TESTIMONY OF DR. JONATHAN PERSHING
DIRECTOR, CLIMATE, ENERGY AND POLLUTION PROGRAM

HEARING BEFORE THE
COMMITTEE ON FOREIGN RELATIONS
UNITED STATES SENATE

INTERNATIONAL CLIMATE CHANGE NEGOTIATIONS:
RESTORING U.S. LEADERSHIP

NOVEMBER 13, 2007

My name is Jonathan Pershing, and I am the Director of the Climate, Energy and Pollution Program at the World Resources Institute. The World Resources Institute is a non-profit, non-partisan environmental think tank that goes beyond research to provide practical solutions to the world's most urgent environment and development challenges. We work in partnership with scientists, businesses, governments, and non-governmental organizations in more than seventy countries to provide information, tools and analysis to address problems like climate change, the degradation of ecosystems and their capacity to provide for human well-being.

I am very pleased to be here to speak to what I consider the most pressing environmental issues faced by the world – and to what I consider a major opportunity for the United States to assume a role of international leadership.

In this testimony, I would like to make a number of key points, each of which I will expand on below:

1. Emissions are rising much faster than we thought, the ice is melting decades sooner than we expected.
2. The world urgently needs the leading emitters – particularly the US and China – to find a basis for agreement and action. To do so, the US itself must take real and immediate steps to reduce emissions.
3. The US must recognize we are operating in a multi-polar world. We can lead, we can help, but we can't dictate to other great powers. China will act for its own interests.
4. China, India, and Brazil are changing their views, and we must negotiate agreements that help all achieve national goals, even if the means to reach these differ from ours.
5. There will be a huge global market for low carbon goods and services, and we must compete for it. Countries that do not adopt policies to reduce emissions will not compete effectively.
6. Markets will promote the development and support the penetration of new technologies. A robust governmental framework is needed to ensure technology development is focused on priority needs.

7. We are unfortunately starting late and we are not likely to avoid all climate damages. The world must agree to address the problem of the neediest and most vulnerable.

If we start in on an agreement on these issues at the forthcoming UN Climate Convention meeting in Bali next month, we will indeed be setting out on a path to success. If we do not, and instead continue to argue for caution and inaction until we have "more information," the world will be a much different, and much less hospitable place.

The challenge is large and urgent

The Earth is warming, primarily due to human activities. Fossil fuels (in spite of their contribution to huge increases in human productivity and great improvements in human well-being), together with significant deforestation, have been the most important causes of global warming. The buildup of carbon dioxide and other greenhouse gases (GHGs) is accelerating, and unless we act very soon to control emissions warming, will rise to very dangerous levels. This is no longer a problem only for our children, but increasingly for the present generation.

In February 2007, the Intergovernmental Panel on Climate Change (IPCC – the official science process endorsed and supported by the world's governments and in which the United States was an active participant) released its most recent scientific report. The report states that it is "unequivocal" that Earth's climate is warming, and confirms that the current atmospheric concentration of carbon dioxide and methane, two important GHGs, "exceeds by far the natural range over the last 650,000 years." Further, the IPCC concludes that it is now "very likely" (greater than 90% probability) that GHG emissions from human activities have caused "most of the observed increase in globally averaged temperatures since the mid-20th century."

Indeed, the impacts of warming have become increasingly evident. Sea ice in the Arctic was at a record low this summer, and Greenland's massive ice sheet is receding – far faster even than predicted in the IPCC report released prior to this summer's unprecedented melting. Glaciers are rapidly shrinking from the Rockies to the Alps. There have been fatal heat waves in Northern Europe and extensive droughts in the Western US, Australia and in the Amazon. Farmers and hunters across the United States report changing growing seasons and changing bird migration. If we already see these kinds of impacts with only about 0.6 ºC (1 ºF) of warming, the nature of future damages, with temperatures ranging to 2ºC and higher, are likely to be catastrophic.

The IPCC also gave us a clear sense of the emissions reductions required to limit the damages – and a timeframe in which to achieve them. The IPCC suggests that world emissions must peak within the next 10-15 years and then decline globally by as much as 50-85% below 2000 levels by 2050 if we wish to see global average temperatures remain

below two degrees of warming. Furthermore, global emissions must be stabilized by 2035.

The US must lead with a domestic policy

The warming occurring today is the result of greenhouse gases emitted over the past half century. The United States, with 4.6 percent of the world's population, has contributed 28 percent of the emissions currently in the atmosphere. Our strong economic growth in the 20th century was fueled by fossil fuel technologies we invented. And it is clear that today the U.S., with the most advanced economic and technological resources and capacity, must take the lead in transforming the global economy to a new, low-carbon future. We cannot expect the rest of the world to act if we do not – or expect countries with per capita incomes 1/10 our own to lead if we will not.

The emissions limits we set for the U.S. matter. Action by the U.S. will be seen as the benchmark against which other countries will measure their commitments. The U.S., with its historical responsibility for the current build up of greenhouse gases in the atmosphere, will continue to be a key contributor to temperature rise – even as other countries may pass us in annual emissions. With our European allies committing to align with the science in their proposal for a 20-30 percent reduction in greenhouse gas emissions by 2020 (and a European Parliament recommendation of a 50% cut in global emissions by 2050, identical to the reduction proposed by both Japan and Canada during last year's G8 discussions), the US role will be pivotal if we are to have concerted OECD action and leadership to advance the efforts of *all* countries to take action.

U.S. legislation must put a clear and specific limit on aggregate emissions and achieve the emissions-reduction target at the least possible cost. The cap establishes certainty as to the total amount of emissions that will occur under the program. The cap must be broad, including as much of the economy as possible, so as to achieve the greatest efficiency. It must have stringent emissions reductions targets, and include a range of complementary policies to reduce emissions from sectors outside of the cap. In parallel, the US must adopt complementary measures to promote new technology, to assure that we have a complete monitoring and reporting system, and to begin to develop national adaptation programs to protect vulnerable people and ecosystems.

Structuring a global climate change solution

U.S. action alone will not be enough to reduce global emissions to the extent required, although it is widely understood that without timely and aggressive U.S. action, a successful international agreement on climate change will be impossible. A number of key elements are required to adequately address the problem of global climate change, and will be critical ongoing aspects of international negotiation: (1) International GHG markets; (2) developing country actions; (3) mechanisms to promote technology development and penetration; (4) minimizing deforestation; and (5) addressing

vulnerability to climate change, and taking necessary steps for adaptation. Each is discussed below.

1. GHG markets

For countries that have the technical and institutional sophistication to embrace them, greenhouse gas markets are a powerful driver for change. The United States is discussing (at least in Congress and at the State level) adopting a cap and trade mechanism. Europe has already implemented one. Other key partners such as Canada, Australia, and New Zealand are poised to do so.

Markets are demonstrating success. Their key features – capping emissions and creating a price that stimulates investment – are both observed in the European case. Emissions in that market have risen at rates significantly below those of the US (see figure 1), while investment decisions, particularly in the power sector, appear to be shifting to technologies with a lower carbon footprint in reaction to a price signal that is currently approximately 23€ /ton of CO_2[1].

Contrary to the mythology sometimes heard in Washington, the EU's emission trading system (EU ETS) has been a striking success. The period 2005-7 has been a trial first phase, and has certainly had its teething troubles, but even during this period MIT researcher Denny Ellerman estimates that it will lead to between 50 and 200 million tons of CO_2 emission reductions[2]. Given the speed and complexity of the system's implementation, this is an extraordinary success by any measure.

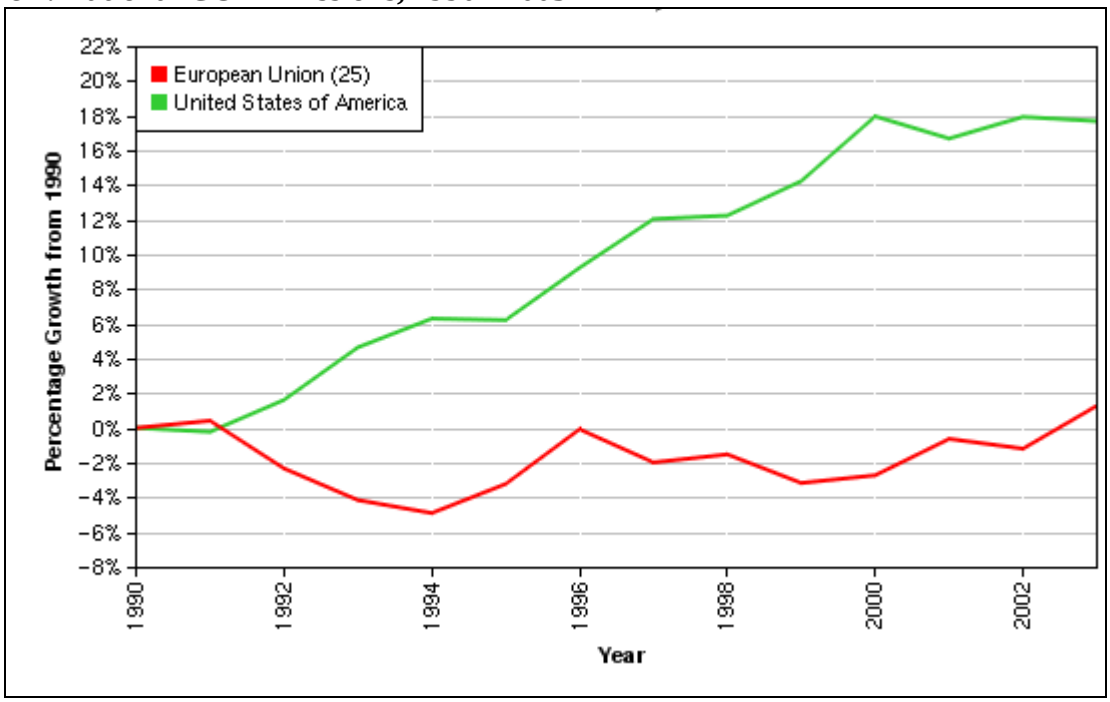
It is true that some design errors were made – and certain operating constraints existed that lead to unavoidable, negative outcomes. For example the pilot phase of the system did not allow carrying forward emissions allowances to subsequent periods – rendering the value of each allowance worthless instead of acting as an incentive to early action. The erratic release of information about the regime led to considerable price spikes – mistakes that could have been avoided with a more transparent system (and one that was in place and fully functioning prior to the start of trading). Finally, the initial allocation of allowances (distributed at the national level, and largely a function of the legal autonomy of member states within the union) provided companies in some countries with excess tons – leading to both windfall profits and to a devaluation of the currency. Each of these problems can be (and is being) addressed in the subsequent phases of the program. The EU is increasing transparency, providing for banking allowances to future periods, auctioning an increasing share of the allowances and tightening the caps; this will address most of the regimes shortcomings. We in the US – and others around the world – are in a position to learn from the EU's mistakes and avoid them ourselves as we adopt our own programs.

---

[1] For European emissions trading system prices, see http://www.europeanclimateexchange.com; 23.84€ /ton of CO_2 is the price for a December 2102 settlement as of November 8, 2007.

[2] D Ellerman and B Buchner, *Over-Allocation or Abatement? A Preliminary Analysis of the Eu Ets Based on the 2005 Emissions Data*, Fondazione Eni Enrico Mattei, November 2006

Figure 1. National CO2 Emissions, 1990 - 2003



Source: WRI, CAIT

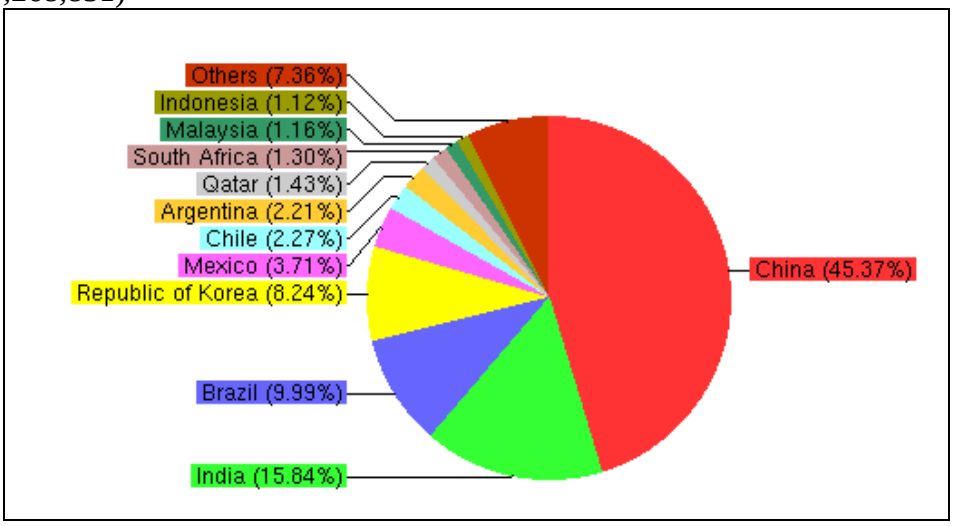
There is not a "one-size-fits-all" policy for climate change; while markets are critical components of a successful regime, not all countries are prepared to adopt or implement a cap-and-trade market mechanism. Among the pre-requisites are a robust legal system that respects property rights and can ensure the integrity of any emissions transactions, a comprehensive and rigorous emissions reporting and monitoring regime, and a strong commitment to ensuring the environmental integrity of the trading system. Such criteria are not yet met by too many countries. In particular, countries such as Russia, as well as others in Central Europe and Asia are not yet able to demonstrate with confidence that their emissions records or legal compliance systems are adequate to allow them to trade in a global GHG market. Without confidence in such globally traded allowances, we run the risk of undermining the environmental integrity of the entire global regime. For these countries, as well as other large developing countries, a full emissions trading program may not be the best solution – although participation in global markets, including through "offset programs" like the Kyoto Protocol's Clean Development Mechanism (CDM) or "Joint Implementation" may be possible. Understanding this potential shortcoming, it is clear that one of the long term goals of the international effort should be to help develop the proper underpinnings for a global market.

The CDM itself is also facing difficulties, although it has generated significant reductions. To date, there have been more than 2600 CDM projects proposed, of which only 844 are registered[3] (a consequence of both poor methodological development as well as the nature of the overburdened approval process). These 844 projects over their

[3] See the UNFCCC CDM web site at: http://cdm.unfccc.int/Statistics/index.html

lifetimes should save 1,080,000,000 tons – a level that already outstrips demand under the commitments for developed country parties in under the Kyoto Protocol. Approximately 80 percent of the annual project credits come from only 4 countries (China, India, Brazil and South Korea); see figure 2. Along with some uncertainty in the integrity of offset credits, this supply/demand ratio as well as limits on the amount of international offset credits Europe will accept for internal compliance has led to a lower price for Certified Emission Reductions (CERs). While European emissions allowances sold for an average of about $23/ton through 2007, offsets sold for less than $11/ton[4]. The relatively low price and lower volumes has also led to only modest funds being available for the kinds of major energy infrastructure projects that might significantly reduce emissions. According a 2007 World Bank/IETA study[5], to date, the total of all CDM projects has only been $5 billion. Such prices and volumes are substantially below the costs of supporting potentially critical new technologies, such as carbon capture and storage, which would be required to neutralize emissions from the rapidly growing GHG footprint in the developing world.

Figure 2. Expected average annual CERs from registered projects by host party (Total 174,268,851)



Source: UNFCCC CDM website: http://cdm.unfccc.int

Resolving conflicts over the CDM (or its successor) will be a key feature in the ongoing post-Kyoto discussion, and a central topic at the Bali negotiations. Concerns remain high that projects may not yield "real, measurable and verifiable" reductions that would be "additional" to those that would have occurred in the absence of the project. At the same time, the burden of proof regarding project eligibility for inclusion into the CDM process is onerous, and may turn many good (albeit sometimes small) project proposals away,

[4] See the World Bank/International Emissions Trading Association's "State and Trends of the Carbon Market 2007, http://carbonfinance.org/docs/Carbon_Trends_2007-_FINAL_-_May_2.pdf

[5] Ibid

further widening the gap between projects undertaken in the poor smaller countries and those in the more capable larger countries.

2. Developing country actions

To address the global climate change problem, major emitters from the developing world will have to bring serious actions to the table. Countries such as China, India, Brazil and Indonesia are among the world's largest emitters, although both cumulatively and on a per capita basis, they remain much lower than the U.S. (see table 1 and 2)[6]. Climate policy cannot ultimately succeed without these countries, any more than it can without America or the rest of the developed world. However, there is room for optimism: in many cases these countries are already taking serious action – more so, in some ways, than the US.

Table 1. Greenhouse gas emissions of the 20 largest emitting countries, 2000

Country	MtC	Rank	% of World Total	Tons C Per Person	Rank
United States of America	1,765.5	(1)	15.65%	6.3	(14)
China	1,341.7	(2)	11.89%	1.1	(122)
European Union (25)	1,288.5	(3)	11.42%	2.8	(53)
Indonesia	837.3	(4)	7.42%	4.1	(24)
Brazil	606.3	(5)	5.37%	3.5	(38)
Russian Federation	537.6	(6)	4.77%	3.7	(33)
India	504.6	(7)	4.47%	0.5	(163)
Japan	370.1	(8)	3.28%	2.9	(50)
Germany	276.6	(9)	2.45%	3.4	(40)
Malaysia	233.5	(10)	2.07%	10.2	(4)
Canada	204.3	(11)	1.81%	6.6	(12)
United Kingdom	179.3	(12)	1.59%	3.0	(47)
Mexico	169.9	(13)	1.51%	1.7	(93)
Italy	144.4	(14)	1.28%	2.5	(67)
Korea (South)	142.0	(15)	1.26%	3.0	(45)
France	139.8	(16)	1.24%	2.4	(69)
Myanmar	138.8	(17)	1.23%	2.9	(51)
Australia	135.2	(18)	1.20%	7.1	(9)
Iran	132.1	(19)	1.17%	2.1	(75)
Ukraine [1]	131.6	(20)	1.17%	2.7	(61)

Source: WRI, Climate Analysis Indicators Tool, http://cait.wri.org

Table 2. 2005 Data, CO_2 emissions only

Country	National total (Million tons C)	% Total	Per Capita Emissions (Tons C)
United States	5,956.98	24.3%	20.14
China	5,322.69	21.7%	4.07

[6] Unfortunately, adequate, up-to-date information on GHG emissions from all countries is missing; while CO2 data is available for 2005, six gas data is only available for three years: 1990, 1995 and 2000. It remains difficult to properly assess recent development in non-CO2 gas emissions or to assess policy effectiveness in the absence of such data.

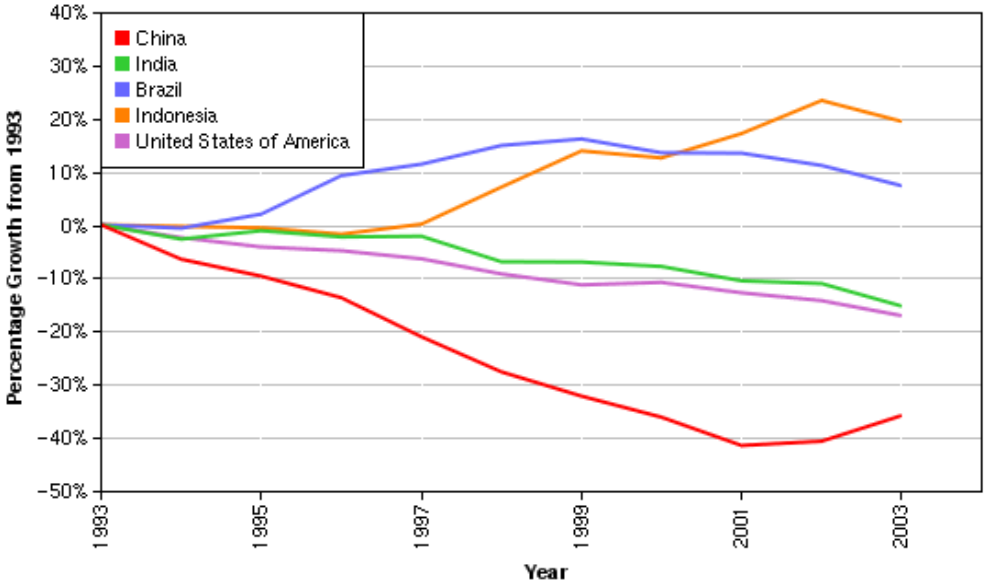
Russia	1,696.00	6.9%	11.88
Japan	1,230.36	5.0%	9.65
India	1,165.72	4.7%	1.07
Germany	844.17	3.4%	10.24
Canada	631.26	2.6%	19.24
United Kingdom	577.17	2.4%	9.55
Korea, South	499.63	2.0%	10.27
Italy	466.64	1.9%	8.03
Iran	450.68	1.8%	6.96
South Africa	423.81	1.7%	9.56
France	415.27	1.7%	6.59
Saudi Arabia	412.35	1.7%	15.61
Australia	406.64	1.7%	20.24
Mexico	398.25	1.6%	3.75
Spain	387.11	1.6%	9.60
Brazil	360.57	1.5%	1.94
Indonesia	359.47	1.5%	1.57
Ukraine	342.57	1.4%	7.30

Source: DOE EIA, http://www.eia.doe.gov/environment.html

WRI maintains a database of national climate change policies in key developing countries to supplement a compendium of energy related policies in OECD countries maintained by the International Energy Agency[7]. Policies range widely, from those designed to promote alternative fuels or transport (e.g., the Brazilian ethanol program) to those that promote energy efficiency and conservation in the top 1000 companies in China. The effectiveness of national policies can be seen in the fact that the CO2 intensity of major developing country economies is declining – in some case (e.g., China), even faster than in the US (see figure 3). National circumstances continue to be hugely influential: in Brazil, for example, new energy demand has largely been met by natural gas, which, while the least CO2 intensive of any fossil fuel, generates enormously more CO2 than does the zero-emitting hydro-power that it has supplemented.

[7] The WRI data base, which includes policies from Argentina, Brazil, China, Costa Rica, India, Indonesia, Iran, Malaysia, Mexico, Nigeria, Pakistan, Philippines, Sauda Arabia, Singapore, South Africa, South Korea, Thailand, and Turkey can be found at: http://cait.wri.org/sdpams/search.php The IEA database, with information focused on IEA member countries as well as limited information on policies adopted by several developing countries, can be found at: http://www.iea.org/textbase/pm/

Figure 3. CO2 intensity of national economies, 1993 - 2003



Source: WRI, CAIT

The international framework must include a structure to allow these actions to be recognized and reviewed. This was missing from the Kyoto Protocol, and will need to be added. A number of options exist to promote such developing country efforts. One of the most prominent focuses on the concept of "Sustainable Development Policies and Measures" or SD-PAMS.

Sustainable Development Policies and Measures (SDPAMS)

For many developing countries, the highest priorities are major domestic problems: health, access to electricity, clean air and water, and a growing economy. The SDPAMs approach starts from the premise that these policies can be implemented in a way that simultaneously reduces GHG emissions.

Two examples help illustrate the point:

(1) Energy security and climate: meeting energy needs is a growing concern not only for the US, but also for China, India, and others. China is expected to import 75% of the oil it consumes by 2030. Any policy that reduces its demand may have enormous benefits. Thus, fuel efficiency standards, or efforts to switch from oil/diesel electric generation to renewable energy or nuclear power would be valuable. Each of these would also lead to a reduction in associated GHG emissions. China, acting on the basis of an energy security constraint, could also mitigate its climate footprint. Of course, not all security measures would necessarily be beneficial: if China increases its coal liquefaction program without CO2 sequestration, its emissions would rise precipitously, even though its energy security problems might be diminished.

(2) Clean air and climate: Another serious problem facing many cities in the developing world is increasing air pollution. As vehicle traffic increases and dirty industry and power generation grow, air quality declines, with related consequences for human health and welfare. Solutions to promote clean air – switching from coal to gas, increased automobile efficiency, improved mass transit, and process standards for industry can all improve the local pollution problem while simultaneously reducing the GHG footprint.

A successful SDPAMS approach will need to be country specific, and issue specific. It will need to build on the domestic priorities, and find synergies between development agendas and climate. This will require technical inputs on the US government side from agencies like DOE, EPA, DOC and AID, and on the private sector side from both multinationals and from small and medium sized enterprises. Congress will need to create systems to encourage such engagement – and push the State Department, DOC and USTR to open opportunities for trade relationships so that markets in such new technologies and systems can be easily developed and exported.

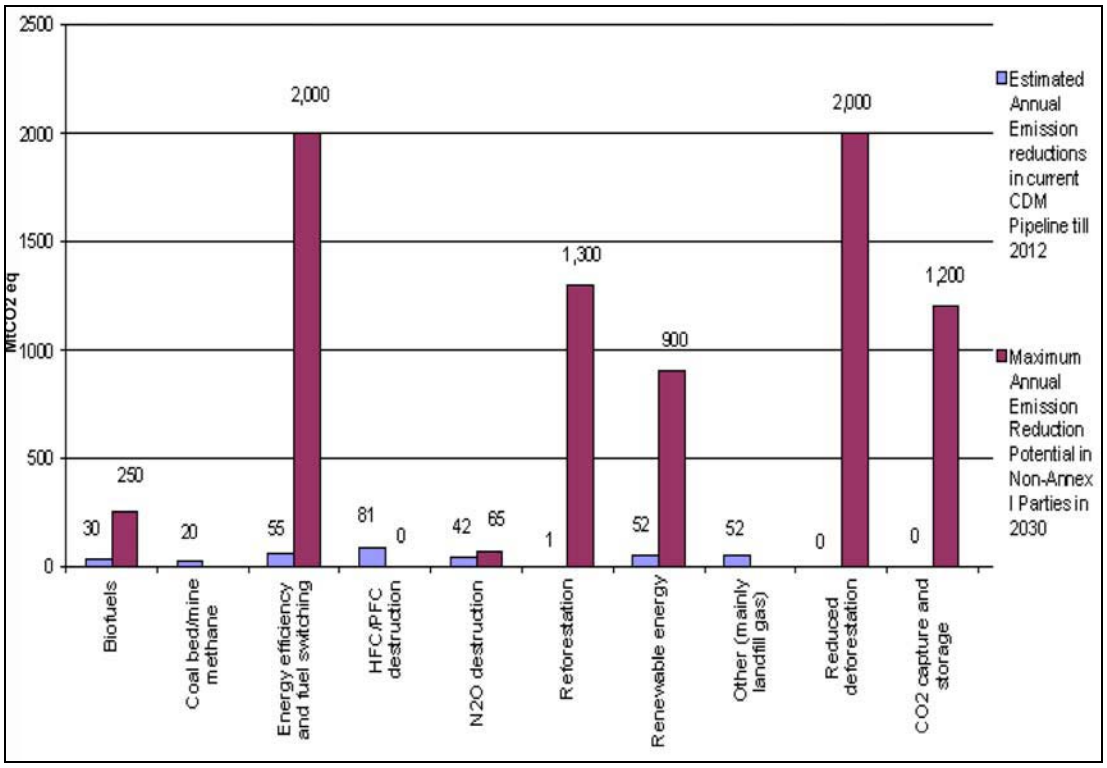
Developing countries too will support such an approach – but it must meet both their local development needs and business interests. The US (and OECD) role in promoting SDPAMS is central. It will mean working to create fair trade agreements in new technologies, and will likely lead to increased competition for the manufacturers of such low cost technological solutions. Historically, US companies have done well in such markets; we need to develop the skills to do well in this new world of environmental technology too. However, this market will develop whether or not we participate. The issue for the US is whether we will play "catch-up" as we have done for many of the telecoms and automotive applications that were invented in the US but built elsewhere, or whether we will be market leaders, with the concomitant economic wealth creation that such leadership brings.

None of this global developing country engagement effort will come cheaply. According to information presented by UNFCCC Executive Secretary Yvo de Boer at the "Dialogue on Long-Term Cooperative Action" held in Vienna –August 28, 2007, the additional estimated investment and financial flows needed in 2030 is large compared with the funding currently available under the Convention and the Kyoto Protocol, but small in relation to estimated GDP (0.3 to 0.5%) and global investment (1.1 to 1.7%) in 2030. DeBoer suggested that mitigation measures needed to return global GHG emissions to current levels in 2030 would require additional flows between $200-210 billion in 2030, while additional flows needed for adaptation in 2030 amount to several tens of billions of dollars[8].

The UNFCCC, in a paper analyzing the technologies and the need for investment to implement those technologies, suggests the potential for emissions reductions is very large – and that only a small fraction is being undertaken through the existing offset projects (see figure 4).

[8] See Yvo deBoer, "Investment and financial flows to address climate change", 2007 http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/presentation_yvo.pdf

Figure 4. Emissions reduction potential and current CDM pipeline



Source: UNFCCC, http://unfccc.int/files/cooperation_and_support/financial_mechanism

It is clear that this funding will be incremental to what is already expected to be spent on energy and infrastructure over the next several decades. Both national governments and the private sector will play a key role in raising and directing these financial flows. Thus, there is a critical role or the US in "greening" the financial sector – including not only private equity incentives, but also more direct prodding of the multilateral development banks – and the creation and funding of new international mechanisms. This is further discussed below, in the section on technology development and penetration.

One additional point might be made with respect to developing country engagement: trade measures to compel action may backfire on the US. It is generally assumed that major developing countries are much less efficient in their use of energy than the United States and other developed nations, and that production in those countries generates greater emissions. Thus, it has been proposed that the US impose border tax adjustments or other trade measures to assure US industry is not competitively disadvantaged. For the economy as a whole, the US may well be more efficient. However, in some important sectors in which US industry competes with developing country producers it is not the case. For instance, in aluminum production the most efficient plants are in Africa, with US and EU producers the least efficient, largely because their capital stock is the oldest. Conversely, US steel production is low in emissions because it uses scrap metal rather than iron ore as a feedstock. If foreign competitors started bidding up scrap prices in

response to carbon constraints the competitive advantage of US producers could disappear. This is worth bearing in mind as we consider trade measures aimed at less efficient producers in global markets. Such measures do not always favor US producers, and in some cases more cooperative action may be possible in specific sectors.

3. Technology development and penetration

There is a widespread consensus that solving the climate change problem will require the development and rapid penetration of new technology. Innovation will be needed in all sectors – and appropriate policies will be required to ensure rapid diffusion.

While there will be some costs to this technology development and diffusion pathway, there will also be enormous opportunities: the new technologies in a low-carbon world represent a major new set of markets. The Clean Energy Trends report[9] estimates that the markets for renewable and hydrogen technologies will have quadrupled from $55.4 billion today to more than $226 billion in 2016. These include:

- Global biofuels market: $20.5 billion (2006) - $81 billion (projected 2016)
- Wind power market: $18 billion (2006) - $60.8 billion (projected 2016)
- Solar PV market: $15.6 billion (2006) - $69 billion (projected 2016)
- Fuel-cell and hydrogen market: $1.4 billion (2006 - $15.6 billion (projected 2016)

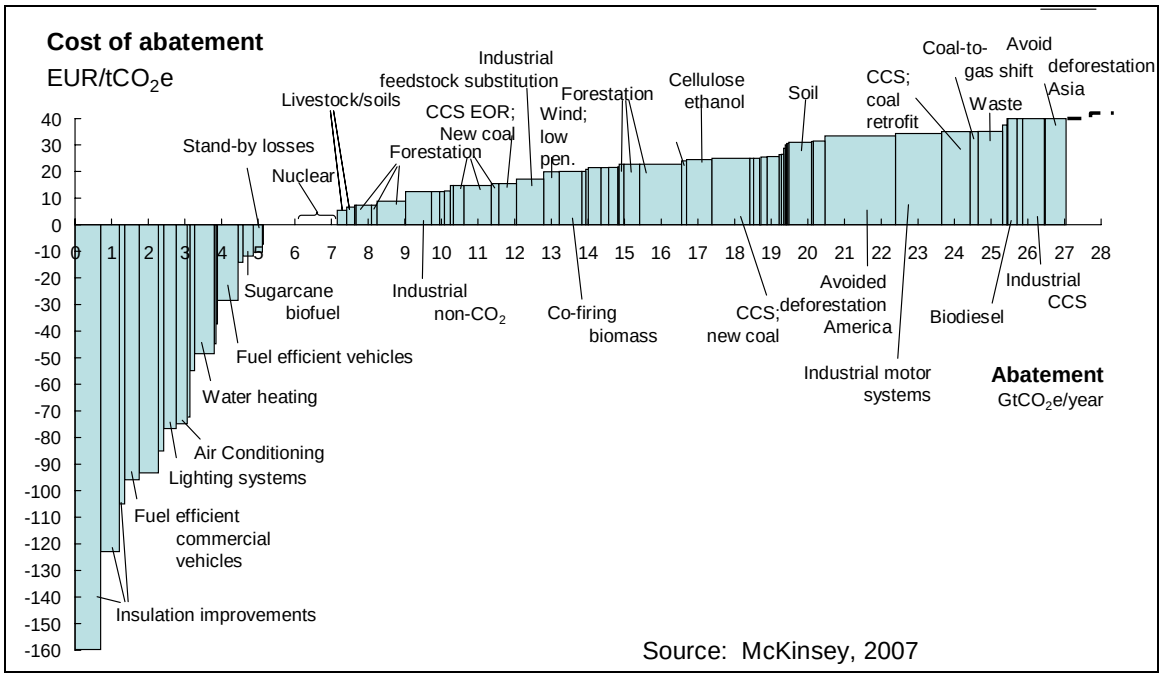
Fundamental to the development of any new technology is the confidence that there is a market for it; and this principle applies equally to the low-carbon energy technologies needed to fight climate change. Those that present "technology approaches" as an alternative to a market-building mechanism such as cap and trade present a false dichotomy: a cap and trade system, if adopted, will be by far the most important driver of new low-carbon technologies. Without it, other technology-based efforts are likely to have minimal effect. It is recognition of this reality that a group of America's most prominent corporations united with leading NGOs in January 2007 to call for mandatory carbon limits in the United States[10]. Leadership in climate policy is not just about moral responsibility: it also places innovative US companies at the heart of these new markets.

Targeting specific technologies is made more challenging by the large range of options. Figure 5 shows one analysis of the technologies that can contribute to reducing emissions. As is apparent, in some cases these can entail costs of more than €40/ton, while in others there is the potential to both reduce emissions and save money through implementation (often through removing a range of non-technical barriers).

[9] For a full report, see the Clean Energy Trends report at http://www.cleanedge.com/reports-trends2007.php

[10] See US Climate Action Partnership: "A Call for Action". http://www.us-cap.org

Figure 5: Marginal abatement costs of technologies



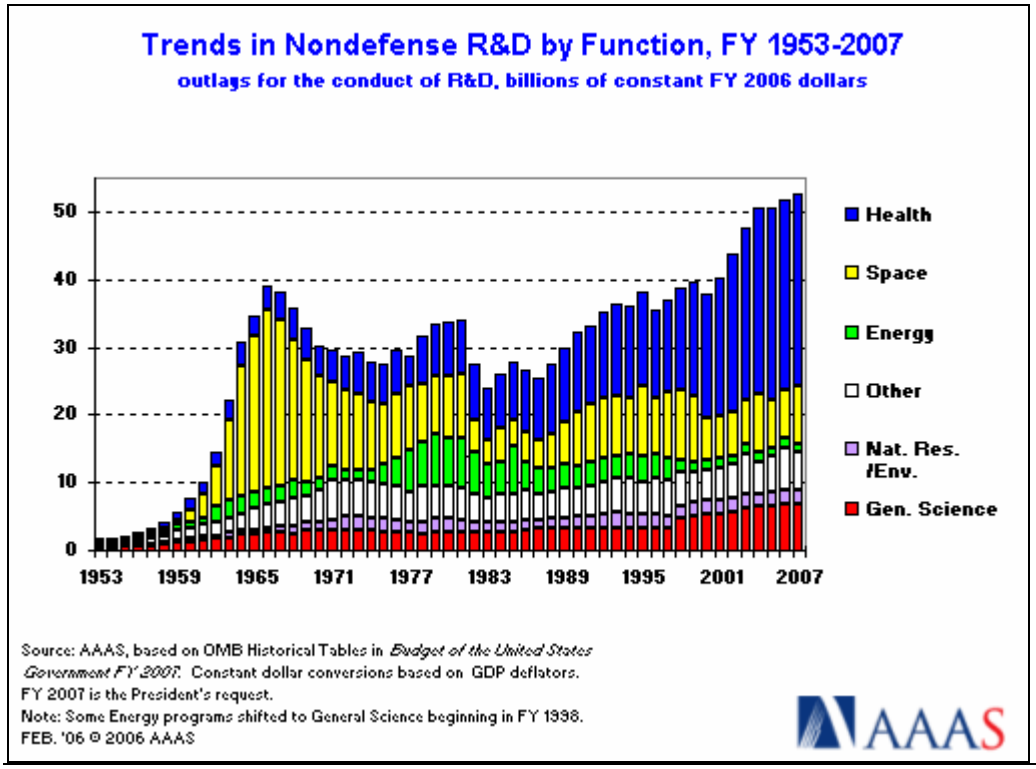
There are a number of complementary measures that can help bring new technologies to the market. Three deserve highlighting: research and development; pre-commercial demonstration; and funds and related mechanisms to transfer technology to poorer countries.

Boosting R&D

Energy technology development is, according to the U.S. Administration, a "high-priority national need." Certainly the concerns raised by climate and energy security concerns would support this assessment. But despite this, federal funding for energy research has been steadily falling since 1980. Federal funding for energy R&D has hovered between $2.31 billion and $3.45 billion for the past twenty years[11], compared to recent expenditures exceeding $20 billion for medical science, for instance (see figure 6).

[11] IEA "Energy R&D Database" http://www.iea.org/RDD/ReportFolders/ReportFolders.aspx

Figure 6. Trends in US R&D



Source: AAAS 2006. *AAAS REPORT XXXI: RESEARCH AND DEVELOPMENT FY 2007.* http://www.aaas.org/spp/rd/rd07main.htm.

Nor is this a uniquely American phenomenon. A recent survey of eleven of the biggest energy R&D funders[12] demonstrated that energy R&D spending worldwide has indeed stagnated (See Figure 7). In every country surveyed, the ratio of energy R&D to GDP declined significantly between 1975 and 2003.[13]

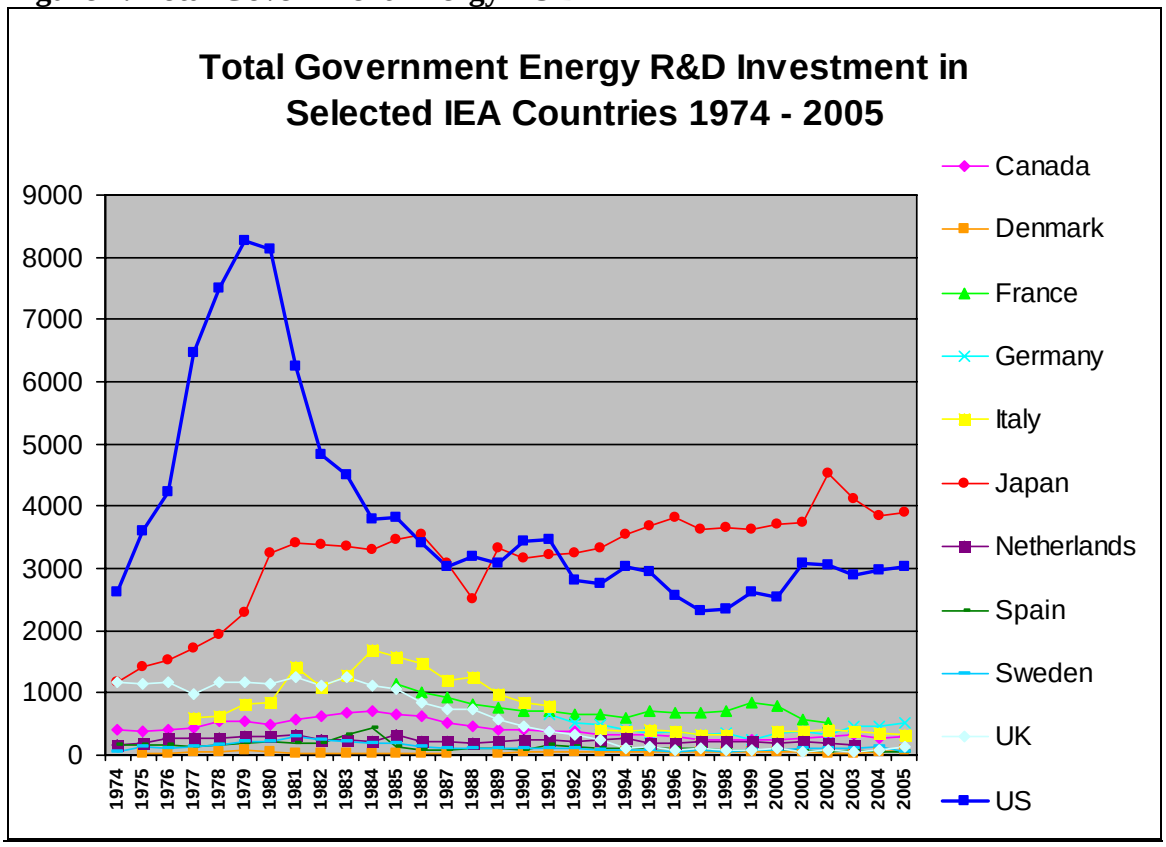
One argument for reducing government R&D is that it allows the private sector to step into its place. However, private sector spending on energy has actually fallen: it is now around a quarter of the 1985 level in absolute terms.[14]

[12] US, Japan, Canada, Denmark, France, Germany, Italy, the Netherlands, Spain, Sweden and the UK

[13] Runci, Paul. 5005. *Energy R&D Investment Patters in IEA Countries: An Update.* Pacific Northwest National Laboratory/Joint Global Change Research Institute Technical Paper PNWD-3581.

[14] American Association for the Advancement of Science (AAAS). 2006. "A Guide to R&D Funding Data." http://www.aaas.org/spp/rd/guide.htm .

Figure 7: Total Government Energy R&D

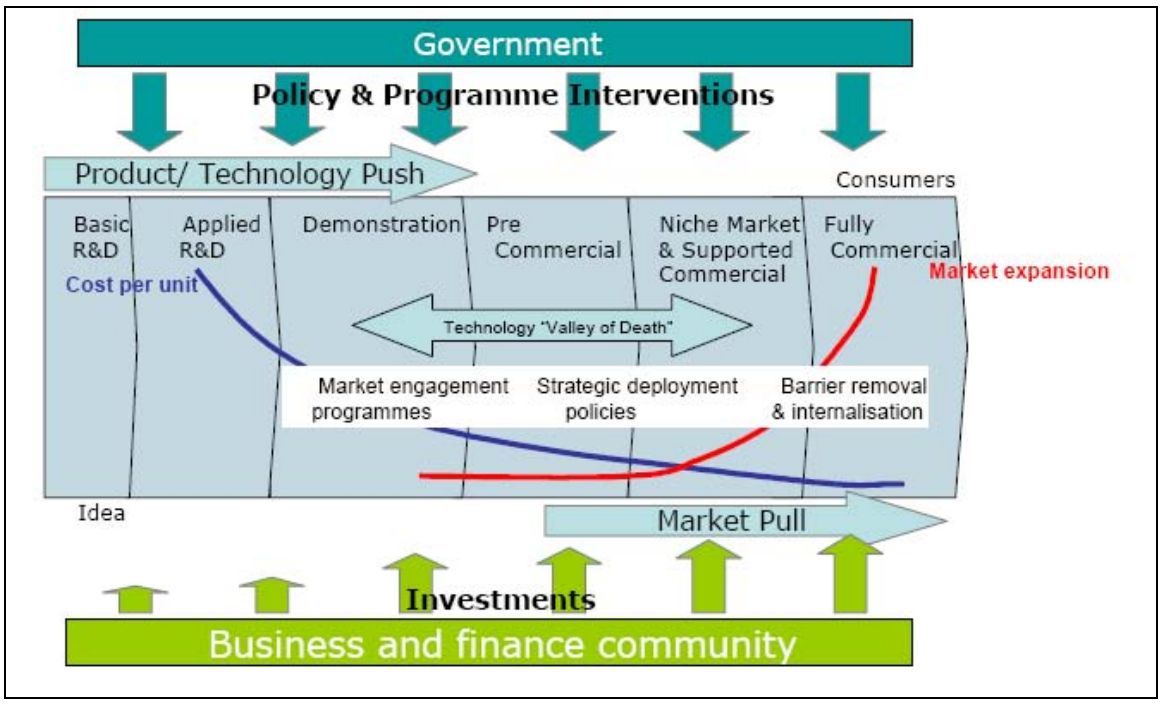


Source: IEA R&D Database/Runci

Pre-commercial demonstrations: Bridging the "valley of death"

Between the research and development phase and the full commercialization of a technology there is a need for commercial scale demonstrations. Particularly for large, capital-intensive technologies private investors tend to shy away from being the first in class. On the other hand, such commercial-scale demonstrations can be expensive, and require judgment from governments as to when to withdraw from the market and let the private sector take over. This gap is sometimes referred to as the "valley of death" in technology development.

Figure 8: Government and Industry Roles in Technology Development



Source: Grubb, Michael. 2006. The Economics of Low Carbon Innovation. Presentation to "Workshop on Understanding Transatlantic Differences". Washington, DC. March 2nd 2006.

In the case of many technologies there remains a significant role for government to partner with private sector players to build demonstration projects. In some cases technologies suffer from high perceived risks, and demonstration projects can reassure investors that might otherwise shy away from large, capital-intensive technologies that lack a proven track record. In addition, some technologies will be needed under significant carbon constraint but will not be developed until that constraint is clearly impending.

For instance, Integrated Combined Cycle Gasification (IGCC) is a relatively novel technology for power generation from coal and other feedstocks. Since it produces a flue gas that is high pressure and CO_2-rich, it is expected to play a major role in the implementation of carbon capture and storage (CCS). However, in the absence of adequate incentives for CCS it is less attractive than alternatives. Although it emits very low levels of criteria pollutants, without CCS it is no more efficient than other modern technologies such as ultra-supercritical pulverized coal (USCPC), costs roughly 20% more to build, and suffers from a limited track record and perceived reliability problems. Establishing a track record for this technology has the potential to accelerate the eventual implementation of CCS. The FutureGen project[15] is one example of government and

[15] FutureGen Alliance, http://www.futuregenalliance.org/

private sector partnership in producing demonstration projects, but the IEA argues[16] that at least ten such demonstrations will be necessary, costing from $500 million to $1 billion each.

Fund technology deployment and transfer

As in other areas, the US to date has been longer on rhetoric than performance in establishing funds for technology, and we still lag behind some of our international partners. However, some technology funds do have active US involvement, and in some cases leadership. The following are some examples of existing funds:

- **US Methane to Markets Partnership** aims to advance cost-effective, near-term methane recovery and to promote the of "clean" energy sources. The total leveraged funding from the private sector, partner countries, and international financial institutions exceeds $261 million.

- **The ProRETT** (Promotion of Renewable Energy Technology Transfer) project, developed by the EU, was open to EU member Countries or Observer Countries. The funding for renewable energy is currently at €2.9 billion ($4.25 billion) over the 7 years of the research framework period.

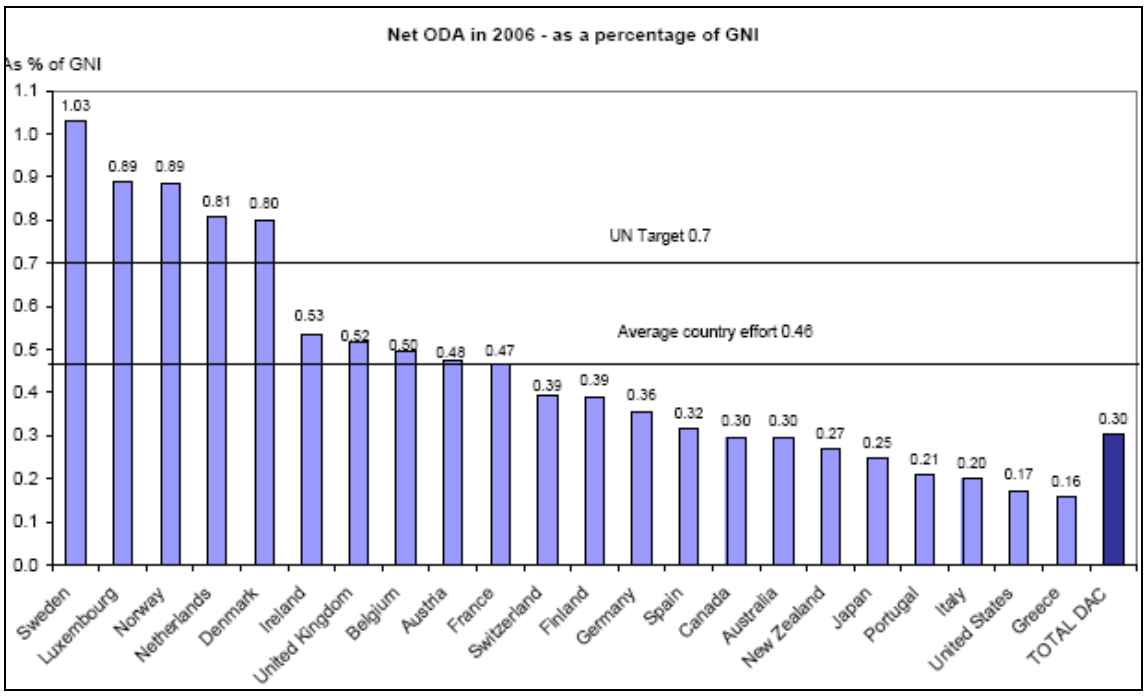
- **GEEREF (**Global Energy Efficiency and Renewable Energy Fund) is aimed at accelerating the transfer, development and deployment of environmentally sound technologies and helping to bring secure energy supplies to people in poorer regions of the world and protecting against climate change and air pollution. The basis of the initial funding is set at €100 million ($145 million) for global coverage, with the aim of leveraging much larger amounts.

- **The international clean technology fund** proposed by the US will aim to help developing nations harness the power of clean energy technologies. The initial proposal was made just before the G8 Summit in Germany this year and is to be structured around government contributions to help finance clean-energy projects in developing countries. At present the fund has no dedicated resources.

These funds are still small compared to Official Development Assistance (ODA), which in 2006 amounted to about $103.9 billion. It is interesting to note that the US is a large donor in absolute terms, spending $22.7 billion in 2006, but small in proportion to the size of its economy. ODA accounts for just 0.17% of Gross National Income, the second lowest percentage after Greece.

[16] International Energy Agency (2006). Energy Technology Perspectives: Scenarios and Strategies to 2050. International Energy Agency, Paris. p.199

Figure 9. ODA as a Percentage of GNI



Source: OECD, 2007

It is clear that the UNFCCC negotiations will provide a forum for only one subset of the technology discussions. In particular, all countries may be prepared to discuss options for the transfer of technology to least developed nations on a preferential basis. However, for the larger discussion on technology development and diffusion, there will be a need to promote more robust markets, as well as cooperative R&D programs. These may be facilitated through language in the UNFCCC, but ultimately will be successful more through bilateral efforts by governments, supported by private sector engagement.

4. Forestry

Forests, and in particular tropical forests, play an important role in the global carbon budget because they can be either sources or sinks of atmospheric carbon. Annual emissions from land-use change (mainly through deforestation and degradation in tropical developing countries) account for approximately 20-25% of the total anthropogenic emissions of greenhouse gases[17]. The top 20 countries ranked according to forest emissions are listed in Table 3. It should be noted that estimates of the magnitude of these emissions are highly uncertain due to several reasons such as a lack of resources, lack of standard methods, lack of capacity at national levels, and lack of data.

[17] See UNFCCC, http://unfccc.int/files/methods_and_science/lulucf/application/pdf/part_i_scientific_issues.pdf

However, broadly speaking, accurate satellite data and careful ground-truthing can yield considerable accuracy for forest cover CO2[18].

Table 3. Top 20 Countries ranked by emissions from land use change and forestry

Country	Emissions from LUCF (MTC)	Non LUCF-Emissions (MTC)
Indonesia	699.5	80.8
Brazil	374.5	91.9
Malaysia	190.7	33.3
Myanmar	116.1	2.6
Congo, Dem. Republic	86.6	0.4
Zambia	64.3	0.5
Nigeria	53.1	21.6
Peru	51.1	7.7
Papua New Guinea	39.8	0.7
Venezuela	39.3	38
Nepal	33.7	0.9
Colombia	28.9	17.3
Mexico	26.5	105
Philippines	25.9	20.5
Cote d'Ivoire	24.9	1.9
Bolivia	22.9	3.3
Cameroon	21.1	1.9
Canada	17.6	144.4
Madagascar	16.5	0.6
Ecuador	16	6.3

Source: WRI, CAIT

Given the scale of the total forest-related emissions, as well as their importance to a number of key developing country parties, there is an increasingly strong momentum in favor of including reductions of emissions from deforestation and degradation (REDD) in a post-2012 climate agreement. Although there remain considerable uncertainty as to what form the REDD inclusion will take, the most prominent proposals depend on large-scale financial transfers through the international carbon markets in which forest commitments are taken at the national level (referred to as a national level crediting approach for REDD).

However, a number of other approaches also exist, and are likely to be considered, including relying exclusively on national forest regulation – perhaps with additional support from international financial aid mechanisms and bilateral donor assistance; or relying on expansion of the project-based carbon offset programs to include forestry (a reversal of current decisions under the UNFCCC that exclude REDD projects from the CDM).

[18] Ibid. While the UNFCCC paper cites an accuracy of 95%, this is a theoretical number that does not include either soil carbon or more importantly, forest degradation, which in Indonesia and the Brazilian Amazon, may reduce carbon by 20-25%.

The World Bank is currently strongly pushing the national crediting approach. The Bank is planning to launch a Forest Carbon Partnership Facility at the Bali session, and has dedicated $300 million to that end.[19] The Bank has recognized the potential pitfalls of such an approach, and is in large measure focusing its pilot effort on addressing the readiness of countries to participate in such a program as well as the methodological and technical problems in the GHG accounting and approval.

Among the most central of these for climate change is the problem of leakage: displacement of activities from one place to another, often outside the jurisdiction of the project implementer (or even the country itself)[20]. While some have argued that leakage is solved by setting a cap at the national level, this may be incorrect. While displacement of activities within a country are largely captured through national approaches, where the demand for timber and other forest products is a principle driver of deforestation, international leakage is very likely to be close to one hundred percent. As demand within both developed and emerging economies increases, it is likely that supply will simply shift to less controlled jurisdictions.

At present, it does not appear likely that any of the UNFCCC mechanisms in isolation could completely halt deforestation. A solution is likely to require a policy structure that focuses less on aggregated deforestation rates and instead provides support for projects, programs, and policies in specific areas – as well as projects that specifically help promote development (the central priority for forested countries and regions). Some of the options available include carbon market driven policies such as an enhanced CDM structure, under which requirements for measures to prevent leakage could be imposed. The SDPAMS model (discussed above) could also prove to be an excellent solution, both in terms of building capacity and targeting the actual drivers of deforestation.

It is clear that any effective mechanism to protect and manage tropical forests will require significant levels of funding. A US policy should thus focus on:

- Recommending to donor and forest countries the testing of a broader range of policy options than just the national crediting approach between now and 2009.
- Working with the multilateral development banks and bilateral lenders to ensure that only a high-quality national crediting approach that links REDD projects with demand reduction efforts in order to reduce leakage moves forward.
- Seeking to build consensus in Bali of the need for a forestry component of the post-2012 agreement to not only address deforestation from a climate perspective, but also to incorporate the non-climate benefits of forest protection, including for biodiversity, local environment and development purposes.

Implementing this policy will require both considerable and sustained political will and resources.

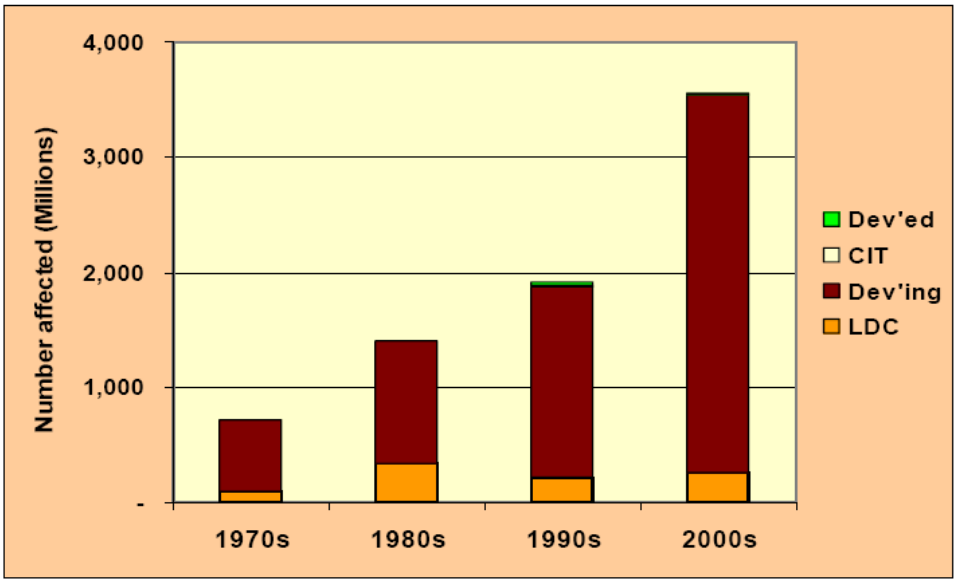
[19] Under the current World Bank proposal, approved by the Board but not yet implemented, $100 million would be used to help countries prepare for participation in a REDD market mechanism, and $200 million would be used to pilot REDD projects

[20] While the Bank has noted the importance of the leakage issue, it will not address the problem through its Forest Carbon Partnership Facility.

5. Adaptation to the Effects of Climate Change

According to the World Bank, nearly 2 billion people in developing countries were affected by climate related disasters in the 1990s, and the rate may double this decade (see figure 10). People in developing countries are more than 20 times as likely to be affected by such disaster as those in the developed world.

Figure 10. Vulnerability to climate change



Source: World Bank, Ian Noble, 2006

Unfortunately, our best projections suggest we are not likely to be on a path that will keep our climate unchanged. This will require adapting to the changes we cannot avoid.

A critical question for developing adaptation policy is whether (in any given circumstance) climate change will be slow and incremental or fast and large scale. If the former, we can and must develop a resilience to change that will enable us, collectively, to cope. Thus, we can work so that we can manage a drought that occurs every 10 years instead of every 12, or a change in rainfall that leads to 10% less water, or an increase in the disease vectors for malaria, or the need to create corridors in addition to parks to protect diversity. In these cases, we need to do a bit more of what we are now doing: more careful husbandry of scarce resources, more medicines, and better planning.

On the other hand, if climate really leads to a step change or significant discontinuity, an incremental adaptive strategy may be counterproductive. A potentially catastrophic example of this may be the city of Lima, Peru: if, as predicted, the glacier that waters the city is melted in 25 years, the city does not have an incremental option – small savings in water will be inadequate. Instead, they need to accept a major change: leave town, begin massive desalination operations, or commence large scale shipping of water into the city.

Clearly, to cope, there will also be a need for massively increased efficiency, and perhaps in the near term, some shifting away from water intensive activities. But over the longer term, these changes will not suffice. The Lima scenario paints a picture less of resiliency than of paradigm change.

A third set of circumstances may occur, in which science is unable to reliably predict whether we face incremental or step change. In these circumstances, the core task of adaptation is not to plan for specific new impacts, but to learn to cope with uncertainty. This calls for investment in robust processes for processing information, making decisions, and responding to the unexpected. The "adaptive" policies and institutions that make such investments effective have yet to be designed, and need substantial creative thought and analysis.

Decisions on how to spend adaptation money thus face the question: "What are we trying to adapt to?" Wasting money on incremental change that could be spent on relocating populations must be avoided; conversely, if incremental shifts are adequate, huge society-wide programs would be equally foolish. And if science cannot predict with certainty when we face incremental or step change, measures are needed that take into account a range of possible climate futures.

One key part of any future international regime will therefore need to consider who will pay for the adaptation required, particularly in the developing world. The sums involved are very large: estimates of climate related impacts range from $10 billion to more than $100 billion per year, and these are only likely to increase. Meeting these costs poses both a moral and a political dilemma. Most developing countries consider historical responsibility in determining who should pay for damages. Under this model (using WRI data) the OECD countries along with the FSU are responsible for about 73% of the contribution to the rise in atmospheric GHG concentrations between 1850 and 2000. This same group of countries also has the capacity to pay: in 2003, OECD & FSU countries produced about 60% of the world total GDP.

However, the politics of such payments are much more difficult. Virtually all OECD countries have seen development assistance decline as a percentage of their GDP. Even including private charitable donations (usually forthcoming in times of massive disaster), we have demonstrated a limited willingness to pay for sustained, long term development priorities.

On the more positive side, there will be business opportunities in disaster preparedness and relief, in the development of technologies that reduce the consequences of climate change such as new drugs, new water savings technologies, and new crops. All of these will reduce the burden that governments must meet. However, Congress has a responsibility too. First and foremost, it must enact a strong climate change program to help minimize global damages. It should consider increasing support for USAID and the various development banks that many of the poorest nations will turn to when disaster strikes. And it should support global agreements, including agreements that include insurance coverage and liability, and financial assistance to alleviate the worst of the suffering that will likely be borne by the world's most vulnerable communities. The US,

and all donor countries, should work to mainstream adaptation into development assistance, and work to remove barriers to trade to facilitate the development of more resilient economies in developing countries that would be less susceptible to climate impacts. Finally there should be an increase in the global budget devoted to fundamental research on adaptation. We will not otherwise be able to cope with what appear to be increasingly certain damages.

Processes

All this will mean frank, sometimes complex conversations with our international partners. The UNFCCC is, and will continue to be the primary forum for engagement on climate change,. Fortunately there is no shortage of additional opportunities for specific exchanges. To cite a few of the most important:

Group of Eight (G8): While the meetings of the G8 Heads of State have long provided an opportunity for discussions of climate change and energy policy, the summit in Gleneagles, Scotland in 2005 (hosted by then-Prime Minister Tony Blair), marked the beginning of a more aggressive phase of climate discussions. At the most recent session, in Heiligendamm, Germany in June 2007, the group (including the US) agreed that climate change is one of the major challenges for mankind and it has the potential to seriously damage the natural environment and global economy. They further agreed that urgent and concerted action is needed and accepted their collective responsibility to show leadership in tackling climate change. To that end, the G8 agreed to consider setting a global goal for emissions reductions, and further agreed to consider seriously the decisions made by the European Union, Canada and Japan which include at least a halving of global emissions by 2050. Finally, the group agreed that the UN climate process would remain the forum for negotiating future global action on climate change, and committed to moving forward in that forum, with a view to achieving a comprehensive post 2012-agreement (post Kyoto-agreement) that should include all major emitters. Japan, host of the next G8 meeting in June 2009, is committed to continuing to use the sessions as an opportunity to further develop a common policy for limiting climate change, including not only energy related emissions, but also those related to land use change and forestry.

Major Economies Meeting (MEM): The United States convened the first Major Economies Meeting in late September 2007. Bringing together senior representatives from seventeen major economies (a group nearly identical to the top emitters group as defined in table 1), the session highlighted the importance of establishing a long-term global goal for greenhouse gas reduction in balance with sustainable development objectives. There was wide agreement that all nations would need to act to advance the global goal. The discussions emphasized the importance of enhancing investments in technology, and the need for financing clean energy technologies in the developing world, with considerable attention also paid to the need to address adaptation in concert with efforts to mitigate climate change. While the MEM session did bring a critical group of countries to the table, it is too soon to tell whether the sessions (of which several

more are planned) will bear fruit. A considerable skepticism exists as to whether the sessions are a forum for agreement, or rather, a venue in which rhetoric outweighs action. Some clarity on how the US intends to work with the group may emerge at the session in Bali – where the US efforts to bring the results of the MEM discussion into the UNFCC process, as agreed in the G8 dialogues (at at the MEM itself) will be tested.

United Nations High Level Event on Climate Change: On September 24, 2007, the UN Secretary General convened a high level session (one day before the opening of the UN General Assembly). The session focused on four themes: adaptation, mitigation, technology, and financing. While there was no consensus outcome from the session (nor was one sought), it was clear that the delegates were in overwhelming agreement: the climate problem was real and increasingly severe; damages were already being observed and immediate steps were needed to mitigate damages and reduce future climate change. Technology was widely considered a key element for any success, and adequate financing – both to alleviate current impacts, and to mitigate emissions, including through the development and integration of new, low GHG technologies, would be required. Perhaps the strongest conclusion was a general agreement on the need to come together and work through the UNFCCC, beginning with the meeting in Bali, Indonesia in December 2007, to take appropriate steps toward an agreement that could enter into forced no later than 2012[21].

Asia Pacific Economic Cooperation (APEC): At their most recent session in early September 2007 (held in Sydney, Australia), the leaders of the APEC countries[22] agreed on the need for global action to address climate change, while also reaffirming the need to take account of differentiated responsibilities and capabilities. Emphasis was placed on the need to develop new, low and zero emitting energy technologies, as well as on combating deforestation, while promoting open trade and investment. As with dialogues in the UN, in the MEM and in the G8, three was agreement that the appropriate forum for international negotiation would be the UN Climate Convention, and the group called on those negotiations to reach an agreement on a post-2012 arrangement that would reduce global GHG emissions. In a more concrete vein, the group agreed to work together to increase energy intensity 25% by 2030 (and called on each member to set national goals), to increase regional forest cover by 20 million hectares by 2020, and to establish a new network for the exchange or information on low emitting energy technologies. Follow through, both on the general agreement to support the UNFCC, as well as on specific target efforts is to be reviewed at subsequent APEC sessions.[23]

[21] For a copy of the Secretary General's meeting summary, see: http://www.un.org/climatechange/2007highlevel/summary.shtml

[22] APEC countries include: Australia; Brunei Darussalam; Canada; Chile; People's Republic of China; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; Philippines; Russia; Singapore; Chinese Taipei; Thailand; United States; Viet Nam

[23] For a full copy of the APEC statement on climate change, energy security and clean development, see: http://203.127.220.67/etc/medialib/apec_media_library/downloads/news_uploads/2007aelm.Par.0001.File.tmp/07_aelm_ClimateChangeEnergySec.pdf

Asia Pacific Partnership (APP): The APP[24], created by the US in 2006, is focused on accelerating the development and deployment of clean, low or zero emitting technologies. In particular, the group, composed of representatives of both governmental and private sector partners for the six major Asia Pacific economies, is examining opportunities through eight task forces: (1) Aluminum, (2) Buildings and Appliances, (3) Cement, (4) Cleaner Use of Fossil Energy, (5) Coal Mining, (6) Power Generation and Transmission, (7) Renewable Energy and Distributed Generation, and (8) Steel. The US chairs or co-chairs the task forces on power, aluminum, coal and buildings. While the group acknowledged its interest in being consistent with the principles of the UNFCCC, its emphasis is on technology development – with a specific private sector focus. As of the 2nd Annual Meeting (held in New Delhi in October 2007), the group had endorsed 110 specific projects, although details of the extent of implementation of these is difficult to ascertain. In 2006, the US proposed a $50 million budget for the APP, significantly less even than the Australian contribution of $75 million. The APP provides an excellent tool for public-private partnerships and the direct business participation in efforts to reduce GHG emissions. However, while the program promotes business collaboration and technology interchange in a way the purely government fora do not, to date its impact has been limited by the lack of a U.S. commitment to clear leadership and clearly expressed GHG limitation goals and by the differential way the U.S. treats collaboration with the developing country members – China and India.

All these processes and others[25] have a role to play in helping shape a climate deal. However, as indicated above, all of them have repeatedly emphasized, with the agreement of the U.S., that the central process for the development of a post-2012 climate agreement is under the United Nations Framework Convention on Climate Change (UNFCCC). Thus, actions the US and other countries take through that forum will dictate the ultimate stringency and effectiveness of the post-Kyoto regime.

A pathway to engaging China

As we are all aware, Chinese emissions are rising rapidly. The International Energy Agency projects that China will surpass US in total energy consumption within the next few years[26] – not surprising given reports that indicate China is building a new power plant nearly every week.

[24] Current APP members include Australia, Canada, China, India, Japan, Republic of Korea, and the United States.

[25] In addition to the fora discussed here, which are either climate specific or which have a broader political agenda where climate change is only one element, there are several new fora focused on forests, including the Asian Forest Partnership and the Asia Pacific Forest Law Enforcement and Governance Process. In addition, China has proposed a new Asian forest network to examine the link between forest and climate in the context of APEC.

[26] International Energy Agency, World Energy Outlook, 2007.

However, even though it is characterized (legitimately) as a developing country under the UNFCCC context, China none-the-less has adopted a significant climate change policy, albeit one that uses a different mix of policy tools than either the European or the U.S. model[27]. In responding to energy security, air pollution, and water and soil degradation issues, China's climate strategy to date has highlighted three key elements:

- *Increasing energy efficiency*. China's target is to reduce energy intensity per unit GDP by 20% between 2006 and 2010 (the 11th Five Year Plan Period). This target codifies the national commitment to reverse the trend of the previous five years, where China, for the first time since the period of economic reform, lost ground in its energy intensity. As part of its efficiency agenda, China has also adopted strong automobile efficiency standards (stronger even than those proposed by California), and it is concurrently raising gas prices to market levels. The combination should significantly limit the growth in Chinese demand (although not enough to offset the large numbers of new vehicles and vehicle miles traveled).
- *Increasing the use of renewable energy*: China's goal is to increase renewables to 15% of the overall energy mix by 2020. This goal is coupled with additional measures to reduce the overall amount of coal in the energy mix (where it still accounts for over two-thirds of total energy use and over three-quarters of electricity generation). Complementary policies in the energy sector include increasing the use of nuclear energy, encouraging methane capture for energy, and increasing the use of natural gas.
- *Increasing forest cover and implementing land-use policies that reduce soil degradation and increase carbon capture*. Reforestation efforts within China have long been consistent and impressive. Anyone who compares a recent visit to the tree-surrounded Great Wall to a postcard of a similar vantage from the first half of the 20th century will be surprised at the previous view of bare hills. Since 1990 forest cover in China has grown from 14 to 18% -- although this has come in no small part as a consequence of rapidly increased imports of forest products from other parts of the world.[28]

Other than reforestation, these goals are very much works in progress. For China to meet its own energy efficiency and renewable energy goals will be extremely challenging. Success will in part be a function of the extent of the technical support China receives to meet these goals. Policy-making in China is typically an iterative process: first a goal is set. Then, if it is not met immediately, implementation is reviewed, new policies are issued and implementation is progressively strengthened.

[27] For details of the Chinese climate policy, see "China's National Climate Change Programme", relased in June 2007, and available at: http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/File188.pdf

[28] Between 1997 and 2005, the value of Chinese forest product imports rose from $6.4 billion to $16.4 billion, and the volume more than tripled See " China and the Global Market for Forest Products: Transforming Trade to Benefit Forests and Livelihoods" available at http://environment.yale.edu/posts/downloads/a-g/China_and_global_markets_for_forest_products.pdf

China is currently developing the tools it needs to meet its goals, including the "1000 Enterprises Program" for energy efficiency; energy conservation and renewable energy laws; new public transportation initiatives; and improvements in efficiency in the building sector. China's industrial energy efficiency goal is to reduce its emissions by 100 million tons coal equivalent between 2006 and 2010 compared with business-as-usual. This corresponds to about a 15% energy intensity improvement and constitutes the equivalent of 240 million tons of CO2 averted. The program, while quite new, appears to be on track: In 2006, China averted 20 million tons of coal equivalents under this program.

China does not yet use energy in buildings at anywhere near the rate that we or the Europeans do: Residential efficiency efforts are also underway. Chinese use of energy per square meter of building space is about 30 kwh/m^2 in rural areas, and 65 kwh/m^2 in urban areas (less than a third of the US average and less than half of the EU average[29]). While these levels will undoubtedly increase, and the Chinese have put in place a number of measures, including insulation requirements and other building standards, promotion of compact fluorescent lights, improved appliance standards and improvements in the efficiency of building materials production to try to stem the rate of increase. For example, China, which makes 70 percent of the world's light bulbs, has agreed to phase out incandescent bulbs in favor of more energy-efficient ones, part of a push by the Global Environment Facility (GEF) to phase out incandescent bulbs globally. China is the first developing country to agree to join this program, and the facility will invest about $25 million for the Chinese program alone.

China has just begun to implement serious metrics to monitor these programs, and to develop performance benchmarks for progress. Additional tools will be needed in this area, as well as in the financing of clean energy projects, and in innovating new approaches to technology adoption. These offer potential areas where the international community can offer technical assistance. The discussion above, on technology development and penetration, suggests additional opportunities for both US and China in this area.

China's goals are ambitious, and will likely be difficult to meet. A combination of factors will be key for success. Perhaps foremost among these will be a commitment by the developed world to collaborate with China and work jointly to develop the tools it needs to reach these goals. This includes much more active engagement by USG agencies in joint research and implementation of energy conservation and renewable energy technologies in China. The limited engagement thus far by both the USEPA and the Department of Energy's National Laboratories has yielded concrete results in both areas, but the scale has been far lower than what the Chinese need to bring the needed technologies to scale.

To resolve the big question that hangs over the heads of our large developing country counterparts and ourselves – how to use coal without emitting CO2 – we will need heavy

[29] Respectively the EU and the US are 187kwh/m^2 and 146 kwh/m^2

investment. Effective uptake of this technology will be enhanced if major research institutes and industry in both the US and China are parts of the teams developing the intellectual property to begin with. Furthermore, U.S. government- funded projects should be linked to counterpart projects around the world. We need to deploy these technologies everywhere quickly, without complex or expensive premiums.

Ultimately, Chinese climate change policy, like that of the United States, will not be driven by international priority setting, but by a domestic acknowledgement of the urgency of the problem, and a clear internal sense of the importance of acting. China is on the early steps of a road to developing and implementing a strong climate program. While the legitimate question remains as to whether it will be large enough and soon enough to avert the worst of the global damages, it is already at least the equal of the U.S. climate policy effort. Moving forward, the United States, through a strong bilateral engagement with China, through active and constructive participation in the international climate dialogue, as well as through setting our own aggressive domestic agenda, can certainly help foster a continued, effective Chinese climate policy.

What we need from Bali

Next month, The Conference of Parties to the UNFCCC will hold its 13th session in Bali, Indonesia. The Bali meeting is perhaps the most critical UN climate meeting for many years. Its principal objective is to successfully launch the negotiations for a post-2012 climate agreement. Swift progress on these negotiations will be necessary to ensure that agreement can be reached by 2009 to set the world on a fair and effective road to managing the climate challenge.

The key features of the Bali agreement will need to include:

1. A mandate to negotiate a new international agreement by 2009
Given the time that it takes countries to ratify and implement international agreements, in order to avoid a gap following the first commitment period under the Kyoto Protocol (which ends in 2012) the post-2012 agreement must be negotiated and agreed by 2009. The negotiation of such a framework will not be simple, so it is important to begin immediately. The United States should clearly signal that it will abandon its strategy of obstruction and support a timely and effective agreement.

2. Processes to frame both developed and developing country commitments.

The most efficient and effective process would be comprehensive, seeking to deal with all outstanding issues under a single umbrella. To date, the US has called for a two track process – one for Parties committed to the Kyoto Protocol (with its emissions trading and market mechanisms) and one for everyone else. This insistence on a two track approach weakens the prospect of eventually getting key developing countries to take actions.

Until the US has a strong domestic cap and trade system in place it may be hard for us to reenter the discussion of targets with much confidence, or indeed with much credibility.

However, the world is likely to look favorably on any serious US efforts to rejoin an emerging agreement as soon as it finds the resolve to do so. In Bali, even if we cannot bring ourselves yet to contribute to the discussion on new commitments, we should at least not block them.

In addition a mechanism to pledge and review varied types of actions from developing countries needs to be introduced. This would be a new development compared to the Kyoto Protocol as it now stands. Such mechanisms, which must be introduced in Bali, need not be agreed there; instead, they would be developed over the span of the next two years, prior to reaching an agreement in 2009. Provisions should be made for including a comparison of national efforts, so that negotiating countries can satisfy each other that each is taking real and substantive measures to control emissions, commensurate with their capacity and level of development.

3. New mechanisms to reduce the destruction of tropical forests.
In some major countries, notably Brazil and Indonesia, the majority of human emissions come from deforestation rather than fossil fuels. Mechanisms are needed to protect these forests, not just for the carbon they contain but because of their inestimable value as havens of biodiversity and home to millions. Again, a final agreement is not required at the Bali session; rather, the meeting must agree to launch a process, to conclude by COP 15 in 2009, to agree on how to handle these critical emissions.

4. New commitments to help the most vulnerable adapt.
Both the UNFCCC and the Kyoto Protocol include mechanisms to help vulnerable populations adapt to the impacts of climate change. Only now are these (still very limited) funds about to become operational. The US can lead by example in pledging greater help, both through multilateral mechanisms and through the recommendation of other, new instruments such as USAID programs and other bilateral assistance. Such efforts will be central to ensuring the success of both a climate agreement in 2009 and to long-term efforts to cope with the global damages of climate change.

A chance for the United States to show its colors

Above all, Bali is an opportunity for the US to reengage. After years of seeing the US standing aloof from, or even obstructing, international progress in the fight against climate change, our international partners are more optimistic. Most are aware of the extensive efforts underway at the State and local level within the US (indeed, many discussions are underway about linking national programs to State efforts[30]). Countries

[30] At a meeting held in Lisbon, Portugal on October 29, 2007, leaders of more than 15 governments met to launch the International Carbon Action Partnership (ICAP), a partnership of countries and regions that have implemented or are actively pursuing the implementation of carbon markets through mandatory cap and trade systems. The partnership provides a forum to share experiences and knowledge. Members include: European Commission; France; Germany; Greece; Ireland; Italy; Netherlands; New Zealand; Norway; Portugal; Spain; United Kingdom ; Arizona; California; Maine; Maryland; Massachusetts; New Jersey; ; New Mexico; New York; Oregon; Washington; British Columbia; and Manitoba;

are also paying considerable attention to the active debate over the adoption of strong federal legislation, though all recognize there is still some way to go before such proposals become US law.

The US is also on record as supporting the UNFCCC process. The Major Economies Meeting may have been short on substance, but our international partners left largely upbeat. They heard Secretary Rice repeat President Bush's pledge that the United States will work to ensure a negotiating process from Bali to 2009, leading to a fair and effective post-2012 climate agreement.

Now is the time for the United States to live up to that pledge and to take up the leadership role it has ignored for so long.