

Who Owns the Clean Tech Revolution?

Intellectual Property Rights and International Cooperation in the U.N. Climate Negotiations

Report and proposals from a conference
October 26-27, 2009
University of California, Berkeley


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by the Center for Environmental Public Policy
and the Energy Biosciences Institute
October 26-27, 2009

Center for Environmental Public Policy
Goldman School of Public Policy
University of California, Berkeley
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Principal author: Robert Collier, visiting scholar at the Center for Environmental Public Policy.

Co-author: Josephine Mutugu, researcher in the specialist series in Energy, Environmental and Intellectual Property Law at the Energy Biosciences Institute.

Principal Investigator, overall project supervision and editing: Blas Pérez Henríquez, director of the Center for Environmental Public Policy and assistant dean for executive and international programs of the Goldman School of Public Policy.

Editing and research: Nathaniel Dewart, Kasandra Griffin and Armando Salcedo Cisneros of the Goldman School of Public Policy; and Sarah Barker-Ball of Berkeley School of Law.

Reviewers: Lee Friedman, professor of Public Policy, Goldman School of Public Policy; Daniel Kammen, Class of 1935 Distinguished Professor of Energy and director of the Renewable and Appropriate Energy Laboratory; and Brian Wright, professor, Department of Agricultural and Resource Economics and the Energy Biosciences Institute. Thanks also to Bernice Lee and Felix Preston of the Energy, Environment and Resource Governance Program, Chatham House; and Stephan Crawford, director, U.S. Commercial Service, Commerce Department, San Francisco.

Design: Heather Sarantis.

Student volunteers at conference: Dipti Desai, Jordan Gonzales, Melissa Lee, Alana Lemarchand, Brittany Lovejoy, Matt Lucas, Mariana Ludmer, Bret Strogen, Taylor Zhou and Mark Zimring.

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Copies of this report are available online at:
http://gspp.berkeley.edu/IPR/whoowns.pdf

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EXECUTIVE SUMMARY

In October 2009, as the outlook for a successful climate summit in Copenhagen grew dim, the Center for Environmental Public Policy joined with the Energy Biosciences Institute to convene a conference about one of the key stumbling blocks in the U.N. negotiations – the debate over the role of intellectual property rights (IPR) in the transfer of emissions-reducing technologies to developing nations.

The outcome of the IPR dispute will determine the future of the global clean tech revolution. Without the rapid diffusion and adoption of emissions-reducing, energy-saving technologies across the planet, especially in poorer nations, there will be little hope of halting or significantly slowing the advance of climate change.

This report is not a literal record of our October conference, which can be viewed on the conference website. Nor does it purport to reflect an absolute consensus of all participants. Its analysis and conclusions are the responsibility of the authors alone, although they have made their best attempt to reflect the presentations and opinions shared at the conference.

The problem

In the series of negotiations under the U.N. Framework Convention on Climate Change (UNFCCC), developing nations have demanded major concessions on clean tech patent rights. They say that because most of the world's historic accumulation of greenhouse gases was emitted by today's wealthy nations, fast-growing emerging economies should be given special assistance in their attempt to access clean technologies. In particular, developing nations say they should be allowed to engage in compulsory licensing, in which the rights under a patent are granted to a non-patent holder by a government mandate. As precedent for this practice, they cite the 2001 Doha Declaration on Public Health signed at the World Trade Organization (WTO), which allows poor nations to conduct generic production of patented drugs for HIV/AIDS and malaria to address the pandemics that kill millions each year.

The clean tech industries of the United States, Europe and Japan reject this analogy, saying that compulsory licensing would freeze the clean tech innovation process and dissuade investors and innovators from working on new technologies. In fact, the clean tech industry's position is supported by economic research that concludes IPR plays a much different role in clean tech than in life-saving medicines. While in the latter, patents confer monopolies that enable pharmaceutical companies to drive up prices

and produce huge profit margins, the role of patents in the pricing of clean tech remains unclear.

Still, the issue of IPR is now a firmly-established part of the official UNFCCC negotiating agenda. The G-77, a diplomatic coalition of 130 nations, would likely drive a hard bargain for removing it from the table.

Dodging the fight

While this fight continues, support has been growing for proposals that would simply dodge the dispute entirely by increasing collaboration in international research and development in new technologies. The newly emerging plans for expanded R&D have taken many forms. At the UNFCCC, proposals range from the U.S. idea of a "hub and spokes" training center arrangement to the G-77's ambitious plans for a huge supranational clean tech development agency.

Yet less can be more, too. Even without a U.N. climate treaty, expanded R&D collaboration can be developed in many ways among a multiplicity of actors and venues. Bilateral or multilateral, private or public, diplomatically coordinated or simply ad hoc, R&D collaboration does not necessarily require a perfect, one-size-fits-all solution.

UC Berkeley and Lawrence Berkeley National Laboratory have significant experience in these areas, as leaders of important cooperation projects ranging from Chinese energy efficiency to low-emissions cook stoves. This practical track record is coupled with equal expertise in using patent law flexibilities, ranging from public-private partnerships to open-source collaborations.

Lessons from elsewhere

As diplomats discuss collaboration on clean tech, some are seeking inspiration from an institution that has long worked on a loosely related issue – the Consultative Group on International Agricultural Research (CGIAR). Founded in 1971, this institution comprises 15 international crop research centers. Its thousands of scientists carry out R&D for the world's poor, creating new disease- and drought-resistant seeds and growing techniques that can help prevent famine and ecological decline.

CGIAR has had significant difficulties, including declining funding and a dysfunctional bureaucracy. It has also had many successes in crop research, increasing food production in developing countries by 7 percent to 8 percent. Yet in many ways, CGIAR's greatest success is simply that it has visibly existed and survived, for better and worse, for nearly four decades around the world. The global community is demanding specific, concrete results at the U.N. climate talks, and the formation of a large, bricks-and-mortar institution for research, development, deployment, training and public education in the clean technologies affecting the world's poorest could have dramatic public appeal.

The Berkeley IPR conference website:
http://gspp.berkeley.edu/programs/cepp_CleanTechAndIPR.html

SAVIOR OR WHIPPING POST?

The U.N. climate negotiations have been bedeviled by disagreements over many issues, but few are as complex as the controversy over IPR.

This debate has generally received less public attention than other topics at the negotiating table, such as emissions cap commitments or financial aid from wealthy nations to poor nations. To the media and many general observers, IPR might seem like a topic more relevant to trade or finance than climate.

But the debate over clean tech IPR has deep implications for the future of global warming and emissions-reducing, energy-saving technologies. Its outcome will decide whether poor nations are able to acquire and install the industrial, agricultural, commercial and residential products and software that they need to pursue low-carbon economic growth. It will directly affect the bottom lines of the clean tech firms that are producing these goods and services. And it will determine whether the scientists and entrepreneurs who are inventing these technologies have the incentives and resources to continue to do so.

The questions being asked point in many directions. Who will own these technologies? Who will control them? And who will benefit?

The creation of a transparent, stable climate agreement on IPR and clean tech R&D could open new markets in developing nations and stimulate entrepreneurship and innovation by the clean tech industry in wealthy and poor nations alike. A successful, well-designed agreement could provide security and transparency to scientists, entrepreneurs and corporations and thus encourage the creation, financing and deployment of new emissions-reducing technologies. In effect, a climate treaty could be an environmental version of the new global trade agreement that has failed to materialize after years of negotiations at the WTO.

For the world's poor and developing nations, a new climate treaty could make available cutting-edge technologies for reducing emissions and adapting to the negative effects of climate change. It could give those nations co-ownership in many of the technologies that are most relevant to the everyday needs of their people. It could allow these nations to become genuine partners in inventing and developing new generations of emissions-saving techniques.

The Energy Biosciences Institute is carrying out extensive research with this plant, Miscanthus x giganteus, which has great potential as a biofuel. This photo shows a measuring pole at the University of Illinois biomass demonstration plots in Champaign, IL.

Photo by Institute for Genomic Biology/ University of Illinois

However, the failure to agree on a successor climate treaty could spark international acrimony and new trade barriers. It could turn the clean tech industry into a whipping post, accused of hoarding patents while the world burns. More substantively and certainly, it would allow global warming to continue unabated, affecting the poorest nations hardest of all.

It is pretty clear that if we continue on with this sort of bipolar situation where, on the one hand, you have companies that say 'we won't license technology' or 'we don't like the notion of any sort of mandatory licensing,' contrasted with, on the other side, you have people saying 'yes we have to have that,' it's really just a recipe for no progress at all. So we really need to find the middle ground, and I think that the partnership concept really gets us there.

–George Romanik, chief IP counsel, Pratt & Whitney, and conference panelist

FRICTION GROWS AT U.N. CLIMATE NEGOTIATIONS

In recent years, the IPR debate has become ideologically and diplomatically contentious. At the U.N. climate negotiations and in the U.S. Congress, lines have been drawn hard and clear. The opposing sides have taken rigid positions, and until recently there was little movement toward compromise.

Yet this debate must be understood in context of a broader, evolving discussion over technology transfer. Generally given little attention in the Western media, tech transfer has been a buzzword ever since it was included in the U.N. Framework Convention on Climate Change (UNFCCC).[1] Established in 1992 and eventually ratified by 192 members, the UNFCCC placed "technology development and transfer" at the center of its agenda. The broad consensus on the need for technology transfer to prevent climate change and ameliorate its economic and humanitarian impacts – "mitigation" and "adaptation" in the new UNFCCC lexicon – was encapsulated in Article 4.5 of the Convention:

> "The developed country Parties …. Shall take all practical steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention. In this process, the developed country Parties shall support the development and enhancement of endogenous capacities and technologies of developing country Parties."[2]

Since then, technology transfer has become a catchphrase in U.N. climate negotiations. Article 10(c) of the Kyoto Protocol, signed in 1997, requires parties to cooperate on the development, application, diffusion and transfer of environmentally sound technologies that are in the public domain, and to create "an enabling environment for the private sector to promote and enhance the transfer of … environmentally sound technologies."[3]

The topic of IPR, which had long taken a background role in the tech transfer debate,[4] grabbed center stage in 2001 because of a wholly separate development – the Doha Declaration on Public Health.[5] This declaration expanded WTO member states' ability under the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) to engage in generic production of life-saving pharmaceuticals. At that time, the debate was fueled by a huge humanitarian emergency – the

rapid pandemic of HIV/AIDS around the globe, especially in sub-Saharan Africa. Many of the poorest nations where HIV/AIDS was spreading fastest could not afford to pay for patented drugs, most of which were controlled by U.S. and European corporations.

The criticism came quickly and proved highly embarrassing for the pharmaceutical industry: Why not allow poor nations to break those patents and mass produce the drugs on a generic basis? If millions of poor people are dying because they and their governments cannot afford drugs to save them, why should patent rights remain sacrosanct? The questions grew louder and louder as G-77 nations, led by Brazil and India, were joined by many health advocates in the United States and Europe. But the pharmaceutical lobby, strongly supported by the Bush administration, dug in its heels and refused to budge, saying that giving in would deprive companies of the profit margins needed to pay for expensive R&D.

Finally, the drug companies gave way. In Doha, Qatar, at the WTO Ministerial Conference in November 2001, the United States signed a declaration that included precedent-setting language on compulsory licensing: "Each member has the right to grant compulsory licenses and the freedom to determine the grounds upon which such licenses are granted."[6]

Small-scale clean tech projects have the potential to significantly reduce greenhouse gas emissions, but they need to be affordable and accessible to people in less developed countries.

Developing nations soon began insisting on using this principle for climate change as well as drugs. After all, they reasoned, if the world's climate emergency was as calamitous as the developed nations claimed, it certainly deserved the same degree of urgent measures as the health emergency of HIV/AIDS.[7]

The existing rules on intellectual property, they said, operate as a barrier to the deployment of clean technologies, similar to the role of patents on HIV cocktails. India and Brazil took the lead, followed closely by China, in arguing that clean technologies should be excluded from full patentability and that any compulsory licensing of clean

The question in my mind is, 'Is it worth having the fight?' because in fact the fight over compulsory licensing ... will radically delay the development of sensible cooperation and collaboration.

– John Zysman, co-director of Berkeley Roundtable on the International Economy and professor of Political Science, UC Berkeley, and conference panelist

technologies should be patterned after provisions in the Doha Declaration. Saudi Arabia, Pakistan, and the Philippines also submitted proposals to include compulsory licensing language in the Copenhagen negotiating text.

But is it valid to draw parallels between HIV/AIDS drugs and clean tech? The G-77 countries and their backers have not pointed to any detailed research that unambiguously supports this linkage. To the contrary, a growing body of research has suggested that the analogy may be incorrect. Studies by Florida State University's Frederick Abbott (2009), Stanford's John Barton (2007), Copenhagen Economics (2009), E3G (2008), and Garten Rothkopf for the U.S. Chamber of Commerce (2009) arrive at slightly different conclusions, but all agree that the role of IPR in the clean tech industry is diverse, varying by sector.[8] The overall impact of patent rights on clean tech pricing is much less clear than in the pharmaceutical industry, they conclude.

Barton, for example, showed that pharmaceutical patents and associated monopoly rights often have a substantial upward impact on price because there may be no substitutes for a new medicine. In contrast, in the renewable energy sector (photovoltaic solar, biofuels and wind), patent protections have expired on

At the core of debates over how to address climate change is the undeniable fact that global warming will have the greatest impact in developing countries. Pictured here is Mount Kilimanjaro in Tanzania, showing a dramatic reduction in the glacier's size. People who live near the mountain rely on runoff from the glacier for crop irrigation and drinking water.

most basic technologies, so only specific improvements tend to be patented. As a result, several competing patented products often exist for any given application, and the resulting competition usually brings prices down to levels lower than what might be charged under a monopoly.[9]

From the industry practitioner's perspective, a similar analysis was made by Eric Walters, a partner of Morrison & Foerster in its Palo Alto office, at the Berkeley IPR conference in October 2009. The clean tech industry differs in several key ways from the pharmaceutical industry, he said. In the former, technologies are much more diverse; so-called blocking patents (which prevent a patent holder from using its own invention without also obtaining a license to a related technological application patented by another) are much more rare; market participants are greater in number and geographical spread; and the cost of manufacturing is relatively higher after completion of the approval process, so the profit margin is lower and thus more socially acceptable.[10]

In early 2009, the U.S. Chamber of Commerce initiated a lobbying campaign to warn against developing nations' demands for IPR concessions at the UNFCCC climate negotiations. The campaign, whose corporate membership included few California firms, became politically successful in Washington despite the growing controversy about the Chamber's strong opposition to Congressional climate legislation.[11]

In response to this campaign, the U.S. House of Representatives voted 432-0 in June 2009 to oppose any concessions at Copenhagen that would weaken the intellectual property rights of American clean technology.[12] In November, a bipartisan group of 42 of the 100 U.S. senators followed suit, sending a letter to the Obama administration urging the protection of clean tech IPR. The senators cautioned against assisting developing countries to obtain clean technologies without fully protecting patent rights.[13]

In coordination with European Union governments, the Obama administration has increasingly sought to eliminate IPR issues from the negotiations table. U.S. diplomats tried vigorously, but largely failed, to get references to IPR deleted from pre-Copenhagen "white paper" documents. At the UNFCCC meetings in Bangkok in October and in Barcelona in November,

In my view, whatever treaties we come to, whatever bilateral (even compulsory) licensing agreements we come to, we must protect the start-ups –treat them differently – for some period of time until they reach some critical mass size so that their intellectual property rights are in fact protected as much as possible and so that the companies can focus on what's important, which is value building.

–Josh Green, partner, Mohr Davidow Ventures, and conference panelist

diplomats dueled back and forth, deleting and re-inserting references to compulsory licensing. The net result was increased friction between developed nations and the G-77 bloc, as India, Bolivia and Bangladesh led the charge by accusing the United States and Europe of seeking to protect clean tech industry profits above planetary health. In turn, developed nations accused the G-77 of endangering the R&D process that will help drive the world's response to global warming.

Throughout the negotiations, discussions were highly politicized. Very few country delegations at the UNFCCC included IPR specialists, leaving decision making to bureaucrats with varying agendas. Officials from the World Intellectual Property Organization and the WTO hovered in the background as informal advisers, but they had no formal UNFCCC negotiating status and their roles were largely ad hoc.[14]

Heading into Copenhagen, the stage was set for a major battle over IPR, with the divide deeper than ever: The United States and Europe on one side, the G-77 on the other.[15]

However, glimpses of a solution were also emerging. At the Bangkok and Barcelona preparatory meetings, support was building for plans to dodge this conflict by significantly expanding international cooperation on clean tech R&D. These R&D proposals varied widely, from the U.S. plan for mere advisory work to the G-77's ambitious plans to create a large scientific-industrial organization.

The limitations and potential of R&D diplomacy were on display in President Obama's mid-November 2009 visit to China. Obama and President Hu Jintao did not announce agreement on a multilateral technology initiative for the UNFCCC, as many observers had expected. But Obama and Hu did agree on a series of important bilateral U.S.-China programs for clean tech R&D. These included: joint work to create common technical standards for electrical vehicles and energy efficiency in buildings and industry; and creation of a Joint Clean Energy Research Center, with financial support from public and private sources of $150 million over five years, split evenly between the two countries.[16]

There's no question that the United States leads the world in smart grid technology. …. Smart grid is one of the biggest areas where U.S. companies could lose a lot because of IPR disputes and policy changes.

–Chris King, chief strategy officer, eMeter Inc., and conference panelist

LESSONS FROM THE GREEN REVOLUTION

India and other G-77 nations have proposed the creation of an international clean tech R&D institution loosely modeled on the Consultative Group on International Agricultural Research (CGIAR).

In view of its supporters, CGIAR has several key attributes. It is structured as a single worldwide organization, thus giving it potential for coordinated policies and fundraising. Its 15 centers are distributed worldwide, thus gaining international sympathies. Its R&D is open-source or based on flexible IPR arrangements rather than being purely proprietary. And its work is focused on creating the new crop varieties and agricultural technologies most needed for sustainable agricultural development among the world's poor.

CGIAR has a central Secretariat at the World Bank in Washington that loosely coordinates the 15 research centers, which function as quasi-independent non-profits:

- International Maize and Wheat Improvement Center – Texcoco, Mexico
- International Potato Center – Lima, Peru
- International Center for Tropical Agriculture – Cali, Colombia
- Center for International Forestry Research – Bogor, Indonesia
- International Center for Agricultural Research in Dry Areas – Aleppo, Syria
- WorldFish Center – Penang, Malaysia
- World Agroforestry Center – Nairobi, Kenya
- International Crops Research Institute for the Semi-Arid Tropics – Hyderabad, India
- International Food Policy Research Institute – Washington, D.C.
- International Water Management Institute – Battaramulla, Sri Lanka
- International Institute of Tropical Agriculture – Ibadan, Nigeria
- International Livestock Research Institute – Nairobi, Kenya
- Bioversity International – Rome, Italy
- International Rice Research Institute – Laguna, Philippines
- Africa Rice Center – Bouaké, Ivory Coast and Cotonou, Benin

According to CGIAR, its research programs have had significant impact, increasing food production in developing countries by 7 percent to 8 percent, and decreasing child malnutrition by 13 million to 15 million people annually. For every $1 invested in CGIAR research, $9 worth of additional food is produced in developing countries.[17] In recent years, for example, CGIAR has achieved a breakthrough in

A failure to negotiate a new U.N. climate treaty could have significant impact on all ecosystems, from the tropics to polar regions.

developing new wheat varieties that not only resist Ug99, a wheat stem rust that has devastated wheat production in Africa, but also produce more grain than today's most popular varieties. Currently, CGIAR is leading a global consortium of scientists in a project to re-engineer photosynthesis in rice to produce 50 percent more grain using less fertilizer and water.

With a 2008 budget of $542 million, CGIAR represents the world's single largest investment to mobilize science for the benefit of the rural poor. When founded in 1971 by the Rockefeller Foundation, the World Bank and several U.N. agencies, CGIAR was conceived as an outgrowth of the Green Revolution, and its mission was tightly scripted as a top-down process in which experts from developed nations spread their knowledge to the poor nations. Gradually, however, its mission was democratized, and it has been widely praised for bringing together thousands of scientific researchers from all over the world to conduct anti-poverty research. It thus constitutes the world's most ambitious international scientific collaboration project.[18]

However, the CGIAR system has been increasingly weakened in recent years. Its most critical challenge is the steady drop in funding from developed nations. CGIAR's budgets have declined in real terms since 1990, endangering its research and even its abilities to maintain its valuable gene banks.[19]

Some funders have complained that CGIAR has a low return on investment – an outcome that, at least in part, results from its mission to provide open-source R&D for the poor rather than to earn profits.

Other problems include poor coordination between centers and with the Secretariat, as well as poor coordination with government policymakers.

Since the mid-1990s, CGIAR member organizations responded to shrinking budgets by engaging in an increasing number of joint projects with private companies such as Syngenta, Pioneer Hi-Bred International and Monsanto. At the same time, CGIAR's leeway for conducting open-source work became constrained by the tightened IPR rules under the Convention on Biological Diversity (1992) and TRIPS (1994).[20]

CGIAR's trend toward collaboration with the private sector has been praised by many governments and experts as a needed step toward self-sufficiency, while it has been sharply criticized by others as a sell-out of CGIAR's principles.[21] These contrasting pressures offer a glimpse of the political headwinds for the UNFCCC as it attempts to devise a strategy for clean tech collaboration.

BERKELEY CONFERENCE

As the U.N. climate talks stagnated, the Center for Environmental Public Policy and Energy Biosciences Institute convened a two-day conference on the UC Berkeley campus on October 26-27, 2009.

The participants represented a wide range of institutions – clean tech companies large and small, venture capital, law firms, foreign governments, domestic and international think tanks, and U.S. universities and national laboratories.

The chief intent of the conference was to facilitate expert discussion among clean tech stakeholders about ways to prevent a negotiating impasse over IPR issues at the climate negotiations. After the two days, it was no surprise to anyone that the only consensus to form over the toughest IPR dispute – the G-77's demands for compulsory licensing – was an agreement that any solution was highly unlikely.

Clean tech executives and other experts made clear that even the industry itself was far from monolithic. Perspectives and vested interests varied considerably, ranging from venture capital firms that have invested heavily in small, go-it-alone, IPR-sensitive startups, to large industrial corporations that work in collaboration with other large firms, governments and laboratories, to solar firms that view IPR as less important than regulatory issues.

Yet threads of common purpose appeared throughout the two days of discussions. Most participants agreed that compulsory licensing is a diplomatic dead end and serves only to poison the well of negotiations. Many also agreed that international collaborative R&D holds great potential and deserves to be explored aggressively, including the CGIAR model.

Following is a summary of some of these common threads:

IP protection and compulsory licensing

To varying degrees by sector, the clean tech industry depends on strong protection of intellectual property. Company executives said that clear and transparent protection of patent rights is needed to enable clean tech firms of all nations – developed and developing alike – to invest the large sums necessary in R&D of new clean technologies.[22]

Compulsory licensing per se does not resolve developing nations' problems because it does not cause the transfer of

the much-needed, non-patented know-how and other expertise needed to make the technologies perform adequately.

The clean tech sector is largely dissimilar to the pharmaceutical industry, so analogies related to compulsory licensing are overdrawn. Clean tech firms have a much greater diversity of technologies, rarely have blocking patents, and have much higher manufacturing costs and lower profit margins.

Overall IP trends

The sectors of wind, fuel cells, high efficiency lighting and hybrid/electric vehicles have been growing increasingly sensitive to IP issues in recent years, as large sums of investment capital have driven the innovation process into progressively faster business cycles. Each sector has shown a significant increase in patent litigation in the United States in recent years.

IPR protection is not the most important concern in some clean tech sectors. More important is institutional development – policy implementation, the rule of law and technical training.

Regulatory framework and standards

Many clean tech firms say they need the implementation and harmonization of international standards. Demand-side management metering, time-of-use pricing and greater use of renewables – all these depend on having common standards similar to the International Organization for Standardization (ISO) system. Some American firms are concerned about large European utilities imposing their own metering standards. For American firms, the National Institute of Standards and Technology (NIST) is the preferred benchmark, while others simply want any common international standard that will encourage governments and companies to adopt emissions-reducing best practices. In renewable energy, the emerging policy benchmarks are the U.S. Renewable Fuel Standard Program and the European Union's Renewable Energy Directive.

China

Poor IP protection in China remains a significant concern for international clean tech investors, thus inhibiting technology transfer. "We just don't take our best IPR to China" was a constant refrain.

It's incorrect to assume that the poorest use very little energy. Don't ignore the poor. They're the unexploded mine on the road of climate change if they follow our growth trajectory.

–Ashok Gadgil, senior scientist, Lawrence Berkeley National Laboratory, and conference panelist

China is expected to lead the world in the number of patent applications filed annually by 2012, overtaking the United States, European Union and Japan. Less developed countries are experiencing low rates of patent filings because many nations do not have strong enforcement mechanisms, thus making it difficult to file patents in these countries.

China is turning the tables as it begins to export large amounts of its own clean technology to Southeast Asia and other world markets, so China is becoming concerned about protecting its own IPR.

Agriculture

Agriculture is one of the leading sources of greenhouse gases related to human activity, primarily because of methane emissions, land use change and the lifecycle impact of nitrogen fertilizer. While U.S. agricultural emissions account for about 8 percent of the nation's total greenhouse gas emissions, the sector's impact in developing countries is far greater. By some estimates, global agriculture causes as much as one-third of the total human-induced warming effect caused by greenhouse gas emissions.[23]

More than 1 billion people are chronically hungry. Technology needs to be designed and deployed at a scalable level to address the climate change and food security concerns of developing countries. CGIAR and some private companies are conducting much-needed research in crop technology for the poor, but much more research is needed to increase agricultural productivity and reduce greenhouse gas emissions, as well as improve adaptation to higher temperatures, salinization and droughts.

Household technology

Domestic technology for the poorest is a major climate change issue, largely untouched by private R&D. For example, 1.6 billion people use kerosene lighting rather than electricity, and a similar number use cookstoves rather than natural gas or electricity. If emissions from these stoves each were cut by 1 ton per year, the resulting reduction of black carbon soot would be the equivalent of almost one full emissions "wedge," 1 gigaton per year. Because LED lights use 100 times less primary energy than fuel-based lighting, replacing fuel as home illumination could displace 200 MT of carbon emissions per year.

China will reach 65-70 percent of its oil being imported by 2020, which is more than even the United States at 63 percent. So oil supply and energy efficiency are becoming a national security concern. Technology transfer on energy efficiency is very important for China.

–Yang Fuqiang, director of global climate solutions, WWF International, and conference panelist

Berkeley Takes the Lead on R&D Collaboration

UC Berkeley and Lawrence Berkeley National Laboratory have become leaders in several international R&D collaboration projects. Examples include:

China Energy Group

For the past two decades, the most important of all international institutions working on energy efficiency in China has been Lawrence Berkeley Lab's China Energy Group. Led by Mark Levine, a senior scientist at the Lab, the group has helped in a wide variety of areas. For household appliances, it has helped develop standards similar to the U.S. Energy Star labels. For building energy use, it advised in the development of building energy codes and less energy-intensive construction materials. For heavy industry, it gave technical aid for the central government's Top-1000 Energy-Consuming Enterprises Program in the power sector, steel and cement industries. For modeling and policy scenarios, it developed the China End-Use Energy Model, an analytical tool to assess energy consumption trends.

Berkeley-India Joint Leadership on Energy and Environment (BIJLEE)

Founded in 2008 at Lawrence Berkeley Lab, BIJLEE brings together researchers to develop scalable and cost-effective energy-efficient and renewable energy technologies and policy mechanisms in India.

The Blum Center for Developing Economies

Established in 2006, UC Berkeley's Blum Center has worked on initiatives for technological advancements for cooking and lighting to developing economies. These have replaced less efficient technologies and resulted in several potential co-benefits, including improved health from reduced indoor air pollution and slower rates of deforestation. The Blum Center is also supporting two lighting focused projects, Lumina (LED Lighting) Project, and Women's Emergency Communication and Reliable Electricity (WE CARE).

Darfur Cook Stoves

Ashok Gadgil, a senior scientist in the Environmental Energy Technologies Division at Lawrence Berkeley Lab, invented one of the most elementary yet most important of all technologies – a better cookstove. The Darfur Cookstove, which is four times more fuel-efficient than the traditional three-stone fire, is now available to the impoverished residents of Darfur, the conflict-ridden region in western Sudan. With joint funding from UC Berkeley's Blum Center for Developing Economies and the Sustainable Products and Solutions Program, the project had distributed 5,000 stoves as of the end of October 2009.

Energy efficiency in buildings

The construction industry and the buildings sector produce much of the world's greenhouse gas emissions. The production of drywall, for example, by itself causes more than 1 percent of the world's CO2 emissions.[24] However, emissions-saving buildings technologies are often unable to break into the Chinese market, which represents about one-half of the world's construction business. Chinese government and university research institutions are increasingly involved in R&D in buildings energy efficiency, but the Chinese private sector is extremely price-sensitive and thus is unable or unwilling to pay for energy-saving best practices.

More than IPR protection, firms that sell energy-efficient products and software for buildings need the Chinese government to strengthen enforcement of its own buildings standards. Local governments often ignore standards set by the central government.

A Darfuri woman using the Berkeley-Darfur Stove. Photo by Michael Helms, 2007

Biofuels

For first-generation biofuels, such as the those derived from corn starch and sugar cane, there have been few concerns over IPR. The largest role in market disparities is played not by patents but by so-called knowhow – trade secrets or tacit knowledge such as the best growing and harvesting practices for cane. For example, Brazil has been able to build a viable cane ethanol production not because of patents on viable cane germplasm but because of application of agricultural expertise.

The role of IPR is more significant for second-generation biofuels technologies. One example is fermentation technology, in which public sector research institutes play a dominant role in R&D and hence patent ownership. Increased government funding has significantly augmented the degree and speed of innovation. Because production of second-generation biofuel technologies may involve the use of ionic liquids and/or transgenic microbes to break down lignocellulose and convert sugars to alcohol, these technologies will be influenced by patenting trends as well as by ownership of co-specialized assets, especially access to feedstocks.[25]

The challenges for international R&D collaboration in both first- and second-generation biofuels are immense. Research institutions and companies with patents do not necessarily have access to feedstocks, and vice versa. Many companies from developed countries have made major investments in developing countries in the hopes that they will have access to their feedstocks. Some of these firms have encountered tough political crosswinds, including conflicting legislation and regulation, as well as hostile media coverage due to public concerns about the potential conflict of food versus fuel.

The ongoing patent race in biofuels has caused the creation of several major public-

Energy Biosciences Institute personnel inspect biofuel feedstocks in Decatur, IL. Among EBI's energy crops are Miscanthus x giganteus, Panicum virgatum (switchgrass), mixed prairie grasses containing Andropogon gerardii (big bluestem), Sorghastrum nutans (Indiangrass), and Schizachyrium scoparium (little bluestem).

Photo by Institute for Genomic Biology/University of Illinois

Open Source Clean Tech?

At the UNFCCC, many G-77 delegations are insisting that even if a new climate treaty does not include compulsory licensing, it must include some provisions that help create and distribute clean technologies through methods that are open-source rather than proprietary. This strategy is generally intended as a compromise with the clean tech industry, looking forward rather than backward, seeking to create an open-source niche within the larger proprietary marketplace.

The movement for open source and free software, which has used self-perpetuating copyright licenses to maintain open access to publicly distributed software, is migrating to the fields of biotechnology and clean tech. Several open source R&D initiatives have been launched, including Eco-Patent Commons, the HapMap Project, Bioinformatics.org, Public Patent Foundation, the Initiative for Open Innovation, and UC Berkeley's Socially Responsible Licensing Program.[26]

Advocates say that clean tech, like software, relies on technological building blocks that should be in the public domain. R&D in both industries relies on a synergistic relationship of proprietary and open-source information, they say, and economic logic suggests it is better to err on the side of open rather than closed patent rights. Opponents beg to differ, warning the trend could lead to a weakening of the innovation process.

A typical controversy is the friction between large biotechnology companies and poor indigenous groups that hold viable biofuels germplasm. These firms want to patent the advances on germplasm, much to the chagrin of indigenous holders of germplasm, whose ancestors have been improving its viability for centuries. Open source biotech projects propose to fix this problem by requiring participants to agree that advances in the technology must remain as openly available as the original technology.[27]

The open source movement has only recently made inroads into the clean tech industry, so UNFCCC diplomats have few road markers as they consider whether to travel down this path.

private collaborations such as the Energy Biosciences Institute, which is an alliance of BP, UC Berkeley, University of Illinois Champaign-Urbana and Lawrence Berkeley National Laboratory. Stanford University's Global Climate and Energy Project, which is supported by ExxonMobil, General Electric, Schlumberger and Toyota, is undertaking research in biomass technologies.

For the poorest nations, the most important issues regarding biofuels R&D are elemental – the potential depletion of food supplies by the diversion of viable cropland to grow biofuels, the availability of jobs promised by the biofuels companies, and the potential reduction of high oil import bills.

Power generation and transmission

The issue of carbon capture and sequestration (CCS) in the coal-fired power industry has undeniably become a major priority of both the U.S. and Chinese governments in recent years. Even under the administration of President George W. Bush, CCS research was given significant attention and resources. When the Bush administration launched the Asia-Pacific Partnership on Clean Development and Climate as a competitor to the Kyoto Protocol, it set its main task as fostering R&D in clean coal technologies and CCS. This subject has immense potential and equally immense technical difficulties, but existing efforts seem to be dealing with the issue at an adequate level, and new attention at the UNFCCC is generally not viewed as a top priority.

The smart grid industry is one of the most significant areas where U.S. companies could be hit hard by IPR relaxation. Many smart grid technologies have already been developed and are at the implementation stage, so many U.S. firms are worried about entering the Chinese market.

The process of power innovation and development moves faster in China than in the United States, (two years versus eight years for deployment of a nuclear plant), and Chinese costs are far lower than those of the United States. For these reasons, China has become an ideal arena for testing and proving the viability of new technologies.

International cooperation

Conference participants agreed that cooperation in clean tech R&D should be incentivized at all levels – government, university and private sector alike, bilateral and multilateral. Lawrence Berkeley Lab and the University of California have notable expertise and experience in this area, and their leaders have expressed interest in exploring further opportunities for deepening and expanding this work in many directions.

One suggestion expressed at the conference was to create a global R&D competition for key clean technology solutions. Under this proposal, the UNFCCC global technology fund would contribute large cash prizes for international team(s) that devise workable, scalable solutions to stated challenges in clean tech development. The prize money would be in lieu of any intellectual property rights,

with the resulting technology becoming a global public good. It was argued that this competition would preserve financial rewards for innovation and would also leave the current intellectual property system intact because it would only apply to a few critical areas of technology.

Much attention was focused on the challenge of identifying the "orphan technologies" that are not being adequately addressed by existing institutions and market mechanisms and that may require additional resources and attention. Surprisingly, little research has been conducted on this topic, leaving policymakers at a loss in determining which clean tech sectors most need extra attention. At the conference, Paul Alivisatos, Lawrence Berkeley Lab's director, announced that the Environmental Energy Technologies Division at the Lab is currently undertaking a research project to identify the most promising orphan technologies, with a public report expected in 2010. In the meantime, however, conference participants suggested these orphan technologies as deserving special focus:

- Water management and drip irrigation.
- Drought resistant crops.
- Small-scale PV solar and wind power applications.
- Household stoves and heating.
- Building codes, appliance standards and international wholesale incentives.
- Smart utility regulation for buildings and industrial efficiency.
- "Smart growth" urban design.

- Policy guidance to create favorable environments for renewable energies, such as grid interconnection standards, net metering, renewable portfolio standards and feed-in-tariffs.
- Climate data monitoring and early warning systems.

CGIAR received frequent mention among conference participants as a possible model for institutionalizing the UNFCCC's ongoing work in R&D. CGIAR's lessons, positive and negative, were discussed extensively, and further research and analysis was recommended.

THE ROAD AHEAD

In the UNFCCC preparatory negotiations prior to the Copenhagen summit, negotiators traded draft agreements back and forth, with a dizzying blizzard of proposals on IPR and clean tech collaboration.

Gradually, from one draft to the next, references to compulsory licensing became fewer and more tenuous. At the same time, however, proposals for R&D collaboration became more detailed and ambitious. Increasingly this area seemed to offer a potential solution to the dispute over IPR, allowing a parallel track to be built around the clash of ideas and ideologies on compulsory licensing.

Yet even on the topic of R&D, major differences emerged. G-77 nations proposed the creation of new institutions that would be even more ambitious than CGIAR, while the United States offered a much slimmer proposal that would have advisory functions only. India, Bolivia and Bangladesh took the lead with the most extensive plans, while China, Argentina and Brazil followed suit. Most of these proposals emerged somewhat confusingly under the sole nameplate of the G-77 and China, a grouping to which they all belong.

In their broadest reach, the proposals took shape as a muscular new institution or global constellation of institutions comprising national and regional "technology innovation centers" and "sectoral technology cooperation bodies." These institutions would be empowered as an international economic development super-agency, with a potential range of functions: conducting R&D on clean tech; operating laboratories; serving as hubs for financing from governmental and private sources, including venture capital; managing manufacturing facilities; acting as regulator of compulsory licensing; as well as providing training, monitoring and verification.[28]

In contrast, the United States proposed a "hub and spokes" plan that would involve a central advisory office to research the development, customization and practical application of tools that help with policy design and technology needs assessments. It would provide training (including training of trainers and on-the-job technical and vocational training) and focus on capacity building. It apparently would have no direct R&D or other asset-building role.

Between these policies is a huge gap, yet one with enormous potential for further research, analysis and diplomatic bridge building. In fact, whether these proposals are appropriate and advisable is perhaps not the most urgent question. By framing the debate in terms that do not involve confiscatory methods or other ideological non-starters, these proposals serve the crucial purpose of allowing diplomats, policymakers, scientists and academic researchers to evaluate the efficacy of existing and new means of clean tech collaboration. What works, what doesn't, and what is truly needed are questions that can be measured and evaluated without counterproductive acrimony.

The policy questions to be asked are many. Should new initiatives for clean tech collaboration be focused only on voluntary assistance and limited budgets or should they have substantial powers and funding? Should any new institutions or networks encompass research, development and deployment, plus production, regulation and monitoring, or just capacity building and technical training? Do diplomatic sensitivities and functional concerns suggest that there should be only one central office (and if so, where) or many offices and institutions worldwide? Which activities and sectors are already being adequately addressed by the private sector and need no further UNFCCC attention? What steps are most needed to encourage collaboration among private companies and between private companies and public institutions?

In answering these questions, however, there must be a hard and fast reality check. Given the looming climate emergency and the world expectation for dramatic action, now is not the time for timid, incremental steps. The global community is demanding non-rhetorical, concrete results at the climate talks. The formation of some sort of bricks-and-mortar multinational institution for research, development, deployment, training and education in the clean technologies most needed by the world's poor could have significant appeal.

As these challenges and questions are becoming clear, there is little time to wait. The global controversy over climate change and clean technology is growing, as is the overall risk of diplomatic meltdown at the UNFCCC negotiations. If the IPR debate can successfully move from sterile confrontation into a discussion over international R&D cooperation, the door will be opened to a new phase of policymaking that will benefit the clean tech industry, the planet and all its inhabitants.

Mexico considers that the greatest challenge in the next 10-15 years of transition is to establish an international and domestic policy conducive to accelerating both the dissemination of existing technologies and the development of new ones on a large scale.

–Mario Duarte Villarello, Mexican Ministry of the Environment and Natural Resources, and conference panelist

APPENDIX: CONFERENCE SPEAKERS AND PANELISTS

Sutardja Dai Hall, Center for Information Technology Research in the Interest of Society (CITRIS), University of California, Berkeley

October 26-27, 2009

- Paul Alivisatos, director, Lawrence Berkeley National Laboratory
- Tom Athanasiou, director, Ecoequity
- Gary Baldwin, director of special projects, Center for Information Technology Research in the Interest of Society, UC Berkeley
- Sarah Barker-Ball, co-president, Berkeley Energy & Resources Collaborative, UC Berkeley
- Allan Bennett, executive director, Public Intellectual Property Resource for Agriculture, UC Davis
- Sara Boettiger, director of strategic planning and development, Public Intellectual Property Resource for Agriculture, UC Davis
- Zorana Bosnic, vice president and director of sustainable design, HOK Architecture
- Robert Collier, visiting scholar, Center for Environmental Public Policy, UC Berkeley
- Mario Duarte Villarello, Ministry of the Environment and Natural Resources (SEMARNAT), Mexico
- Daniel Farber, Sho Sato Professor of Law and chair of the Energy and Resources Group, UC Berkeley
- Julio Friedmann, leader, Carbon Management Program, Lawrence Livermore National Laboratory
- Ashok Gadgil, deputy director, Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory
- Mei Gechlik, lecturer, Stanford Law School
- Josh Green, partner, Mohr Davidow Ventures
- Cassie Hidler, business development analyst, Arcadia Biosciences Inc.
- Chris King, chief strategy officer, eMeter Inc.
- Kerri Kuhn, Cleantech Program manager, Morrison & Foerster

- Victor Menotti, executive director, International Forum on Globalization
- Mark Mitchell, COO, Serious Materials Inc.
- Josephine Mutugu, researcher in the specialist series in Energy, Environmental and Intellectual Property Law at the Energy Biosciences Institute, UC Berkeley
- Wendy Neal, vice president and chief legal officer, Arcadia Biosciences Inc.
- Stephanie Ohshita, associate professor of Environmental Science, University of San Francisco
- Cymie Payne, associate director, Center for Law, Energy and the Environment, Berkeley School of Law
- Blas Pérez Henríquez, director, Center for Environmental Public Policy, UC Berkeley
- George Romanik, chief IP counsel, Pratt & Whitney
- Tessa Schwartz, co-chair of Clean Tech Group, Morrison & Foerster
- Satpal Sidhu, COO, ePod Solar Inc.
- Eric Walters, partner, Morrison & Foerster
- Viviana Wolinsky, licensing manager, Lawrence Berkeley National Laboratory
- Yang Fuqiang, director of global climate solutions, WWF International
- John Zysman, co-director of Berkeley Roundtable on the International Economy and professor of Political Science, UC Berkeley

Videos for each session can be found at the conference website: http://gspp.berkeley.edu/programs/cepp_CleanTechAndIPR.html

ENDNOTES

1. The term "technology transfer" has been in use at least since the United Nations Environment Program's Stockholm Declaration of 1972. See: www.unep.org/Documents.Multilingual/Default.asp?DocumentID=97&ArticleID=1503. The Convention on Biological Diversity (1992) also has provisions on tech transfer: www.cbd.int/doc/legal/cbd-un-en.pdf.
2. United Nations Framework Convention on Climate Change, http://unfccc.int/resource/vwvzdocs/convkp/conveng.pdf.
3. Kyoto Protocol note 3, Art 10(c). Available at: http://unfccc.int/kyoto_protocol/items/2830.php.
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6. Ibid.
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9. Barton, op. cit.
10. Speech, Conference on Intellectual Property Rights and Technology Transfer in the U.N. Climate Negotiations, Oct. 26, 2009, University of California, Berkeley.
11. Coalition for Innovation, Employment and Development, www.thecied.org.
12. Amendment to H.R. 2410, Library of Congress, Washington, 2009. Available at: www.rules.house.gov/111/AmndmentsSubmitted/hr2410/larsen19_hr2410_111.pdf.
13. Letter to President Obama, Nov. 2, 2009. Available at: www.ip-watch.org/weblog/wp-content/uploads/2009/11/110209obamasenateletter1.pdf.
14. Interviews with Yang Fuqiang, WWF International (Oct. 27, 2009), Jacob Werksman, World Resources Institute (Sept. 24, 2009), and Victor Menotti, International Forum on Globalization (Oct. 26, 2009).
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16. Formation of this center was originally announced in July 2009 during a visit to China by Secretary of State Hilary Clinton. Obama's visit in November provided public disclosure of a few more details about the center, but despite the drumroll of new publicity, it was not immediately clear why more concrete progress had not been achieved in the interim.
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About the conference organizers

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http://gspp.berkeley.edu/programs/cepp.html

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http://www.energybiosciencesinstitute.org

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Richard & Rhoda Goldman School of Public Policy
University of California, Berkeley
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