Institute for Policy Innovation

A Survey of the Global Policy Landscape for Green Technology and Intellectual Property

by Chris Israel

POLICY REPORT 193

APRIL 2011

Executive Summary

While there is consensus that carbon-based energy sources will continue to meet the vast majority of the world's energy needs for years to come, it is also clear that major breakthroughs across a range of clean energy technologies are essential to reconcile finite natural resources with seemingly infinite global energy demand. According to the U.S. Energy Information Administration (EIA), world energy consumption will increase by 44 percent by 2030, and the largest projected demands come from non-OECD countries where energy infrastructures are underdeveloped and the need for efficiency is paramount.

Domestically, a national consensus is emerging that the U.S. must lead in the development and deployment of clean and efficient new sources of energy.

It is clear that the nations of the world are responding to the clean energy challenge. Brazil has a National Action Plan on Climate Change; India has established a National Enhanced Energy Efficiency Mission, and China is working on a set of indigenous innovation policies designed to stimulate development of a green technology program within China.

Significant investments are being made in both the public and private sectors toward clean energy research. According to the World Economic Forum, global private sector spending on clean technology was $142 billion in 2008.

Not surprisingly, the intellectual property system is playing a key role in clean tech innovation. As might be expected, clean tech patent filings are rising apace with increases in investment. And in clean tech innovation, patents are fulfilling their traditional role of incentivizing investment, mitigating investment risk, facilitating the sharing and transferring of technology through licensing, and enhancing collaboration.

The outlook for clean technology innovation and commercialization is bright, and the U.S. has a unique set of talents and capabilities, including our IP system. It is clear that the IP system supports rather than undermines the development and deployment of clean technologies, and facilitates technology transfer to other nations. Our commitment to the IP system as a key element in our innovation system will continue to be tested, however, as others seek to promote their own competitive advantage by weakening ours.

Internationally, some countries are aggressively pursuing IP-based innovation and investment strategies while, at the same time, calling for weakened international IP protections. While such apparently contradictory policies may appear to be in their competitive interests in the short term, in the long term these policies would be harmful to their national interests.

But there is a place for continued innovation in the IP system itself. In addition to traditional forms of IP protection, a range of new models for addressing IP issues related to clean tech have arisen. Patent pools and prize systems are being explored, though it is unclear that such approaches will be superior to existing structures. Making such devices mandatory, as has been suggested by some, should be avoided in nascent, rapidly growing industries such as clean tech.

Table of Contents

The Growth and Promise of Clean Technologies and the Role of Intellectual Property in Addressing Key Challenges

It is probably impossible to begin a report on the current state and future potential of clean energy technologies[1] without addressing the environmental and economic impact which the U.S. experienced as a result of the oil spill in the Gulf of Mexico that consumed the attention of policy makers and the public for three months in 2010. The oil spill which began after an explosion on the Deepwater Horizon on April 20, 2010 became one of the largest environmental disasters in U.S. history and has set off a cascading chain of events, including a moratorium of all deepwater drilling in U.S. coastal waters. While efforts to contain the spill have proven successful and the clean-up has been completed, the economic challenges to the Gulf region will continue, and the debate over how to effectively meet the energy needs of the U.S. will rage on.

While there is consensus that carbon-based energy sources will continue to meet the vast majority of the world's energy needs for years to come, it is also clear that major breakthroughs across a range of clean energy technologies are essential to reconcile finite natural resources with seemingly infinite global energy demand. According to the U.S. Energy Information Administration (EIA), world energy consumption will increase by 44 percent by 2030, and the largest projected demands come from non-OECD countries where energy infrastructures are underdeveloped and the need for efficiency is paramount.

"… major breakthroughs across a range of clean energy technologies are essential to reconcile finite natural resources with seemingly infinite global energy demand."

In addition, as we saw after the oil spill in the Gulf, an unshakable national consensus is emerging that the U.S. must lead in the development and deployment of clean and efficient new sources of energy. Government at all levels is responding to this consensus by laying out national priorities, funding research and development, promoting clean tech businesses, offering tax incentives and even expediting national patent applications for clean technologies.

Our competitors are not standing still either Brazil has a National Action Plan on Climate Change, India has established a National Enhanced Energy Efficiency Mission and China is working on a set of indigenous innovation policies designed to stimulate technological developments and the creation of intellectual property within China.

It is very clear that meeting the projections for growth in clean technology deployment along with the expectations of global policy makers will require large and effective investments in R&D from both the government and the private sector. The U.S. government will spend about $4.9 billion on energy research in 2010, and the American Energy Innovation Council recently recommended that the U.S. government increase this to $16 billion annually to put energy research more in the range of federal funding of health ($27.7 billion) and defense ($77.3 billion).[2] And, according to the World Economic Forum, global private sector spending on clean technology and energy efficiency was $142 billion in 2008.[3] Some projections for the potential size of the global clean technology market and the level of spending needed to meet ambitious environmental goals run as high as $600 billion in 2020.[4]

1. The OECD defines clean technology as, "(T)he installation or a part of an installation that has been adapted in order to generate less or no pollution. In clean as opposed to end-of-pipe technology, the environmental equipment is integrated into the production process."

2. www.americanenergyinnovation.org

3. http://www.weforum.org/pdf/climate/Green.pdf

4. New Energy Finance, Global Futures, March 2008

Achieving this level of funding and maximizing its impact will require the establishment of effective global policies that welcome risk capital, incentivize innovation, promote free and open markets and, importantly, protect intellectual property (IP).

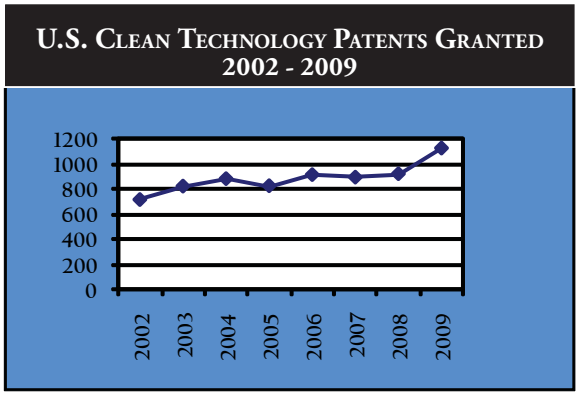
"Achieving this level of funding and maximizing its impact will require the establishment of effective global policies that welcome risk capital, incentivize innovation, promote free and open markets and, importantly, protect intellectual property."

Not surprisingly, given the level of investment and attention, there has been a steady increase in the number of U.S. patents issued every year across a range of clean technology categories. The number of U.S. patents for solar, wind, hybrid/electric vehicles, fuel cells, hydroelectric, tidal/wave, geothermal, biomass/biofuels and other clean renewable energy sources has risen from 720 in 2002 to 1,123 in 2009.[5]

Over the same period of time, venture funding of these technologies in the U.S. has risen from $900 million to $5.8 billion, and clean tech venture investments outpaced both software and biotech in 2009.[6]

An initial facet of this report will be an attempt to establish and analyze this empirical correlation between increasing patent activity in the clean tech space and the dramatic rise in venture funding.

This report will also assess the overall role that intellectual property plays in driving diverse clean tech innovations, establish how IP supports the global diffusion of clean technologies, and finally, explore the policy approaches of major economies to promote clean tech innovation and commercialization.



5. Clean Energy Patent Growth Index: http://cepgi.typepad.com/heslin_rothenberg_farley_/

6. Cleantech Group

IP's Role in Incentivizing and Financing Breakthroughs

Like the rest of the economy, private investment in clean tech companies was down in 2009. But not as much as might have been expected. Venture capital (VC) investment in the global clean tech sector was about $5.6 billion in 2009, down about 33 percent from the $8.4 billion invested in 2008. In 2009, almost one-quarter of all global venture funding went into clean technology. This is more than software, biotechnology or any other industrial sector.[7] And a rebound occurred in 2010, as U.S. clean tech firms attracted almost $1.5 billion in venture funding in the second quarter of 2010 alone. This is based on the growing sense that customers are lining up to buy the clean tech products of the future.

Global venture investment spans a range of clean technologies and contributed to almost 600 diverse projects in 2009. And while the U.S. received nearly 60 percent of this investment, it is very clear that the drive for innovation and breakthroughs in the clean tech industry is global, with investments in Europe and Israel increasing last year and Chinese firms accounting for 72 percent of global clean tech IPOs in 2009.[8]

> "Patents help to significantly mitigate the risk of bringing new inventions to market…In fact, private venture capitalists invest largely based on the strength of patents. Without these patents, there would be no venture capital investment, leading to no job creation, no energy independence, and no breakthroughs in climate change."
>
> *Robert Nelsen, co-founder and managing director of Arch Venture Partners.*

Venture funding, private sector R&D, government research funding and corporate merger and acquisition activity all combine to provide the critical investments necessary to nurture clean tech breakthroughs. Among these sources, VC funding tends to be directly tied to overall long term (5-10 year) performance of a firm and the most discerning when it comes to returns on investment. This is where the relationship between investment in cutting edge technologies and intellectual property begins to take shape.

A recent project led by Intellectual Asset Magazine and a team of faculty at MIT's Sloan School of Management assessed over 9,000 U.S. venture-backed technology companies' IP positions. The group concluded that 86 percent of the companies that were either acquired or had an initial public offering possessed what the researchers classified as a "strong" IP position in terms of clear and relevant ownership of core technologies.[9]

How does this translate directly to clean tech innovations that we are seeing in the market today? Consider the IP positions of a few of the companies identified by *Bloomberg News* as leading IPO candidates in 2010-2011[10]:

- Well-known Silicon Valley company Bloom Energy had five patents granted in 2009, all of which pertain to its fuel cell systems that have been deployed by companies like Google, Wal-Mart, Staples and eBay, and featured on *60 Minutes*. Bloom has raised $400 million in venture funding over the past eight years.

7. http://cleantech.com/news/5464/cleantech-hits-record-vc-deal-2009

8. www.cleantech.com

9. http://www.iam-magazine.com/blog/detail.aspx?g=ae1d78db-9c5e-41aa-a4f9-161c7de6c9fb

10. http://www.bloomberg.com/news/2010-07-01/tesla-ipo-surge-may-signal-further-investment-for-clean-energy-technology.html

- San Diego-based Sapphire Energy was granted a patent in 2009 for a process to produce carbon-neutral crude oil and has raised over $100 million from investors including Bill Gates. It also received a $104 million grant from the Department of Energy in late 2009.
- Electric car maker Tesla Motors was granted five key patents in 2009 protecting technological developments ranging from an apparatus to optimize battery charging to a process for cooling its engine. Tesla had an initial public offering in the U.S. on June 29, 2010 and reached a market valuation of over $3.35 billion in November of 2010.

"… the ability of innovative firms to finance breakthroughs has some correlation to their ability to protect and leverage their intellectual property.

Certainly much of the investment into companies like these and their ultimate market valuation will be driven by factors of demand, financial management, competitors and ability to scale their innovations. But it is clear the ability of innovative firms to finance breakthroughs has some correlation to their ability to protect and leverage their intellectual property. Or, as was noted in a recent study released by the World Intellectual Property Organization, "One of the most important issues evaluated by venture capitalists is the security of intellectual property."[11]

This is a very subtle and variable notion however. The findings of recent research published in the *Berkeley Technology Law Journal* show the importance and usefulness of intellectual property as an incentive and driver of investment is likely tied to the characteristics of specific industries.[12] In industries such as biotech (which would include applications such as biofuels, green plastics, environmental biotech, and others) patents tend to play a much more pronounced role with startups trying to attract capital as well as finding market share. Software companies, however, tend to see patents as much less important in their efforts to capture competitive advantage. The *Berkeley* study goes on to note, however, that, "patenting may play a previously underappreciated role in helping startups to secure investment from various sources of entrepreneurial capital, including not only angel and venture investors, but also "friends and family" and commercial banks."[13]

A 2010 study of 1,332 U.S. startups released by the *Berkeley Technology Law Journal* found these companies had an average of 4.7 patents. The average among venture-backed biotech companies was much higher at 34.6 patents.

Overall, while the acquisition of intellectual property (most frequently patents) helps to drive investment in research and development-intensive industries such as clean tech, its impact on actual innovation is much more nuanced. The *Berkeley* study concludes that filing for and acquiring patents provides just above a "slight incentive" for the companies it surveyed to engage in activities closely tied to actual innovation—invention, R&D and commercialization. So while a strong and proactive strategy for building an effective IP portfolio seems to be a prerequisite for firms to acquire the financing necessary to establish and position themselves in the market, the actual process of doing the necessary R&D and commercializing a product is less dependent upon the patent portfolio behind it.

11. http://www.wipo.int/sme/en/documents/venture_capital_investments.htm

12. Graham, Stuart J. H., Merges, Robert P., Samuelson, Pamela and Sichelman, Ted M., High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey (June 30, 2009). Berkeley Technology Law Journal, Vol. 24, No. 4, pp. 255-327, 2009; CELS 2009 4th Annual Conference on Empirical Legal Studies Paper. Available at SSRN: http://ssrn.com/abstract=1429049

13. Ibid.

Why a Framework of Intellectual Property Rights Is Necessary to Address a Range of Energy Challenges

In 2009, there were 1,123 patents granted in the U.S. for clean technologies that span eight broad categories. This mix of technologies included cutting edge processes for turning sunlight into power, hybrid-car technologies and biofuels derived from algae.

U.S. Patents Per Year/Major Clean Tech Categories[14]

	Wind	Solar	Hydrid/Electric vehicle	Fuel Cell	Hydro-electric	Tidal or Wave	Geo-thermal	Biomass/ Biofuel	Total
2002	42	162	144	349	6	9	2	12	714
2003	49	156	122	464	5	11	5	24	821
2004	72	124	98	551	8	18	8	16	880
2005	92	104	101	501	7	11	6	14	824
2006	109	95	105	572	8	18	5	13	912
2007	133	100	105	517	4	15	4	28	892
2008	155	95	86	530	10	34	9	19	919
2009	156	155	105	634	3	26	10	49	1,123

Finding impactful, long-term solutions to our energy challenges will require a mix of diverse technologies with thousands of paradigm-changing ideas and incremental innovations along the way. As this innovation cycle plays out we will see the number of patents granted for clean technologies continue to grow, and we will also see entirely new categories of technology emerge.

The scale of the global energy challenge alone demands what some have called a "moon-shot" for an entire generation of scientists, engineers, workers and entrepreneurs. Despite the fact that global energy consumption actually decreased by 2.2 percent in 2009 due to the global economic slowdown, a report by the consulting firm McKinsey & Company estimates that global energy demand will increase by 2.1 percent a year from 2010 to 2020. McKinsey estimates that 90 percent of this growth will come from developing countries which are seeing an explosion of automobiles while they are also racing to improve their infrastructures and grow new, energy-intensive industries. The challenge to dramatically improve energy efficiency and develop a wide range of clean energy alternatives that can meet needs ranging from cooling buildings in the U.S. to industrial construction in China and sustainable farming in India demands a huge portfolio of solutions. This in turn requires a strong and robust intellectual property system to draw investment, promote innovation and sustain commercialization.

There are hundreds of examples of this process playing out across the globe, and we see it in simple solutions and extensive projects.

For example, Belgium-based SBAE Industries bills itself as "The Algae Company," and, indeed, it is the leading European producer of algae that is used in applications ranging from aquaculture to biofuels. The company has applied for 380 patents to protect its technology and raised $14 million venture funding. It has recently secured investors in the U.S. and is developing projects in Florida.

14. Clean Energy Patent Growth Index : http://cepgi.typepad.com/hesllin_rothenberg_farley_/

UK-based energy storage startup Nexeon has developed proprietary processes to improve the performance and life cycle of batteries for a range of applications from consumer devices to automobiles. The company has 12 patent families and has a number of additional patents pending internationally, and has attracted over $14 million in venture funding in 2009.

The global market for fuel cell technologies is estimated to reach $2.6 billion by 2015,[15] and as noted in the table below, fuel cell technologies account for the majority of patent activity in the U.S. over recent years. Of the top 10 clean technology patent assignees in the U.S. from 2002-2009, eight of them were companies primarily involved in fuel cell activity.

Top Patenting Firms and Technology Area 2002-2009

Patent Assignee	U.S. Patents 2002-2009	Primary Technology
Honda	503	Fuel Cells
General Motors	359	Fuel Cells
Toyota	213	Fuel Cells
United Technologies	186	Fuel Cells
General Electric	183	Wind
Nissan	177	Fuel Cells
Ballard Power Systems	169	Fuel Cells
Ford	159	Fuel Cells
Plug Power	107	Fuel Cells
Canon	98	Solar

Among this list of well-known multi-national firms is the small Latham, NY-based company Plug Power. Plug Power began in 1997 and demonstrates the diversity of technology and approaches that is enabled by innovation and IP. They have carved out a niche by supplying power for electric lift vehicles, helping grocery chains, major distribution facilities and individual companies like Coca-Cola move products more cheaply and efficiently using fuel cell power.

These examples speak to the diversity of the work being done by IP-intensive clean tech companies in developed countries. Despite this, renewable energy still comprises only 18 percent of global energy consumption. The place for dramatic growth to be realized is in developing countries that have a high, mostly untapped potential for renewable energy resources particularly in areas such as wind, geothermal, biomass, small-scale hydro, and solar resources.[16]

"… renewable energy still comprises only 18 percent of global energy consumption."

Large projects such as the solar power facility in Upington, South Africa, being planned by utility company Eskom clearly demonstrate the connection between the deployment of clean technology solutions and intellectual property that enables them.

15. Global Industry Analysts, Inc. June 2010.

16. The World Bank Climate Investment Fund: www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/SREP%204-22-10print.pdf

Professor Vivian Alberts, a physicist at the University of Johannesburg, has long been a leading researcher in the field of solar power generation. His breakthroughs in reducing the size and production cost of commercial solar panels while increasing their productivity helped lay the groundwork for the roughly $600 million solar energy facility to be built in Upington, which is the first major solar project in Africa. This facility is designed to produce 100 MW (enough energy to power about 30,000 homes) and could produce as much as 600 MW. [17] This will be an important model for a region that has tremendous potential for solar production. Scientists estimate that a square kilometer of desert receives the solar energy equivalent of 1.5 million barrels of oil every year, and this facility is expected to drop South Africa from 15th biggest carbon dioxide emitter to the 25th.[18]

India is currently the fourth largest producer of solar energy, and Indian firm Suzlon is the largest wind-turbine manufacturer in Asia. The company has a significant R&D footprint in India and has made a number of breakthroughs in the application of composites in the wind turbine industry. Suzlon's world-class technology and the diversity of its innovation is tied to the IP it has developed and will continue to build upon. The company has initiated cases to protect its IP and filed for almost 20 patents in India in 2007-2008.

"India is currently the fourth largest producer of solar energy…"

17. http://www.eskom.co.za/annreport09/026.html

18. www.ecolocalizer.com

How IP Supports the Global Diffusion of Clean Energy Technologies

The OECD has defined technology transfer as "the disclosure of results from research and development, the licensing or assignment of intellectual property rights related to such results, exchange of information, education and training, and joint ventures." Explicit in this and nearly every other definition of technology transfer is the presence of an intellectual property right and a legal structure which allows for the appropriate license or assignment of it.

The transfer and ultimate diffusion of important technology depends on the ability to establish and manage intellectual property rights. This process has facilitated extensive global investment in innovation, created paradigm-changing technologies, launched entire industries and led to breakthroughs from the personal computer to cutting edge sources of clean technology.

Recognizing the importance of IP to the development and deployment of technology, the World Trade Organization (WTO) has conditioned protections for IP on the necessity of governments to promote technology transfer.[19] On this front, developed countries have responded with a significant number of programs designed to stimulate technology transfer to developing countries—a total of 292 unique programs from 1999 to 2007 according to the UN.[20]

It has become quite clear that a strong baseline of IP protections coupled with effective government policies and open markets provide the most effective framework for the diffusion of clean technologies to markets around the world.

"A range of short-sighted policies can slow or even halt the global diffusion of important technologies."

A range of short-sighted policies can slow or even halt the global diffusion of important technologies. For example, in the context of the United Nations Framework Convention on Climate Change (UNFCCC) negotiations held in Copenhagen in late 2009, a number of proposals emerged in the name of technology transfer that would have set back innovation and would not have resulted in greater movement of technology. Prior to meetings in Copenhagen, the role that intellectual property played in the global innovation and commercialization process was called everything from a "sticking point"[21] to "green protectionism."[22]

Specifically, efforts to expand the use of compulsory licenses were put forward as a way "to address intellectual property rights"[23] which presumed that IP is a barrier to the diffusion of clean energy technologies to developing economies. However, it has become increasingly clear that this presumption does not accurately capture the realities behind the flow of global innovation.

A study released by the Brookings Institution in November 2009 notes that, while, "research on the empirical effects of property rights on technology transfer, particularly to developing nations is murky…strong IPR protection is an important catalyst for encouraging innovation in developing countries, and actually helps promote the

19. WTO TRIPS Agreement Article 66.2

20. http://ictsd.net/downloads/2009/03/final-suerie-moon-version.pdf

21. Meyer-Ohlendorf, Nils and Christiane Gerstetter 2009: Trade and Climate Change - Triggers or Barriers for Climate Friendly Technology Transfer and Development? Dialogue on Globalization Occasional Papers No 41 . Berlin: Friedrich Ebert Stiftung.

22. Ibid.

23. http://unfccc.int/resource/docs/2009/awglca6/eng/inf01.pdf

sharing of technology as consistent and predictable legislative processes protect foreign direct investment and further joint ventures and international collaboration."[24]

The Brookings report also makes the observation that the concerns of developed countries regarding the theft of IP in important emerging economies such as the BRIC countries, Mexico, South Africa and others may be tempered over time as these nations themselves have begun to build up sizable patent portfolios for clean technologies.

Two additional reports published in 2009 from the U.S. and the EU clearly conclude that intellectual property rights are neither a barrier to innovation, nor do they hinder the diffusion of clean energy technologies to emerging and developing economies. That is a big enough statement. But these reports, from the U.S. International Trade Commission (ITC) and the EU Directorate General for Trade (DG Trade) actually go further. They conclude, that, in the words of the ITC, "patents are facilitating, not stifling innovation."

"Between 1975-2006, the U.S. Patent and Trademark Office issued 20,428 patents for industrial biotech."

In its report, the ITC looked at the overall impact of IP, in this case utility patents, in the field of industrial biotechnology. In the real world this can mean enzymes that breakdown biomass to produce biofuels, or more environmentally friendly bio-based plastics. These technologies are obviously relevant to a range of climate change and energy-related challenges. Between 1975-2006, the U.S. Patent and Trademark Office issued 20,428 patents for industrial biotech. ITC's analysis of this dense collection of patents revealed a number of trends. First, there is a notable growth in the number of patents held by U.S. universities (fueled by the Bayh-Dole Act of 1980). Second, patents in this field are not concentrated in the hands of a few owners, and new patentees are steadily entering the market. Finally, more than 70 percent of the companies interviewed by the ITC for this study said that "patent barriers" are one of the *least* significant issues they face.

"… more than 70 percent of the companies interviewed by the ITC for this study said that 'patent barriers' are one of the least significant issues they face.

What has this meant for innovation? First of all, the report highlights the importance of collaboration within the broader innovation process. According to the ITC, "Patents and other types of intellectual property facilitate increasingly frequent collaborations by providing the foundation for the transfer of technology and knowledge between firm, university, and government actors."

This point about IP fueling the transfer of knowledge and innovation is exceptionally relevant when considering the report commissioned by DG Trade which asked the provocative question in its title: "Are IPR a Barrier to the Transfer of Climate Change Technology?"

The DG Trade report analyzed over 215,000 patents filed globally from 1998-2005 for seven "emissions-reducing" technologies. These include solar, wind and fuel cell technologies which account for over 80 percent of all clean energy patent applications over the period reviewed. The trends they discovered reinforce and compliment the work of the ITC. First, the EU's report finds that (contrary to fears of monopoly ownership of certain technologies), "no single nationality actually dominates the market for a particular technology."

This leads to the most important question: what does this mean for the transfer of clean energy technologies among developed, emerging and developing economies? Here's what the EU's report has to say "for several of the seven most advanced technologies for which we have patent information, emerging countries account for a significant share of the patents which are protected in developing countries, making it

24. www.brookings.edu/~/media/Files/rc/papers/2009/11_environmental_technology_ebinger/11_environmental_technology_ebinger.pdf

less likely that patents and IPR constitute a major barrier for *transfer* (their emphasis) of carbon abatement technology from developed to emerging economies."

The EU report also found an interesting dynamic exists regarding the application of clean technology solutions in the least developed countries: "least developed countries can meet ambitious (carbon) abatement targets by applying mostly technology which is not protected by IPR…Hence, for the least developed countries, IPR protection does not appear to be a barrier for transferring the technology necessary for meeting the abatement targets which are currently being discussed."

It should be clear that changing global rules regarding the protection of IP (for example, by expanding compulsory licensing) would not just be a solution in search of a problem, it would have a devastating impact on the innovative process that will address and solve our biggest challenges. Again, the EU's report makes the case clearly and at length, "IPR protection is not the main barrier preventing the transfer of environmental technologies to developing countries. A large number of relevant technologies are not patented in low-income developing countries, and in emerging market economies a significant number is patented by local companies." It goes on to say that, "there is a serious risk that a broad use of compulsory licensing (or other measures weakening IP rights) would constitute a disincentive for companies engaged in that sector, which might reduce their investment in such technologies. This would clearly be detrimental in the long term … IPR as such is not what makes technology too expensive for the least developed countries and emerging economies to access."

"The U.S. and the EU have proposed an elimination of all tariff and non-tariff barriers on clean energy technologies in the WTO."

The U.S. and the EU have proposed an elimination of all tariff and non-tariff barriers on clean energy technologies in the WTO. This would be the single most significant step the global community could take to stimulate technology diffusion immediately.

In the end, meaningful technology diffusion will be driven by global collaborations that truly establish a win-win environment. An August, 2009 cover story in *BusinessWeek* called this the "radical future of R&D … a world of collaboration across corporate and national boundaries."[25] This future will see breakthroughs from pioneers in areas like wind energy technology from west Texas to Tamil Nadu, India. The Indian firm Suzlon (the third largest wind energy company in the world), is already competing with U.S. and European companies as they drive each other to develop and diffuse increasingly more efficient and cost-effective solutions. IBM has recently established R&D collaborations in Saudi Arabia, Switzerland, China, Ireland, Taiwan and India. Eli Lilly is working with an Indian firm to speed the drug development process, and Hewlett Packard has formed a joint lab with researchers at Tsinghua University in Beijing.

"What these global collaborations do require and respond to is a strong respect for investment, innovation and IP, as well as an open global marketplace to tap new ideas and reach new consumers."

Collaborations like these cannot be devised, designed or controlled by politicians or bureaucrats. They do not exist in negotiating texts of global treaties and do not find any meaning in "Doha-like" declarations or calls to "address intellectual property rights." What these global collaborations do require and respond to is a strong respect for investment, innovation and IP, as well as an open global marketplace to tap new ideas and reach new consumers.

25. http://www.businessweek.com/magazine/content/09_36/b4145040683083.htm

There is compelling evidence that this type of IP-fueled collaboration and innovation is rapidly creating greater equilibrium among developed and developing countries. From 1994-1998, emerging economies accounted for just 3.75 percent of all patented clean technologies. By 2008, 20.5 percent of all clean technology patents came from emerging markets (primarily the BRICs).[26]

BusinessWeek's article also highlighted a meeting between IBM CEO Sam Palmisano and then Brazilian President Luiz Inacio Lula da Silva which ended with President da Silva inviting Palmisano back to Brazil "because it would mean you're announcing many investments in my country."[27]

The discussion between Palmisano and da Silva represents the "radical future" of global collaboration, not backward-looking policies that blame IP and raise protectionist barriers.

"From 1994-1998, emerging economies accounted for just 3.75 percent of all patented clean technologies. By 2008, 20.5 percent of all clean technology patents came from emerging markets (primarily the BRICs)."

26. http://www.wipo.int/export/sites/www/meetings/en/2009/ip_gc_ge/presentations/uosukainen.pdf

27. http://www.businessweek.com/magazine/content/09_36/b4145040683083.htm

Trends in Global Policy Approaches

The United States

The U.S. has provided significant leadership in the development and promotion of clean technology solutions within a framework that supports intellectual property. The U.S strategy for developing and deploying clean tech innovations can generally be cast in three broad categories: funding R&D, driving sound global policy, and implementing domestic policies that promote IP and innovation.

In 2008, then President Bush proposed establishing a $10 billion Clean Technology Fund (CTF) at the World Bank to support the deployment of clean technologies globally and reduce carbon emissions in developing countries. To date, roughly $6.3 billion has been pledged to the fund, which is considering a range of projects in developing countries.

Domestically, public funding for energy research is roughly $4.9 billion in 2010. The newly created Advanced Research Projects Agency-Energy (ARPA-E) received about $400 million in 2010, and has provided research grants to U.S. institutions for a range of blue-sky projects. Some of the initial ARPA-E sponsored projects have focused on strengthening the U.S. electrical grid, making dramatic improvements to building efficiency and researching biofuels, among others.

"In recent years, the U.S. has been a consistent voice for strong IP policies as a way to promote the development and diffusion of clean technologies…"

In addition to this funding, the stimulus bill passed in early 2009 dedicated $8.6 billion to support energy efficiency programs and another $10.5 billion to "grid modernization" projects.

In recent years, the U.S. has been a consistent voice for strong IP policies as a way to promote the development and diffusion of clean technologies in fora ranging from the World Intellectual Property Organization (WIPO) to the UNFCCC. This effort began in a pronounced way at the 2005 G8 Summit in Gleneagles where leaders of the G8 and G20 nations met and agreed to address difficult climate change challenges primarily through technological advances rather than arbitrary emissions reduction goals.

More recently, the Obama Administration and Congress have maintained a consistent level of support up to and during the UNFCCC negotiations in 2009. In October, 2009, 34 Members of Congress sent a letter to Secretary of State Hillary Clinton urging her to support strong IP protections in the context of the UNFCCC negotiations. Prior to this letter, the House of Representatives voted 432-0 for an amendment to legislation that authorized funding for U.S. foreign relations activities that indicated the U.S. should as a matter of policy, "prevent any weakening of, and ensure robust compliance with and enforcement of, existing international legal requirements … for the protection of intellectual property rights related to energy or environmental technology."

"This commitment includes the U.S. Patent and Trademark Office's announcement of a new pilot program…to fast track the review of clean technology patents."

For its part, the Obama Administration did show a strong commitment to the protection of intellectual property rights during the UNFCCC process and has added to this stance by introducing new domestic policy initiatives to support both IP and promote clean tech innovation.

This commitment includes the U.S. Patent and Trademark Office's (USPTO) announcement of a new pilot program in December 2009 to fast track the review of clean technology patents. Currently this process can take up to 40 months. The new program could reduce the process by up to 6 months for applicants. As Commerce Secretary Gary Locke said at the launch of this program, "By ensuring that many new products will receive patent protection more quickly, we can encourage our brightest innovators to invest needed resources in developing new technologies and help bring those technologies to market more quickly."

China

A comparison of the U.S. and China provides an interesting perspective on the importance of IP security to those who drive clean tech innovations. China is aggressively pursuing a strategy to promote alternative energy sources and develop home-grown leaders in clean technology. And it has the full weight (and resources) of its government behind this effort. China committed a significant amount of funding to clean tech as part of its stimulus efforts in 2009 and has aligned its state-owned banks, power grids and utilities behind an effort to create domestic or "indigenous" energy innovation.

Behind China's rather innocuously titled *National Medium- and Long-Term Plan (MLP) for the Development of Science and Technology (2006-2020)* lies a complex and concerning architecture for propelling China to the forefront of scientific and technological development through indigenous innovation. One of the very explicit goals of indigenous innovation is for China to create its own IP in critical industry sectors such as energy technologies. The MLP speaks directly to this in its actual definition of indigenous innovation as "enhancing original innovation through co-innovation and re-innovation based on the assimilation of imported technologies."

China's indigenous innovation plans attempt to make the transfer of key intellectual property and technological know-how part of the price of access to its market. The new policy discourages the importation of critical technologies without a corresponding transfer of IP and warns that this could weaken its domestic research and development capacity.

"China's indigenous innovation plans attempt to make the transfer of key intellectual property and technological know-how part of the price of access to its market."

Not only is this very questionable trade policy and possibly inconsistent with China's commitments to the World Trade Organization, it flies in the face of the very global and collaborative nature of innovation, and poses one of the biggest threats to the development and diffusion of clean technology in China—a country that desperately needs it.

China already has a very poor record of IP enforcement from rampant copyright piracy and counterfeiting to well-known difficulties in obtaining patent protection in Chinese courts. In addition, the U.S. and China routinely square off internationally at WIPO, the WTO and other fora regarding the strength and enforceability of intellectual property rights. For example, China was one of the most vocal supporters of a "patent free" environment for clean technologies in the context of the UNFCCC negotiations.

> "(E)nhancing original innovation through co-innovation and re-innovation based on the assimilation of imported technologies."
>
> *Definition of indigenous innovation contained in China's National Medium- and Long-Term Plan (MLP) for the Development of Science and Technology (2006-2020)*

The move to create a nationalistic innovation infrastructure directed by a handful of technocrats in Beijing and not by the thousands of talented Chinese scientists and researchers is an alarming trend that will limit access to the Chinese market and ultimately keep the most cutting edge clean tech solutions out of the country.

China's failure to value and protect intellectual property is not just a matter for policymakers and diplomats—it resonates with investors and entrepreneurs as well. Despite the huge potential market for clean technology that China represents, in a recent Reuters poll of 41 U.S. venture capital investors, 88 percent believed that the U.S. was the best place to base a clean tech business while only 16 percent ranked China as the top place to locate.

Brazil

Despite the fact that Brazil often emerges as an antagonist towards stronger IP protections in global policy discussions, the growth of its world-class ethanol industry is a lesson in IP-led economic development. Indeed, Brazil is the world's largest market for renewable energy—85 percent of its power is generated by hydroelectric facilities and 52 percent of its vehicles are powered by ethanol.[28]

"Brazil is the world's largest market for renewable energy— 85 percent of its power is generated by hydroelectric facilities and 52 percent of its vehicles are powered by ethanol."

Beginning in 1975, Brazil articulated dual goals of reducing its dependence on foreign oil importation and simultaneously creating opportunity for its agricultural sector by promoting innovation and development in sugar cane-based ethanol as a fuel source.

The country now produces 33 percent of the world's ethanol and Brazil's production capacity is expected to grow by 50 percent by 2012.[29] This highly-developed industry has not only fueled an increase in domestic ethanol patents according to Brazil's national patent office, it has attracted a range of international investors and partners and led to the development of new industries such as "green plastics." These composites, derived from sugar cane, actually *absorb* CO2 during their production process and are biodegradable. Brazilian chemical company Braskem, the first company to file for a nanotechnology patent in Brazil, has recently invested $211.5 million into a project to produce green plastics that has already drawn the attention of Toyota.[30]

In addition to long-standing efforts to develop its renewable energy industry, Brazil has articulated a four part *National Science, Technology and Innovation Strategy*:

1. Consolidate, enhance and modernize the National Science, Technology and Innovation System, expanding the scientific and technological base of the country.

2. Create an environment that favors innovation within the country, stimulating the private sector to invest in research, development and innovation activities;

3. Integrate all the country's regions and industrial sectors to build up the national capabilities for science, technology and innovation

4. Develop a comprehensive social base supporting the *National Science, Technology and Innovation Strategy.*

As part of the global discussion regarding IP protections for clean technologies, however, Brazil's position seems to be somewhat at odds with its own National Strategy and the framework that has emerged over the past thirty years supporting its domestic IP-based industries. It was the Brazilian Foreign Minister who recommended at the May 2009 UNFCCC Bali Conference, a "Doha Declaration on Climate Change" that would mimic the current Doha Declaration on Public Health negotiated during 2001 that permitted developing countries to issue compulsory licenses for patented medicines.

Brazil's domestic trajectory as a leader in renewable energy will largely depend upon its ability to innovate globally-applicable solutions based upon its inherent capacity in areas like hydropower and ethanol. Any efforts it makes to weaken global IP protections will ultimately be self-defeating.

28. www.brookings.edu/~/media/Files/rc/papers/2009/11_environmental_technology_ebinger/11_environmental_technology_ebinger.pdf

29. www.wilsoncenter.org/topics/pubs/Brazil.Stage.Web.InnovationChallenge.Aug20071.pdf

30. www.icis.com/Articles/2009/07/15/9232844/brazilian-ethanol-attracts-bioplastics-investors.html

India

India is, in many ways, similar to Brazil in terms of the apparent contradiction between its rapidly emerging clean technology sector and positions taken by the Indian government to weaken IP protections for clean energy innovations. As noted, India already is home to the world's 3rd largest wind company, which has R&D facilities around the world (including the U.S.) and collaborates with global leaders like GE and Seimens. India's power industry, which is largely state-owned, has been involved in a number of projects with international partners to increase efficient and clean power generation across India. In addition, powerful private sector firms such as Tatas and Bharat Forge have built strong, well-structured licensing agreements with partners such as GE, ABB, Mitsubishi and Toshiba without the need for compulsory licenses or otherwise compromising IP.

"…the government of India does not believe that the transfer of clean technologies to developing countries can be left to the market."

This process seems likely to expand within India and it more closely resembles the vision of Prime Minister Manmohan Singh's *National Knowledge Commission* that laid out the principle that, "IPRs have emerged as an indispensible strategic tool in today's knowledge economies and societies, particularly in the context of economic globalization."

However, a 2009 summary of India's position on global climate change indicated that the government of India does not believe that the transfer of clean technologies to developing countries can be left to the market. India's position went further to call for such technologies to be treated as "public goods", and also for compulsory licensing of such technologies as a matter of routine.[31] This seems to be in contradiction to the principles of compulsory licensing laid out in the Indian Patents Act and their intent within the WTO's Trade Related Aspects of Intellectual Property (TRIPS) Agreement. Neither Indian patent law nor the TRIPS Agreement envision compulsory licensing as a rule, but as an exception, to be used in cases of emergency when fair licensing efforts have failed. This position, whether it is played out in global negotiations or in domestic policy is truly shortsighted and would be harmful to India's interests in the long run.

The European Union

The EU was active in pursuing policies to address climate change as early as the 1990s and provided major support for both the 1992 UN Framework Convention on Climate Change and the 1997 Kyoto Protocol. These diplomatic agreements placed primary emphasis on implementing regulatory structures to attempt to limit greenhouse gas emissions, and in keeping with this approach, the EU launched its Emissions Trading Scheme (EU ETS) in January 2005. It is the largest emissions trading program in the world, and currently covers over 10,000 facilities in the EU that account for 45 percent of its total emissions.[32]

"…current EU projections indicate that overall emissions in the 27 nation European Union will be 7.7 percent below what is called for by the Kyoto Protocol."

The ETS program has shown mixed results with the emissions allocations for the initial 2005-2007 period actually being higher than the baseline 2005 levels. However, current EU projections indicate that overall emissions in the 27 nation European Union will be 7.7 percent below what is called for by the Kyoto Protocol.

The ETS and the EU's support for the Kyoto Protocol obviously stand in contrast to approaches taken by the U.S. which have focused more on innovation and technological development. The EU has, however, been active for a number of years in evaluating the relationship between IP and clean technology development. The European Patent Office conducted a "Scenarios for the Future" study in 2006 which

31. http://moef.nic.in/downloads/public-information/presnt_CC.pdf

32. http://www.fas.org/sgp/crs/misc/RL34150.pdf

took an early look at the impact that the climate change debate could have on the IP system in Europe. Once again in 2008, the EPO hosted the "European Patent Forum 2008—Inventing a Cleaner Future." The conference claimed to be the first global discussion dedicated to examining how "the fields of patenting and intellectual property" can support innovations that will address global energy needs and environmental concerns.

> "Patents play an important role for climate change technologies, just as they do in all other technical fields—they provide incentives, first to create new products and processes and then to distribute them as widely as possible."
>
> *Benoit Battestelli, President, European Patent Office*

There is clearly a good deal of introspection in the EU regarding the relationship between IP and clean tech. As current EPO President Battestelli spoke to the importance of IP to clean tech innovation in a speech on July 22, 2010, "Patents play an important role for climate change technologies, just as they do in all other technical fields—they provide incentives, first to create new products and processes and then to distribute them as widely as possible." He also discussed at length a study that EPO has undertaken with the United Nations Environment Programme (UNEP) and the International Centre for Trade and Sustainable Development (ICTSD) on the relationship between patents and the development and transfer of clean-energy technologies. This report is scheduled to be released in late 2010 and should provide a significant indication as to the policy course the EU will take regarding the protection and promotion of IP as it relates to clean technology.

Japan

With fuel cells and energy storage topping the list of patented clean technologies in the U.S. it is clear that Japanese firms such as Toyota, Nissan, Honda, Toshiba, Canon and others are dominant global innovators who place a high value on their IP. In addition, Japan leads the U.S. in areas like solar cell technologies, producing 17 percent of the world's solar cells compared to only 5 percent in the U.S.

This type of technological leadership is consistent with the Japanese Patent Office's (JPO) goal of helping Japan become the world's "most advanced IP-based nation," and the JPO and the Japanese government are taking a number of steps to support an innovative clean tech sector. The government of Japan has also set a target of reducing carbon emissions 25 percent by 2020 which has led it to develop a number of global policy initiatives and direct financial support to maximize its historically strong manufacturing and electronics industries.

"the government of Japan is actively seeking to help finance the deployment of its leading clean technologies to other countries through a multi-billion dollar loan program…"

First, in November 2009, Japanese Prime Minister Hatoyama and U.S. President Obama agreed to expand an existing cooperative effort to develop clean energy solutions. The agreement will strengthen ties between research institutions in the U.S. and Japan as well as exploring solutions across a range of technologies including nuclear.

Working with the U.S. is easy, but Japan has also sponsored 18 "model projects" in China in which the Japanese government has financed the deployment of Japanese clean energy technologies in areas ranging from steel manufacturing to biomass.[33]

Most significantly, the government of Japan (in contrast to China's protectionist approach) is actively seeking to help finance the deployment of its leading clean technologies to other countries through a multi-billion dollar loan program administered by the state-owned Japan Bank for International Cooperation.

33. http://www.time.com/time/magazine/article/0,9171,1820128,00.html

Japan joined the U.S. and the EU during the UNFCCC negotiations in Copenhagen to express opposition to proposals to extend compulsory licensing of clean technologies for developing countries, and through the G8 process and other international dialogues, such as negotiations of the Anti-Counterfeiting Trade Agreement, remains a steady supporter of strong IP protections.

International Bodies and New Models

In addition to the proliferation of national strategies to promote clean technologies, a range of international organizations as well as new models for addressing IP issues relating to clean tech will continue to have significant impact.

The U.N. Framework Convention on Climate Change (UNFCCC)

The UNFCCC process continues and the 16th Conference of Parties (COP) meeting took place in Cancun in December 2010. The 15th COP meeting, in Copenhagen, had the goal of setting binding agreements for long term greenhouse gas emissions. This goal was not met, however, as major developed and developing nations could not agree on a set of goals which equitably addressed the economic and environmental concerns of leading countries. Indeed, in the lead up to the Copenhagen meeting, President Obama indicated that a binding agreement would not be possible and instead urged leaders to adopt a set of "politically binding" goals. This led to the "Copenhagen Accord" signed by 28 nations (including India and China) which laid out a number of agreed open objectives including pledges to cut carbon emissions in half by 2050 and increase funding to support developing countries to $100 billion by 2020. The Accord does not address IP directly and only speaks of general goals regarding technology transfer and capacity building.

The E-10 Plan

In the wake of the UNFCCC COP 15 meeting in Copenhagen, the Brookings Institution presented a proposal for the establishment of an E-10 group that would more efficiently be able to address difficult issues regarding global climate change that cannot possibly be effectively resolved in an unwieldy 192-member consensus-driven process like the UNFCCC. The E-10 group would be comprised of United States, the European Union, China, Russia, India, Japan, Canada, South Africa, Australia, and Brazil. This group of nations represents 76 percent of global CO2 emissions, but this group also comprises the most innovative countries that have access to significant private and public resources to drive the development and commercialization of clean technologies. Importantly, Brookings also points to research that demonstrates that all E-10 nations are in economic positions to acquire climate change mitigation technologies "without the need for special financing mechanisms like compulsory licensing and patent pools."[34]

Patent Pools

The idea of creating large pools of clean technology patents that would be freely available for any relevant application or use has been put forward by some leading companies and has taken its most interesting form in the Eco-Patent Commons that was established in early 2008. The project is administered by the World Business Council for Sustainable Development (WBCSD) and counts IBM, Nokia, Dow, DuPont, HP and Xerox among its contributing companies.

34. http://www.brookings.edu/~/media/Files/rc/papers/2009/11_environmental_technology_ebinger/11_environmental_technology_ebinger.pdf

The Eco-Patent Commons has over 100 patents that touch on a range of technologies.

Eco-Patent Commons Members:	
IBM	Fuji
Nokia	Xerox
Pitney Bowes	HP
Sony	Ricoh
Bosch	Taisei
Dow	DuPont

Some international organizations and advocates for developing countries have advocated for the establishment of vast voluntary, or mandatory (as would be created through extensive compulsory licensing) clean technology patent pools. According to research done by Knowledge Ecology International (KEI), it has been very rare for patent pools to be established in nascent, rapidly-growing industries that show signs that technology is being transferred efficiently.[35] In a study done by KEI in 2007, 36 patent pools were identified dating from 1856-2006. Of these, only 2 were established specifically "in response to U.S. policy objectives". The majority of the early patent pools (spanning much of the early 1900s) were established to either break or establish cartels or monopolies for manufactured products. More recently, patent pools have been established to facilitate the standardization of widespread consumer technologies such as DVD, 3G and Bluetooth.

There have been recent proposals made (by KEI in particular) to establish public policy-based patent pools in areas such as AIDS vaccines and medical innovations. These proposals have attracted significant attention and study, particularly in the case of addressing AIDS. A number of global health organizations, academics, economists and private sector leaders have joined the effort to seek innovative ways to tackle global health problems and maintain the flow of investment into breakthrough drugs.

While this approach has met with some success in the health care area—GlaxoSmithKline has made a number of patents available to fight tropical diseases[36]—it is unclear that such an approach would translate into an area as new as clean technology that often requires massive infrastructure investment along with the basic knowledge of the technology.

Research Prizes

While a vast majority of major scientific research and innovation in clean technology will continue to be funded through traditional methods such as venture capital as well as government and private R&D, the idea of establishing private sector prizes to reward clean tech innovation seems to fill a useful niche. A range of private sector prizes including the Virgin Earth Challenge, California's Clean Tech Open and the X Prize have offered millions of dollars for innovators who successfully meet the objectives sought by the prize organizers.

For example, the Virgin Earth Challenge offered $25 million for a demonstrable and commercially viable design that will result in the removal of one billion metric tons of CO2 from the atmosphere for 10 years.[37]

In an example more directly attached to current events, the San Francisco-based X Prize Foundation announced in July 2010 a $1.4 million prize for solutions designed to help remove oil from the Gulf of Mexico in the wake of the oil spill there. Beyond this targeted project, the X Prize Foundation, which receives funding from corporations and wealthy philanthropists, is developing additional prizes to drive breakthroughs in clean technologies.

35. http://keionline.org/content/view/69/1

36. http://www.gsk.com/collaborations/contribution.htm

37. http://www.virgin.com/subsites/virginearth/

Conclusion

The development and deployment of clean technologies will play a major role in (literally) fueling economic growth and global policy in the coming years. There will be a variety of different policy approaches, but the basic formula will be the same—promoting innovation, commercializing breakthroughs and finding global markets. Over its history, the U.S. has excelled at this process. Indeed, the U.S. in many ways pioneered it.

Today, industries are created and re-invented at a pace never seen before. We do not know where and when breakthroughs will come in the area of clean technology, but we know that the investments will be huge, the competition will be fierce and the developments will probably amaze us. In this environment we need to rely on core principles and policy makers need to provide certainty and clarity. As demonstrated in this report, incentivizing investment and protecting intellectual property must be absolute as the U.S. looks to lead the clean technology race.

Recent developments have been encouraging and U.S. policy makers have shown a clear understanding of the link between dramatic advancements in clean technology and the need to protect the IP that supports it. This commitment will continue to be tested, however, and others will seek to promote their own competitive advantage by weakening ours.

The outlook is bright and the U.S. has a unique set of talents and capabilities. The opportunities are immense, as Andy Hannah, CEO of Pittsburgh-based clean energy company Plextronics puts it, "Today's clean-tech intellectual property is tomorrow's oil."[38] This is exactly the combination of factors that has resulted in dynamic growth and explosive innovation from U.S. business. They will lead, and our policies must support them.

38. http://www.popcitymedia.com/features/hannahonenergy1205.aspx

About the Author

Chris Israel in an adjunct fellow at the Institute for Policy Innovation. Israel is also with American Continental Group, which he joined in 2010

Prior to joining ACG, Mr. Israel was Managing Partner of PCT Government Relations which he founded in 2008. While at PCT he worked with a range of companies and organizations to develop public policy strategies designed to maximize their ability to innovate, compete and thrive in a challenging global environment.

In 2005, Israel was appointed to be the first U.S. Coordinator for International Intellectual Property Enforcement by President Bush. Israel also served as Deputy Chief of Staff to Commerce Secretaries Donald L. Evans and Carlos Gutierrez. Prior to that, Israel served as Deputy Assistant Secretary for Technology Policy at the Commerce Department.

Note: The author and IPI thank the United States Patent & Trademark Office for a grant funding this paper.

About the Institute for Policy Innovation

The Institute for Policy Innovation (IPI) is a nonprofit, non-partisan educational organization founded in 1987. IPI's purposes are to conduct research, aid development, and widely promote innovative and nonpartisan solutions to today's public policy problems. IPI's focus is on developing new approaches to governing that harness the strengths of individual choice, limited government, and free markets. IPI is a public foundation, and is supported wholly by contributions from individuals, businesses, and other non-profit foundations.

© 2011 Institute for Policy Innovation

IPI Issue Brief is published by the Institute for Policy Innovation (IPI), a non-profit public policy organization.
NOTE: Nothing written here should be construed as an attempt to influence the passage of any legislation before Congress. The views expressed in this publication are the opinions of the authors, and do not necessarily reflect the view of the Institute for Policy Innovation or its directors.

Direct all inquires to: Institute for Policy Innovation,
1660 S. Stemmons Freeway,Suite 245
Lewisville, TX 75067
972.874.5139 (voice) 972.874.5139 (fax)
email: ipi@ipi.org
www.ipi.org