problem posed by climate change.

IV. A TENTATIVE FRAMEWORK FOR EST TRANSFERS

The diverse nature of the many nations of the developing world makes a uniform solution unlikely. However, to agree that solutions must be nuanced to account for a nation's particular circumstances is not to concede that the present disorganized array of one-off transactions is necessarily the best way forward. A system that allows for differences in the technical and scientific capacity of countries need not compromise on values of efficiency, accountability, or equity.

A. The Two-Fund System: A Proposal

The solution presented here involves the setting up of two global funds with distinct purposes. This Note entitles them Fund 1 and Fund 2. Fund 1 is the more complex of the two funds. Its mission is to facilitate the actual transfer of ESTs. Fund 1's contributing members would be primarily the Annex 1 countries to the Kyoto Protocol and its proposed beneficiaries would be primarily the non-Annex 1 countries. Fund 2, on the other hand, aims to effect infrastructural change in the least-developed countries, potentially over a longer period of time.

1. Fund 1: Facilitating EST Transfers

The limited aim of Fund 1 is to provide developing countries with ESTs at cost or lower. Private firms are encouraged to make sales of technology or to license technology at fully commercial terms (i.e., at market rates) to the various nations of the developing

world. These developing countries can then present proof of these purchases or licenses to the overseers of Fund 1 and receive specified subsidies in exchange for such presentation of proof.

Not every beneficiary nation will receive the same subsidy under Fund 1. Indeed, for the leadings TPDCs such as China or India, the subsidy may be significantly smaller than for the Small Island Developing States, whose extreme vulnerability to climate change is compounded by their low technical capacities.[100] The calibration of the subsidy would, therefore, likely turn on a complex mix of factors. First, for instance, economic and developmental indicators, such as per capita incomes and literacy rates, would almost certainly have to be amongst the relevant parameters. Second, Fund 1 must also accommodate the expected needs and vulnerabilities of dependent nations—countries which can expect to bear disproportionate costs arising from climate change or countries whose mitigation and abatement costs are particularly high should qualify for higher subsidies, provided that such countries have taken steps to render mitigation or abatement efforts as efficient as possible. Third, factors relating to a nation's scientific and technical capacity would be equally important in determining the level of subsidy.

For instance, following academic suggestions, the subsidy-setters might seek to determine the share of medium or high technology products in total manufacturing value added, research expenditures as a percentage of GDP,[101] the number of patents granted within a specified time period,[102] or the existence of research institutions that have attained a specified level of accreditation.[103]

If consensus is obtained amongst the Annex 1 countries, the calibration of subsidy could influence conduct amongst beneficiary nations in other ways. Nations with a good record of protection of intellectual property could be rewarded by the grant of a higher level of subsidy than others. Nations that have a strong record of abatement or mitigation activities could be similarly incentivized to continue in the same vein.

100. For data on the particular vulnerability of Small Island Developing States, see CLIMATE CHANGE SECRETARIAT, UNFCCC, CLIMATE CHANGE: SMALL ISLAND DEVELOPING STATES 13–23 (2005), *available at* http://unfccc.int/resource/docs/publications/cc_sids.pdf.

101. Basheer & Primi, *supra* note 54, at 105.

102. Daniele Archibugi & Alberto Coco, *Measuring Technological Capabilities at the Country Level: A Survey and a Menu for Choice*, 34 RES. POL'Y 175 (2005).

103. *Id.*

Subsidies awarded under Fund 1 would not be set in stone. Rather, they would be shifting and dynamic, with each nation's record assessed on an annual basis or other suitable time frame. The continued grant of subsidies could be made conditional upon the attainment of climate targets within a given time period—in other words, beneficiaries would be required to show that they were making good use of the technology provided. Similarly, subsidies would shift in relation to economic developments that had the effect of making a nation better or worse off. Over time, Annex 1 countries might even look to the gradual phasing-out of subsidies on a country-by-country basis. Leading TPDCs could be removed from the subsidy list fastest, with other nations to follow, based on their evolving technical capacities.

A dynamic system of subsidies is also necessary in order to combat the perverse incentives that Fund 1 may produce. Thus, for instance, nations that persistently violate intellectual property laws or engage in fraud upon the system through collusion, misrepresentation, or non-disclosure of essential data could be penalized by a system of lower subsidies or even by expulsion from the system, following a vote to that effect. By contrast, nations that offer acceptable reasons for non-compliance with certain conditions on which the subsidies are predicated will receive no sanctions. A nation that can justify its inability to meet climate targets by pointing to force majeure events—such as foreign acts of aggression or unpredictable natural calamities, e.g., earthquakes or epidemics—will not be subject to sanction under the system.

Before closing this brief description of Fund 1, it is essential to discuss the actual funding of Fund 1. As mentioned earlier, the majority of Fund 1 contributors will be Annex 1 countries. However, leading TPDCs such as China should also be offered the chance to join Fund 1. These TPDCs would simultaneously be contributors and beneficiaries under Fund 1—they would receive a comparatively small subsidy for their purchases of technology or their payment of license fees and they would pay higher subsidies for their sales to poorer, less technically proficient countries.

Tentatively, the ideal source of funding for Fund 1 should be provided by the nations whose private firms make the sales to the developing world. The level of subsidy would also be linked in direct proportion to the level of sales. Here, it is important to clarify that I do not mean that the mere fact of incorporation should trigger the obligation to provide subsidies—that would

create a perverse incentive as private firms might flock to formally incorporate in the nation most capable of providing subsidies, while retaining principal places of operation in other states. Instead of incorporation, the subsidy should be paid by the jurisdiction with the legal right to collect corporate income tax on the operations of the private firm.

In many cases, private firms will pay, or will be liable to pay, corporate income tax in more than one jurisdiction. In such cases, each country assessing corporate income tax will incur the obligation to pay subsidies. If it can be shown, however, that the corporation's activities in the jurisdiction have no connection with EST sales, then that jurisdiction should bear no obligation to provide subsidies.

Tying subsidies to corporate performance may have certain beneficial or virtuous consequences. Subsidies will be costly for the home state of the firm, but this does not mean that states will necessarily react by exiling EST firms to avoid paying the subsidy. The activities of a firm within a jurisdiction may provide multiple benefits to the home state in terms of: new employment generated; contributions to the public exchequer in the form of taxes, licensing fees, and regulatory payments; the deepening of capital and credit markets; and other forms of wealth creation. There would, therefore, be every reason for states to set off the expected payment of subsidy against these variegated benefits.

2. Fund 2: Augmenting the Technical Capacities of the Least Developed Nations

Fund 2 has more general aims than Fund 1 and operates against a longer time horizon.[104] Fund 2 is a development fund that aims to augment the technical capacities of the least developed nations. The membership of Fund 2 is smaller—TPDCs, for instance, are

104. Initiatives already exist which have similar goals to the goals that Fund 2 would have. Most notably, the Least Developed Countries Fund ("LDCF") aims to support national implementation of adaptation plans for the least developed countries. Yet another initiative with similar goals but broader coverage is the Special Climate Change Fund ("SCCF"). Both the LDCF and the SCCF are administered by the Global Environmental Facility ("GEF"). GEF is is a global partnership among 178 countries, international institutions, non-governmental organizations, and the private sector to address global environmental issues while supporting national sustainable development initiatives. For further details on the LDCF and the SCCF, see generally UNFCCC, LDC Fund, http://unfccc.int/cooperation_support/least_developed_countries_portal/ldc_fund/items/4723.php (last visited June 8, 2010).

not members of this Fund. Every donor to Fund 1 is a donor to Fund 2, but not every beneficiary of Fund 1 is a beneficiary of Fund 2. Instead, the beneficiaries of Fund 2 are only the poorest countries, measured both economically as well as against technical or scientific indicators. The application of two measures is unlikely to generate much controversy because economic poverty is often accompanied by a very low level of technical proficiency.[105]

Fund 2 operates on the basis of direct grants or loans rather than subsidies, and it aims to create the kind of implementation capacity which would make it meaningful to supply ESTs to these least developed countries. Here, it might be useful to provide a broad categorization of the range of tasks that Fund 2 might undertake.

Broadly, Fund 2 is engaged in the medium-to-long term approach of what Cynthia Cannady calls "climate change technology innovation strategy" ("CCTIS").[106] A CCTIS approach is an application of general innovation strategy in the field of climate change with an ultimate goal of technology development and commercialization. In the private sector, this is sometimes referred to as "Intellectual Property Asset Management" and its overall goals are strengthening research, increasing IP ownership by national firms or public institutions, and the creation of long-term capacity. Fund 2 could assist these rather ambiguous goals in the following ways:

1) Subsidizing the hiring of developed country professionals and the training of developing country professionals engaged in abatement or mitigation activities or in general scientific or technical education.[107]
2) Strengthening domestic research institutions by providing funds for laboratories, research facilities, and technical education institutions.[108]
3) Preparing Fund 2 beneficiaries for life beyond the existence of the funds by assisting in the creation of a climate conducive to foreign investment. This could take the form of strengthening domestic intellectual property protection, streamlining local legal systems, providing tax and subsidy benefits to foreign investors, and developing domestic antitrust enforcement so as to discourage predatory conduct

105. Basheer & Primi, *supra* note 54, at 105.
106. CANNADY, *supra* note 76, at v.
107. *Id.* at 21.
108. *Id.*

> against nascent local firms.[109] The overall goal here is to ensure the free flow of foreign investment over the long term, a factor that itself stimulate of technology transfer over a sustained period of time.[110]

Fund 2 contributions are not necessarily tied to EST sales in the way that Fund 1 contributions are. Instead, they may mimic the proportions specified for national commitments under the Kyoto Protocol or seek to achieve discrete targets in terms of promoting technical literacy and innovation in the least developed countries.

A crucial aspect of the tentative framework under discussion here is that the two funds operate in tandem to achieve distinct goals. Fund 1 is a complex mechanism that is expected to bridge the technology gap over a shorter term. Fund 2, by contrast, is essentially a development fund whose entire aim is to ensure developing world self-sufficiency in EST manufacture and deployment.

B. Some Possible Objections Considered

The two-fund framework proposed here fulfills some of the requirements of the international regulatory framework suggested in Part IV. One might begin by noting that Fund 1 is essentially a market-based mechanism that uses a price instrument in the form of subsidies. As such, it is in harmony with the existing climate regime's general preference for market mechanisms.

Further, Fund 1's use of a calibrated subsidy and Fund 2's restricted membership are acknowledgments not only of the diversity of developing world nations but also of the international climate change regime's requirement of "common but differentiated responsibilities." Clearly, if developing nations receive assistance according to both their needs and abilities, this structure goes some way towards meeting the UNFCCC's background principle of common but differentiated responsibilities.[111] Similarly, tying subsidies to corporate sales and the liability to pay corporate tax will ensure that the bulk of

109. *Cf.* Gaetan Verhoosel, *Beyond the Unsustainable Rhetoric of Sustainable Development: Transferring Environmentally Sound Technologies*, 11 GEO. INT'L ENV'TL L. REV. 49, 71–72 (1998). Verhoosel does not mention antitrust enforcement but makes the same general point about taking measures which could encourage foreign investment, such as protecting intellectual property.

110. *Id.* at 72.

111. UNFCCC, *supra* note 8, at art. 4, ¶¶ 3, 5, 7.

subsidies are borne by the states with the greatest industrial capacity.

At the same time, this form of differentiation amongst Fund 1 contributors is not perfect. Fund 1 contributors who favor ESTs over dirtier technologies will bear the burden of paying subsidies, while nations that use dirtier technologies will not. However, the international climate change regime may act as a corrective measure since it imposes limits on nations that use dirtier technologies in the form of carbon caps.[112]

1. Participatory Efficiency

One objection might be advanced under the requirement of participatory efficiency. Clearly, the Fund 1 framework imposes costs on nations that have developed EST sectors. What, then, incentivizes nations to participate in Fund 1? One major incentive might lie in the fact that participation in Fund 1 is very likely to encourage EST sales by national firms. Fund 1 contributors can be assured of a loyal clientele of developing nations that will find fund-subsidized ESTs cheaper than unsubsidized ESTs. Over the long term, as private firms from Fund 1 donor countries develop brand loyalty or lock-in effects in developing-country markets, this may have other benefits for Fund 1 contributors. Fund 1's biggest incentive is its promise of access to markets in developing countries. As countries develop sophisticated EST sectors, Fund 1 will provide their private firms easy access to new markets—often markets in the greatest need of their technologies. In this way, Fund 1 creates incentives for new participants but strictly within the voluntary framework of international law.

In a different context, Jonathan Wiener suggests a more sophisticated objection to the use of technology subsidies within the international law context.[113] Wiener suggests that the subsidy provisions may encourage risky behavior in three ways. First, risk-takers may begin to behave as if they were insured against the consequences of their risk-taking conduct. Second, sources may posture to secure larger subsidies by worsening their situation in the relevant ways. Finally, and worst of all, capital markets may respond to abatement subsidies by increasing investment in the subsidized industry so that the industry has no incentive to

112. See notes 27 and 28 and accompanying text, which note the Kyoto Protocol's clear preference for market mechanisms over sanctions as deterrents.

113. Wiener, *supra* note 84, at 726–27.

discontinue the subsidized conduct. Thus, an abatement subsidy may reduce pollution at an individual firm but simultaneously increase pollution across the entire polluting industry.[114]

Wiener's objections carry weight in the context of pollution-abatement subsidies, but the specific kinds of subsidies envisaged under Fund 1 are not vulnerable to Wiener's criticisms for several reasons. First, in Fund 1, the subsidies are actively policed by contributors—collusive, fraudulent, or posturing conduct is penalized by the reduction or removal of the subsidy. Second, the subsidies shift in response to several variables. For example, if a nation cannot provide good cause for failing to meet its climate targets, the subsidy disappears, thereby disincentivizing the kind of conduct that seeks to perpetuate subsidies. Finally, though it is certainly true that EST firms that have high sales revenues will attract investment in capital markets,[115] this is a virtue rather than a vice. A world in which ESTs sell better than dirtier technologies is a world with a more stable climate.

2. The Inefficiency of a Centralized Administration

Wiener also views subsidies as particularly problematic when they are administered by a centralized aid institution that enjoys market power.[116] Since these funds do not have to compete aggressively to sign up projects, they have fewer incentives to be cost-effective. Accordingly, their performance in selecting projects and policing targets may often be lackadaisical.[117]

Further, Wiener also makes the charge that beneficiaries may view such funds as "monopsonist," and choosing or rejecting funds seemingly at whim.[118] Over time, beneficiaries come to distrust such institutions, placing the future of the entire enterprise at risk. This is a serious criticism of a fund such as Fund 1.

Fortunately, Fund 1 is a much more modest enterprise than the omnipotent funds Wiener describes. First, Fund 1 is not in the business of identifying or selecting projects. Instead, all transactions are between private firms operating within the jurisdiction of Fund 1 contributors and developing nations or

114. *Id.* at 727.

115. Indeed, this has become reality, even for companies that may not as yet have had high sales (or any sales at all). Venuri Siriwardane, *Cashing in on Clean Technology*, INC., Jan. 2, 2009, *available at* http://www.inc.com/articles/2009/01/clean-tech.html.

116. Wiener, *supra* note 84, at 727.

117. *Id.*

118. *Id.*

developing nation member-entities. Upon presentation of receipts and accounting, Fund 1 merely pays out a subsidy based on the volume of sales. Corruption and collusion are certainly possible in the representation of accounts for subsidy payments, but here the Fund 1 contributor, or its nominees on the Fund, will have every incentive to police these demands closely to ensure that it is not overpaying. The converse problem is also accounted for: if a Fund 1 contributor challenges too many subsidy demands, its private firms will no longer be preferred providers for developing countries that cannot recoup their promised subsidy payments. The appropriate analogy might be an insurance provider that refuses to honor its coverage—over time, customers will defect to other providers within the same market.

Since Fund 1's activities are modest, it is also unlikely to be perceived as a monopsonist by its beneficiaries. Instead, it is closer to a kind of clearinghouse that endorses and provides payments on the basis of transactions already concluded.

3. Policing: A Residual Objection

Much of Fund 1's activities involve a natural system of checks and balances—private players want to be able to make sales to developing nations, which want to be able to collect on their promised subsidies. In contrast, the developed countries that are the home jurisdictions of these private firms want to pay as little as possible in subsidies while simultaneously ensuring that their member firms remain competitive in the international market.

In the resulting model, each player has an incentive to ensure that the system is being used fairly by the other players. A nation that gives out subsidies without policing them adequately may not only face criticism from domestic taxpayers, but also be sanctioned by other nations that view its lax subsidy-payment policies as unfairly damaging the competitive abilities of their own member firms.

Nevertheless, Fund 1 must account for significant policing problems. Chief amongst these is the end-user problem. One of Fund 1's most attractive features is its use of calibrated subsidies—nations receive funds according to both their needs and their ability to pay. The use of a differentiated subsidy, however, will necessarily mean that ESTs are available more cheaply to some nations than others. This creates a perverse incentive for certain nations and their member-firms to try to defraud the system by

routing EST sales through the most heavily subsidized nation. To provide an example, a Chinese user of solar technology may seek to route its purchase of solar panels through an entity in Chad. The Chadian entity may then seek to collect a subsidy based on the purported sale from the home state of the firm that supplied the solar technology, and then pay a portion of the subsidy collected to the Chinese firm. What results is a distortion of Fund 1's entire model of subsidized sales: resources are diverted to countries that do not use them, subsidies are provided to countries that are not in the most pressing need, and, ultimately, climate change targets are not achieved.

This certainly approximates a nightmare scenario for Fund 1. However, even for this deeply problematic use of Fund 1 resources, there are certain internal checks that may serve to prevent large-scale fraud.

One major check on such diversion of subsidies is the tying of subsidies to climate goals or targets. If, after years of purchasing ESTs, Chad is unable to show good cause for the non-attainment of climate goals, it is liable to be sanctioned by the removal or reduction of its subsidy. Fund 1 contributors may also consider other forms of penal sanction or seek the recovery of subsidies paid.

Private firms also have good reason to actively police the end-use of the technologies that they supply. For instance, firms may be wary about supplying sophisticated technologies to countries which have a poor record of intellectual property protection or which actively circumvent their international obligations. Fund 1 contributors may also implement domestic legislation that penalizes private firms that collude in the diversion of subsidies or fail to take reasonable care to prevent its occurrence. One possible model for such policing might be the extensive restrictions imposed on the export of military hardware or dual-use items to certain countries.[119]

As a final point, while acknowledging the serious nature of the policing problem that the issue of end-use gives rise to, it is worth noting that similar issues could arise under compulsory licensing. If a compulsory license were exploited primarily in order to supply a foreign market rather than the domestic one, it would amount to

119. *See, e.g.*, 15 C.F.R. §§ 730–74 (2009) (U.S. Export Administration Regulations (EAR)); 15 C.F.R. § 750.8 (2009) (sanctions for violation of the EAR may include the revision, suspension, or revocation of a license).

a violation of Article 31(f) of TRIPS.[120] As with the issue of end-use by Fund 1 beneficiaries, private firms would have to aggressively police the working of these licenses to ensure that they were not being used for the purpose of illegal exports.

V. CONCLUSION

The use of Fund 1 and Fund 2 in tandem provides an alternative to compulsory licensing, which is sensitive to the different positions of various developing countries. In the preceding sections, this Note has attempted to set out some of the reasons that make compulsory licensing an inappropriate solution to the complex issue of ensuring the flow of ESTs to the developing world.

In conclusion, however, it is important to note a significant political benefit that this alternative solution confers—it allows us to avoid a potentially ugly confrontation about compulsory licensing. Compulsory licensing is a somewhat drastic step—indeed, in the context of intellectual property, it might be likened to a nuclear option. It risks damaging relations between foreign investors and host countries, and may jeopardize future investment prospects.

At the risk of speculation, it also seems unlikely that TPDCs would take the decision to confront developed nations who are valuable suppliers of capital and foreign investment over compulsory licensing in any but the most extreme cases where the gains are significant and the costs negligible. This kind of confrontation certainly took place in in Doha,[121] but it is unlikely to reoccur over ESTs.

A battle over technology transfer along the lines of Doha would be disastrous, especially because the remarkably different structure of markets for clean technologies makes it unlikely that the alliances that led to the Doha compromise would be repeated in the context of ESTs. Nations that hastened to authorize compulsory licensing might face considerable retaliation, not only from the developed world but also from TPDCs whose member-firms owned appreciable quantities of intellectual property.

120. TRIPS Agreement, *supra* note 30, at art. 31(f).

121. Emma Young, *U.S. Accused of Double Standards on Drug Patents*, NEW SCIENTIST, Nov. 2, 2001 (noting the importance of developing countries' access to patented medicines as a key issue at the fourth ministerial conference in Doha on November 9, 2001), *available at* http://www.newscientist.com/article/dn1512-us-accused-of-double-standards-on-drug-patents.html.

Amy Kapczynski noted that battles over intellectual property can have a "framing effect"[122] so that future disputes are analyzed through the prism of past conflicts. The use of "frames" to view disputes involves a "diagnosis" (the identification of a problem and the attribution of blame), "prognosis" (the identification of a solution and the allocation of responsibility for it), and "motivation" (calling on others for action against the problem).[123]

The significance of the developing world's victory at Doha might well have led to a similar framing effect. Thus, parties to future disputes regarding access to knowledge or the transfer of technology may necessarily view their own battles through the lenses of past conflicts over pharmaceuticals. This framing effect may explain why civil society activists and some developing world politicians see compulsory licensing as a solution to EST transfer, and ultimately to climate change itself. It would be dangerous to allow the continuation of a misconception that suggests that EST transfer is just like Doha without the medicines. ESTs are far too valuable as resources and climate change is far too grave a challenge to be considered on any terms other than their own.

122. Kapczynski, *supra* note 52, at 809.
123. *Id.* at 815.