S. HRG. 109–879

U.S.-INTERNATIONAL CLIMATE CHANGE APPROACH: A CLEAN TECHNOLOGY SOLUTION

HEARING

BEFORE THE

SUBCOMMITTEE ON INTERNATIONAL ECONOMIC POLICY, EXPORT AND TRADE PROMOTION

OF THE

COMMITTEE ON FOREIGN RELATIONS UNITED STATES SENATE

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C O N T E N T S

APPENDIX

Additional Material Submitted for the Record

U.S.-INTERNATIONAL CLIMATE CHANGE APPROACH: A CLEAN TECHNOLOGY SOLUTION

MONDAY, NOVEMBER 14, 2005

U.S. SENATE,
SUBCOMMITTEE ON INTERNATIONAL ECONOMIC POLICY,
EXPORT AND TRADE PROMOTION,
COMMITTEE ON FOREIGN RELATIONS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 3:01 p.m. in Room SD-419, Dirksen Senate Office Building, Hon. Chuck Hagel presiding.

Present: Senators Hagel [presiding] and Alexander.

STATEMENT OF HON. CHUCK HAGEL, U.S. SENATOR FROM NEBRASKA

Senator HAGEL. Good afternoon. This past February the UN Global Climate Treaty, known as the Kyoto Protocol, entered into force, requiring more than 30 industrialized nations to significantly reduce man-made greenhouse gas emissions by 2012. As you are all aware, the United States is not a party to that agreement. In July 1997 the Senate unanimously passed Resolution 98, the Byrd-Hagel Resolution, which called on the President not to sign any treaty or agreement in Kyoto unless two conditions were met: first, the United States should not be party to any legally binding obligations on greenhouse gas emissions reductions unless developing country parties are also required to meet similar standards; second, the President should not sign any treaty that would result in serious harm to the economy of the United States. The Kyoto Protocol did not meet either of these conditions and President Clinton never submitted it to the Senate for ratification.

Climate change remains a global challenge in need of a global response. In February I proposed comprehensive bipartisan climate change legislation which I believe will contribute to new domestic and international consensus on climate change and engage the United States in a leadership role on climate change. This summer the Senate passed the Energy Policy Act of 2005, has been signed into law by the President. The bill included the major provisions of my climate change legislation, which included the promotion and adoption of technologies that reduce greenhouse gas intensity in the U.S. and developing countries.

We are here today to discuss this new law and implementation of these climate changes. Current international approaches to global climate change tend to overlook the role of developing countries

as part of either the problem or the solution. This makes little sense if the goal is to reduce global emissions. China alone will soon become the world's largest emitter of manmade greenhouse gasses. At the same time, China and other developing countries still lag behind developed countries in living standards and other quality of life indicators. It is in the shared interest of the United States and all industrialized nations therefore to help developing countries maintain their economic growth while leapfrogging over the highly polluting stages of development that we have already passed through.

This new law elevates climate policy to a high priority on the U.S. foreign policy agenda. It also seeks to promote the export of and investment in technologies, practices, and knowledge that will reduce greenhouse gas emissions around the world. The law lowers trade barriers and supports exchanges, training, and demonstration projects. These projects cover everything from carbon sequestration and clean coal to low emission vehicles and cogeneration.

The Department of State is designated as the lead agency, with significant responsibilities for the U.S. Trade Representative, the Department of Energy, USAID, OPIC, and international financial institutions.

Achieving reductions in greenhouse gas emissions worldwide is one of the important challenges of our time. America has an opportunity and a responsibility for global climate policy leadership. But this is a responsibility to be shared by all nations.

I look forward to working with the Bush administration, the private sector, public interest groups, as well as America's friends and allies in implementing this achievable climate change policy. By harnessing our many strengths, we can help shape a worthy future for all people and build a better world.

Today's hearing will examine the framework of the administration's approach to implementing international climate change policy in the Energy Policy Act of 2005. In addition, we are here to learn about the path forward on the Asia-Pacific Partnership regarding climate change.

The first panel of witnesses today will include: Jim Connaughton, Chairman of the Council on Environmental Quality; Paula Dobriansky, Under Secretary of State for Global Affairs; David Garman, Under Secretary of Energy for Energy, Science, and Environment. The second panel will be Eileen Claussen, President of the Pew Center on Global Climate Change. Ladies and gentlemen, we thank you for your time today and we appreciate very much your contributions. I would remind each of you that your full text will be included in the record, so if you care to give the entire text that is okay. If you would like to give a summary version, that is acceptable as well.

We have just been joined by our colleague from the State of Tennessee, Senator Alexander. Senator Alexander, do you have any comments?

STATEMENT OF HON. LAMAR ALEXANDER,
U.S. SENATOR FROM TENNESSEE

Senator ALEXANDER. I look forward to the testimony. I congratulate Senator Hagel for his leadership on this in forcing us to con-

front more clearly the issues that are involved in climate change. My questions, after I hear the testimony, will be oriented toward how we as a Congress can encourage the innovation in technology that will help us, as you have suggested in the legislation that you proposed and I co-sponsored, that will help us have a larger amount of our new energy from carbon-free or low-carbon, low-carbon sources.

I want to specifically—I will specifically be referring to the work that the National Academy of Sciences has recently done at the request of Senator Domenici and Senator Bingaman and myself, which is to identify how we keep our advantage in science and technology so that we are able to maintain our standard of living, so we can keep our jobs and keep America on top. As Dr. Chu, one of the panelists of the National Academy said, a former Nobel prize-winning physicist, said: The most important thing we can do is keep our advantage in science and technology and the most important problem to solve is energy.

I look forward to the testimony and I have some specific questions that I want to ask about to what extent the Congress is interfering with or how can we better help the country and the administration succeed in being more aggressive in seeking new sources of clean carbon-free or low-carbon energy.

Senator HAGEL. Senator Alexander, thank you.

Mr. Connaughton, we will begin with you. Good afternoon. Thank you.

STATEMENT OF HON. JAMES L. CONNAUGHTON, CHAIRMAN, WHITE HOUSE COUNCIL ON ENVIRONMENTAL QUALITY

Mr. CONNAUGHTON. Good afternoon, Mr. Chairman, and thank you. I want to thank you and the members of the committee—Senator Alexander, it is good to see you again—for the constructive dialogue we have had over the last several years on this important bundle of issues related to clean development and climate change.

I thank you for inviting me to testify today on behalf of the Bush administration to describe for you our vision for addressing what really are interconnected challenges of promoting economic growth and development, eradicating poverty, of improving energy security, reducing harmful air pollution, and tackling this long-term challenge of climate change.

In particular, Mr. Chairman, I want to congratulate you, Senator Pryor, Senator Alexander, and your bipartisan co-sponsors for your successful amendment to the Energy Policy Act of 2005. The authority that it provides and the direction that it gives will help us advance a broad, common ground agenda for action domestically and internationally among both industrialized and developing nations.

The key to success of your amendments to the Energy Policy Act is a realistic understanding of the needs of the major developing countries. Shortly before the G-8 meeting this year in Gleneagles, Scotland, President Bush said: "The best way to help nations develop while limiting pollution and improving public health is to promote technologies for generating energy that are clean, affordable, and secure." Some have suggested the best solution to environmental challenges and climate change is to oppose development

and put the world on an energy diet. But at this moment about two billion people have no access to any form of modern energy. Blocking that access would condemn them to permanent poverty, disease, high infant mortality, polluted water, and polluted air.

In the President's words, we are taking a better approach. In the last 3 years the United States has launched a series of initiatives to help developing countries adopt new energy sources, from cleaner use of coal to hydrogen vehicles, to solar and wind power, to the production of clean-burning methane, and to less polluting power plants. We continue to look for more opportunities to deepen our partnerships with developing nations. The whole world benefits when developing nations have the best and latest energy technologies.

Over the past 4 years the Bush administration has been building the structure of a more constructive, practical, and realistic approach to international action on clean development and climate change. This strategy is producing real results and it is centered around three essential aspects.

One is technology development, and you will hear a lot about that from Under Secretary Garman today. The second is about technology deployment, and I think Under Secretary Dobriansky will have something to say about that. The third—and this is the glue—is a better integration of our development goals, our integration of our environmental improvement goals related to pollution, our climate change strategies for reducing greenhouse gasses, and the fundamental of energy to promote economic growth.

At the domestic level the President has set a national goal of reducing the greenhouse gas intensity of the U.S. economy by 18 percent by 2012. To help achieve that goal, we established strong partnerships for action with the private sector, including major partnerships among the most highly emitting sectors in our economy, including programs at DOE as well as programs at EPA. We have dozens of mandatory, voluntary, and other incentive-based programs under way.

Importantly, this year's energy bill, nearly every major provision of it will help advance and deploy many of the President's priorities for cleaner, more efficient, and less greenhouse gas-intensive energy systems. The energy bill includes over $11 billion in incentives for the production of wind, geothermal, and solar power, consumer tax credits for the purchase of highly fuel efficient, hybrid and clean diesel vehicles, and hopefully in the near future hydrogen vehicles, incentives for clean coal technology, a new structure for emission-free nuclear power, as well as incentives and mandatory requirements related to the use of renewable biofuels.

These new authorities will help us maintain the steady progress we have made in recent years toward the President's greenhouse gas intensity goal, and this is a good news story. If you look at Chart No. 1 to my left, between 2000 and 2003 the United States managed to hold its net greenhouse gas emissions nearly constant while growing our economy by nearly $1.5 trillion. That is about the size of the entire economy of China. At the same time, we increased our population by more than 9.5 million people. That is about the size of the country of Sweden.

This emission trend is the fifth best among major countries during these 4 years. Now, if you add to that air pollution, air pollution has been reduced in America by nearly 10 percent in that same period. So we are on the right trajectory.

Preliminary estimates of CO_2 for 2004 indicate a possible increase of about 1.7 percent, though the final data for 2004 will likely show offsetting emission reductions in the more potent greenhouse gasses, such as methane. The total should therefore be well below the 4.3 percent GDP growth that we experienced last year. Not only does that put us well on track to meeting the President's emission intensity goal, it also is a firm example of the kind of approach, Mr. Chairman, that you put into your amendment of a focus on intensity as the most useful metric for understanding our performance.

Now let us turn to the international outlook. Data collected by the Energy Information Administration reinforces the importance of continued partnership among mature and emerging economies on energy technology and deployment. Chart 2 here demonstrates that by 2010 carbon dioxide emissions from emerging economies, such as China and India, will surpass those from mature market economies like the United States.

The picture on air pollution is quite similar. Our air pollution is declining; in the major emerging economies it is increasing.

Just as we seek to reduce our own emission intensity, other fast-growing economies of the world do have significant opportunities to substantially reduce their own emission intensity, as this next chart demonstrates, also produced by the Energy Information Administration. If you look at countries such as Russia, China, the Middle East, Eastern Europe, and India, this is a projection of the kind of opportunities that your legislation can help enable. The international cooperation and investment that will come from your amendment to the energy bill will help us achieve this kind of a projection of progress.

Let me give you two examples, then, of the partnerships, tangible ones, that will help us pull this off. First, last year we created the multilateral Methane to Markets Partnership, which focuses on the profitable—I underline the word "profitable"—deployment of existing technologies and practices for the capture and use of the clean-burning fuel methane, which is the main component of natural gas. We are going to capture it and use it from landfills, from coal mines, from animal waste management systems, and from leaky gas production and distribution systems.

This innovative partnership has a goal of reducing the carbon equivalent of 50 million metric tons by 2015. This partnership alone would then account for about one-tenth of the total emissions that the Kyoto Protocol countries would be trying to achieve. At the same time, we would be reducing methane, which is a potent air pollutant and also poses a safety hazard. So we meet combined objectives through that.

That is why, with the good impetus of your legislation, that we can build on this approach through the more recent and much more consequential multilateral initiative, the Asia-Pacific Partnership for Clean Development and Climate. The six major nations in this partnership include Australia, China, India, Japan, Korea, and

the United States, which together account for half of the world's economy, energy use, and greenhouse gas emissions.

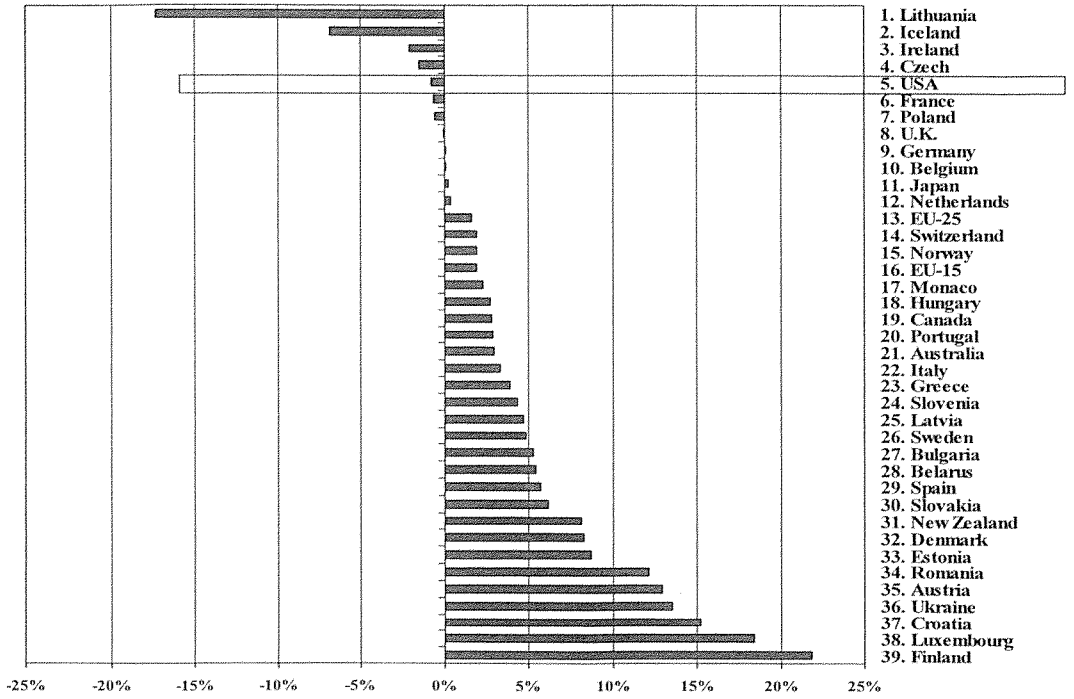
In announcing the Asia-Pacific Partnership on July 27, 2005, President Bush said that: "This new results-oriented partnership will allow our nations to develop and accelerate deployment of cleaner, more efficient energy technologies to meet our national pollution reduction, energy security, and climate change goals in ways that reduce poverty and promote economic development."

With the chairman's permission, I would like to submit the materials that accompanied the President's statement in the announcement of that partnership, which includes a vision statement that was crafted by all six countries.

Senator HAGEL. It will be included in the record.

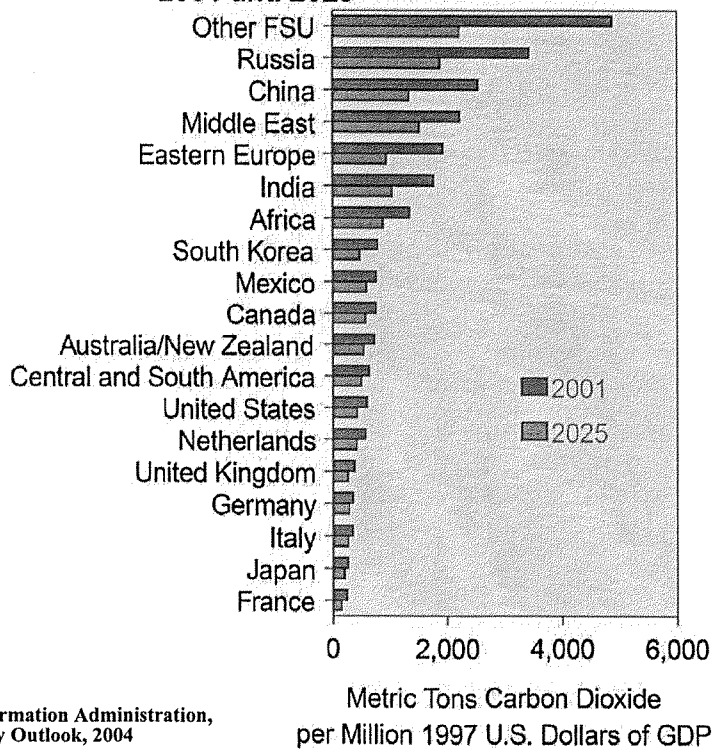
[The information previously referred to follows:]

Trends in GHG Emissions, 2000-2003



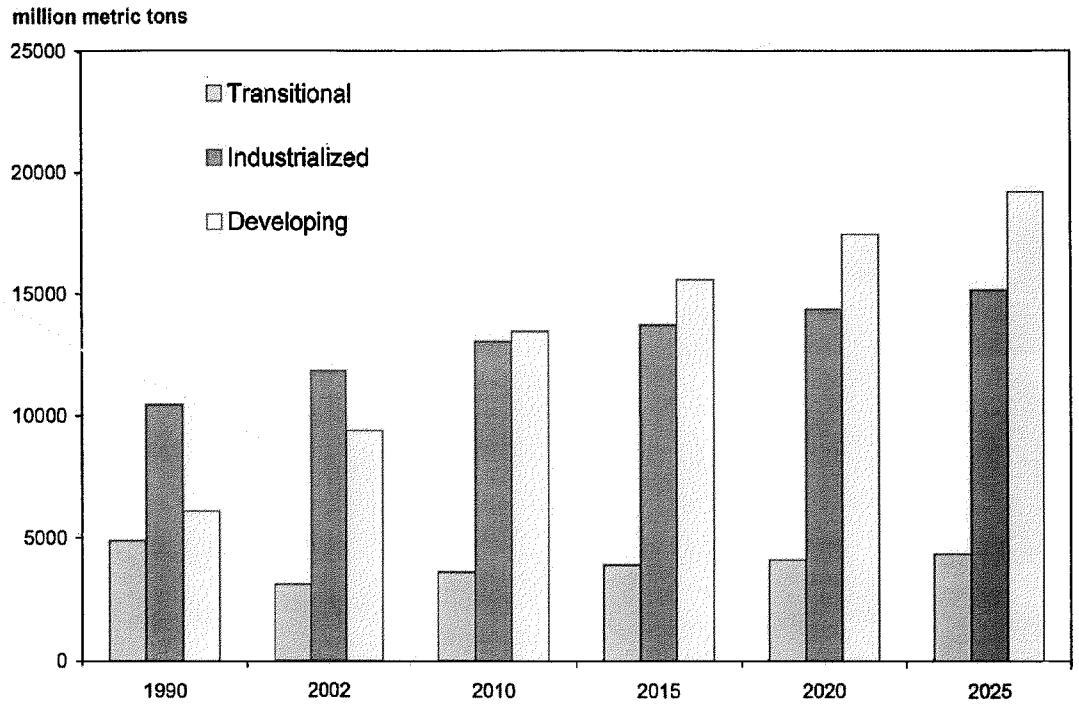
Source: UNFCCC, 2005 National Inventory Reports and Common Reporting Formats; http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/2761.php

World Carbon Dioxide Intensity by Selected Countries and Regions, 2001 and 2025



Source: Energy Information Administration, International Energy Outlook, 2004

World Carbon Dioxide Emissions by Region



Source: Energy Information Administration, International Energy Outlook, 2005

Mr. CONNAUGHTON. When he signed the Energy Policy Act of 2005, the President praised the legislative authority that you provided for the Asia-Pacific Partnership. As we approach the formal launch of the partnership in Australia after the new year, we hope to work with you, Mr. Chairman, Senator Alexander, and the other members of the committee to ensure that your legislation is effectively implemented and appropriately funded.

I thank you for the opportunity to testify and I look forward to our exchange.

[The prepared statement of Mr. Connaughton follows:]

PREPARED STATEMENT BY HON. JAMES L. CONNAUGHTON, CHAIRMAN, WHITE HOUSE COUNCIL ON ENVIRONMENTAL QUALITY

Mr. Chairman, I want to thank you and the Members of this committee for your leadership on clean development and climate change issues. And I thank you for inviting me to testify today on the Bush administration's vision for addressing the interconnected challenges of economic growth and development, poverty eradication, energy security, pollution reduction, and climate change.

I also want to congratulate you, Mr. Chairman, Senator Pryor, and your bipartisan cosponsors, for your successful amendment to the Energy Policy Act of 2005. The authority it provides will help us advance a broad common ground for action domestically and internationally by both industrialized and developing countries.

Shortly before the G-8 meeting this year in Gleneagles, Scotland, President Bush said:

> "The best way to help nations develop while limiting pollution and improving public health is to promote technologies for generating energy that are clean, affordable and secure. Some have suggested the best solution to environmental challenges and climate change is to oppose development and put the world on an energy diet. But at this moment, about two billion people have no access to any form of modern energy. Blocking that access would condemn them to permanent poverty, disease, high infant mortality, polluted water and polluted air."
>
> "We're taking a better approach. In the last 3 years, the United States has launched a series of initiatives to help developing countries adopt new energy sources, from cleaner use of coal to hydrogen vehicles, to solar and wind power, to the production of clean-burning methane, to less-polluting power plants. And we continue to look for more opportunities to deepen our partnerships with developing nations. The whole world benefits when developing nations have the best and latest energy technologies."

Over the past 4 years, the Bush administration has been building the structure of a more constructive, practical and realistic approach to international action on clean development and climate change. In February 2002, the President announced a comprehensive domestic and international strategy for addressing the serious, long-term challenge of global climate change. This strategy is producing real results.

The President set a national goal of reducing the greenhouse gas intensity of the U.S. economy 18 percent by 2012. We established strong partnerships for action with the private sector, including DOE's Climate VISION program and EPA's Climate Leaders program. We have taken the lead on transformational technology development initiatives such as the Hydrogen Fuel Initiative to accelerate the future of an emissions-free hydrogen transportation system, and FutureGen, which will demonstrate the world's first coal-fueled power plant that will produce almost no harmful air pollution or greenhouse gases.

And nearly every major provision of the broader Energy Bill enacted this summer will help advance and deploy many of the President's priorities for cleaner, more efficient, and less greenhouse gas intensive energy systems, including over 11 billion dollars in incentives for production of wind, geothermal and solar power, consumer tax credits for highly fuel efficient hybrid and clean diesel vehicles, clean coal technology, emissions-free nuclear power, and renewable bio-fuels.

These new authorities will help us maintain the steady progress we have made in recent years toward the President's greenhouse intensity goal. [CHART 1], Between 2000 and 2003, the United States managed to hold its net greenhouse gas emissions nearly constant, while growing our economy by nearly 1.5 trillion dollars—almost the size of the entire economy of China—and increasing our population by more than 9.5 million people—about the size of Sweden. This emission trend is

the fifth best among major countries during these 4 years. These reductions come from desirable improvements in efficiency and deployment of advanced energy technologies and practices, and continued structural shifts in our economy to lower emitting industries, and an undesirable shift of higher-emitting energy intensive industries to other countries with significantly lower energy costs.

Preliminary estimates CO_2 for 2004 indicate a possible increase of 1.7 percent, though the final data for 2004 will likely show offsetting emissions reductions in the more potent greenhouse gases such as methane. The total should therefore be well below the 4.3 percent GDP growth we experienced last year, putting us well on track to meeting the President's emission intensity goal.

As we seek to reduce our own emissions intensity, other fast growing economies of the world have significant opportunities to substantially reduce their emissions intensity. [CHART 2] The international cooperation and investment that Title 16 of the Energy Bill authorizes are essential to ongoing progress globally.

Undersecretary Garman will discuss the administration's leadership in launching and revitalizing a series of international technology development initiatives on issues ranging from hydrogen, to nuclear power, to carbon capture and storage.

Undersecretary Dobriansky will highlight the bilateral clean energy and climate agreements with 15 countries and regional organizations accounting for nearly 80 percent of the world's greenhouse gas emissions. And last year we created the multilateral Methane to Markets Partnership, which focuses on the profitable deployment of existing technologies and practices for the capture and use of this clean burning fuel—the main component of natural gas—from landfills, coal mines, animal waste management systems, and leaky gas production and distribution systems. This innovative partnership seeks to reduce the carbon equivalent of 50 million metric tons by 2015.

Data collected by the Energy Information Administration reinforces the importance of continued partnership among mature and emerging economies on energy technology development and deployment. [CHART 3] By 2010 carbon dioxide emissions from emerging economies, such as China and India, will surpass those from mature market economies like the United States.

That is why, this summer, we introduced our most recent, and even more consequential, multilateral initiative, the Asia Pacific Partnership for Clean Development and Climate. The six major nations in this partnership—Australia, China, India, Japan, Korea, and the United States—account for half of the world's economy, energy use, and greenhouse gas emissions. In announcing the Asia Pacific Partnership on July 27, 2005, President Bush said that:

> "This new results-oriented partnership will allow our nations to develop and accelerate deployment of cleaner, more efficient energy technologies to meet national pollution reduction, energy security, and climate change concerns in ways that reduce poverty and promote economic development."

When he signed the Energy Policy Act of 2005, the President praised the legislative authority it provides for the Asia Pacific Partnership. As we approach the formal launch of the Partnership in Australia after the New Year, we hope to work with you, Mr. Chairman, to ensure that your legislation is effectively implemented and appropriately funded.

I thank you for the opportunity to testify. I look forward to responding to any questions you may have.

Senator HAGEL. Mr. Connaughton, thank you.

Under Secretary Dobriansky, welcome.

STATEMENT OF HON. PAULA J. DOBRIANSKY, PH.D., UNDER SECRETARY FOR DEMOCRACY AND GLOBAL AFFAIRS, DEPARTMENT OF STATE

Secretary DOBRIANSKY. Thank you, Mr. Chairman, Senator Alexander. I welcome this opportunity to describe some of the Bush administration's international activities in the development and commercialization of clean and efficient energy technologies. I am particularly pleased to discuss Title XVI, subtitle B, of the Energy Policy Act of 2005, which, like the administration, emphasizes a practical, technology-based focus on climate change, and also to outline our new Asia-Pacific Partnership on Clean Development and Climate.

The administration's international engagement on climate change centers on five fundamental ideas: First, a successful international response to climate change requires developing country participation on near-term efforts to slow the growth in emissions and longer-term efforts to build capacity for future cooperative actions.

Second, we should view climate change goals as part of a broader development agenda—one that improves energy security, promotes economic growth and development, reduces air pollution, mitigates greenhouse gases, and eradicates poverty. This message resonates with developing countries.

Third, technologies are key to meeting these objectives.

Fourth, international efforts should be pursued in a spirit of collaboration and a sense of partnership.

Finally, we need to work collaboratively with the private sector.

We are putting these ideas into practice. Since 2001, we have established bilateral climate partnerships with 15 countries and regional organizations that, together with us, comprise some 80 percent of global greenhouse gas emissions. These partnerships serve as the umbrella for over 400 collaborative activities on science, technology and policy issues.

We have also initiated and participate in a range of new science and technology initiatives designed to meet climate and clean development goals. For example, the Group on Earth Observations has developed a plan for an intergovernmental, comprehensive, coordinated and sustained Earth observation system to improve environmental monitoring and forecasts, which now has been approved by 58 countries and the European Commission. Our international energy research and development partnerships include GEN IV (the Generation IV Nuclear Partnership), the Carbon Sequestration Leadership Forum, the International Partnership for the Hydrogen Economy, and International Thermonuclear Experimental Reactor, ITER, which lend new international emphasis to strategic technologies that can make a large contribution to our efforts to reduce greenhouse gas intensity and diversify the global energy portfolio.

The Methane to Markets Partnership focuses on advancing cost-effective near-term recovery of methane, a potent greenhouse gas, and its use as a clean energy source. As Jim indicated, the partnership targets four major areas: methane sources, landfills, underground coal mines, natural gas and oil systems, and agricultural sources. With 17 partners, it represents over 60 percent of global methane emissions.

In addition, during the 2002 World Summit on Sustainable Development, the United States established many public-private partnerships, including the Clean Energy Initiative. I want to describe what this initiative entails. There are four programs: the Global Village Energy Partnership, which is led by the United States Agency for International Development, which seeks to increase access to modern energy sources in developing countries in a manner that enhances economic and social development and reduces poverty; the Partnership for Clean Indoor Air, led by the Environmental Protection Agency, which addresses increased environmental health risks faced by more than two billion people in the developing world who burn traditional biomass fuel indoors; the

Partnership for Clean Fuels and Vehicles, also led by the Environmental Protection Agency, will help reduce air pollution in developing countries by promoting the elimination of lead in gasoline and encouraging the adoption of cleaner vehicle technologies. Efficient Energy for Sustainable Development, led by the Department of Energy, aims to improve the productivity and efficiency of energy systems.

Also at WSSD, the United Kingdom launched the Renewable Energy and Energy Efficiency Partnership, which aims to accelerate the marketplace for renewable energy and energy efficiency. The United States joined this partnership in 2004.

Our approach puts climate change in the context of broader development goals. During July's G-8 meetings, leaders agreed to a plan of action on climate change, clean energy, and sustainable development. The plan is based on over 50 specific practical activities, mostly focused on technology development, that put climate change goals in the context of other development imperatives, including poverty eradication.

While building on these practical actions and multiple benefit approaches, we announced in July the Asia-Pacific Partnership for Clean Development and Climate to promote greenhouse gas intensity reduction and other clean development goals. The partnership reflects the extent to which we have been able to arrive at commonly agreed upon approaches toward climate change with a number of key countries. The six countries that make up, currently make up this partnership—Australia, China, India, Japan, Korea, and us—represent approximately half of the world's economy, population, and greenhouse gas emissions.

Mr. Chairman, in the spirit of the Hagel-Pryor amendment, partners will work to create new investment opportunities, build local capacity, and remove barriers to the introduction of clean, more efficient technologies. This effort cannot succeed without strong private sector involvement and we are reaching out to them. The ministerial launch will take place in January in Australia.

Finally, I would like to just discuss the Hagel-Pryor amendment to the Energy Policy Act of 2005. The administration welcomes this legislation. We believe that reducing greenhouse gas intensity is the best metric for measuring progress in climate change policy. We are now actively working to fulfill the initial requirements of Title XVI, subtitle B, climate change technology deployment in developing countries. We expect to have a report to you in February that identifies the major emitters of greenhouse gasses and provides a range of baseline information to the Congress on progress on greenhouse gas intensity reduction projects, obstacles to implementation, and opportunities for greater advancement, and which will serve as a basis for developing our strategy on these issues.

We have active collaboration already in many of these countries, but in many cases that collaboration can be considerably strengthened. We will work to ensure that our international cooperation in this area is based on the practical collaborative approach that we have developed with our partners to date.

We expect the Asia-Pacific Partnership to be one of the key means through which we implement our actions under the Energy Policy Act. Our partners China, India, and Korea rank first, sec-

ond, and third respectively among fast-growing industrializing economies in terms of 2003 carbon dioxide emissions from the consumption and flaring of fossil fuels. The partnership explicitly references greenhouse gas intensity reduction among its clean development goals.

We also see that a range of existing programs can contribute to these efforts and that we can strengthen these programs and develop new strategies for achieving the objectives of the title.

In conclusion, meeting the challenge of the expected future growth in global energy demand and reducing greenhouse gas emissions will require a transformation in the way the world produces and consumes energy over the next generation and beyond. It will require new ways of collaborating with our partners to break through longstanding stalemates. This is why we are leading global efforts to develop and deploy transformational technologies for both the developed and developing world.

I thank you for this opportunity to testify before the subcommittee and look forward to responding to any questions you may have. I am submitting a longer version of my testimony for the record.

Thank you.

[The prepared statement of Dr. Dobriansky follows:]

PREPARED STATEMENT OF HON. PAULA J. DOBRIANSKY, PH.D., UNDER SECRETARY OF STATE FOR DEMOCRACY AND GLOBAL AFFAIRS, DEPARTMENT OF STATE

Mr. Chairman, members of the subcommittee, thank you for the opportunity to appear before you today to address the "U.S.-International Climate Change Approach: A Clean Technology Solution." During this afternoon's testimony my colleagues and I will describe the numerous activities that the Bush administration is taking to support the multiple goals of improving energy security, promoting economic growth and development, reducing air pollution, mitigating greenhouse gases and eradicating poverty.

I am particularly pleased to discuss here today Title XVI, Subtitle B of the Energy Policy Act of 2005—which is in keeping with the administration's practical, technology-based focus to this issue—and to outline our new Asia Pacific Partnership on Clean Development and Climate.

In his June 2001 and February 2002 climate change policy speeches President Bush highlighted the importance of international cooperation in developing an effective and efficient response to the complex and long-term challenge of climate change.[1]

The administration's international engagement on climate change issues centers on five key ideas, all of which extend from and build on our own experience here in the United States. First, a successful international response to climate change requires developing country participation, which includes both near-term efforts to slow the growth in emissions and longer-term efforts to build capacity for future cooperation actions. Absent the participation of all major emitters, including developing countries, the goal of stabilizing GHG concentrations will remain elusive.

Second, we will make more progress on this issue over time if we recognize that climate change goals fall within a broader development agenda—one that promotes economic growth, reduces poverty, provides access to modern sanitation and clean water, enhances agricultural productivity, provides energy security, reduces pollution, and mitigates greenhouse gas emissions. Countries do not look at individual development goals in a vacuum, and approaches that effectively integrate both near- and longer-term goals will yield more benefits over time.

Third, technology is the glue that can bind these development objectives together. By promoting the development and deployment of cleaner and more efficient technologies, we can meet a range of diverse development and climate objectives simultaneously.

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[1]http://www.whitehouse.gov/news/releases/2001/06/20010611-2.html and http://www.whitehouse.gov/news/releases/2002/02/20020214-5.html

Fourth, we need to pursue our international efforts in a spirit of collaboration, not coercion, and with a true sense of partnership. This is especially true in our relations with developing countries, which have an imperative to grow their economies and provide for the welfare of their citizens. Experience has shown these countries to be quite skeptical of climate mitigation approaches that they think will divert them from these fundamental goals. It is also true that many of the largest greenhouse gas emitters are also among our most significant trading partners. They have rapidly advancing—in many cases, world class—industries and considerable technical wherewithal. We view countries like China and India as responsible partners in our efforts.

Finally, we need to engage the private sector to be successful. While the right kind of government-to-government collaboration can pave the way for great progress, we will need to harness the ingenuity, resources and vision of the private sector in developing and deploying technology.

We are putting these ideas into practice. Since 2001, we have established a range of partnerships that will address key aspects of the climate challenge while also advancing other important international objectives. We have established bilateral climate partnerships with 15 countries and regional organizations that, together with us, comprise some 80 percent of global greenhouse gas emissions. These partnerships serve as the umbrella for over 400 collaborative activities undertaken by U.S. agencies and their partners on science, technology and policy issues. Through these partnerships, U.S. experts are working with Australia and New Zealand to strengthen our capacity to monitor climate in the Pacific; with India to promote local level pollution and energy solutions that will have greenhouse gas intensity benefits; with Brazil to promote effective application of renewable energy; with Japan and Korea to promote greater integration of climate and energy strategies throughout Asia; and with China to enhance technical capacity for climate-related decisionmaking.

In addition to our bilateral partnerships, we have initiated and participate in a range of new technology initiatives designed to meet climate and clean development goals. Let me briefly highlight a few of the most significant partnerships:

• Group on Earth Observations:[2] On July 31, 2003, the United States hosted 33 nations—including many developing nations—at the inaugural Earth Observation Summit (EOS), out of which came a commitment to establish an intergovernmental, comprehensive, coordinated, and sustained Earth observation system. The climate applications of the data collected by the system include the use of the data to create better climate models, to improve our knowledge of the behavior of carbon dioxide and aerosols in the atmosphere, and to develop strategies for carbon sequestration.

The United States was instrumental in drafting a 10-year implementation plan for a Global Earth Observation System of Systems, which was approved by 55 nations and the European Commission at the 3rd EOS summit in Brussels in February 2005. The United States also released its contribution through the Strategic Plan for the U.S. Integrated Earth Observing System in April 2005.[3] The plan will help coordinate a wide range of environmental monitoring platforms, resources, and networks.

• International Energy Research and Development Partnerships: The Generation IV Nuclear partnership,[4] the Carbon Sequestration Leadership Forum,[5] the International Partnership for the Hydrogen Economy,[6] and ITER.[7] In the last 4 years, the administration has engaged in four partnerships that lend new international emphasis to strategic technologies that can make a large contribution to our efforts to reduce greenhouse gas intensity and diversify the global energy portfolio. The State Department is working closely with DOE to engage our partners, and all of these partnerships include key developing countries as full partners in our efforts to advance these important technologies—an important capacity building function that will also serve to promote the growth of global markets.

• The Methane to Markets Partnership:[8] This partnership, launched in November of last year, focuses on advancing cost-effective, near-term methane recovery and

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[2] http://earthobservations.org/
[3] http://iwgeo.ssc.nasa.gov/docs/EOCStrategic_Plan.pdf
[4] http://www.nei.org/index.asp?catnum=3&catid=1215
[5] http://www.cslforum.org/
[6] http://www.iphe.net/
[7] http://www.iter.org/
[8] http://www.epa.gov/methanetomarkets/ and http://www.methanetomarkets.org/. Founding Methane to Markets member governments include the United States, Argentina, Australia, Brazil, China, Colombia, India, Italy, Japan, Mexico, Nigeria, Russian Federation, Ukraine, and

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use as a clean energy source to enhance economic growth, promote energy security, improve the environment, and reduce greenhouse gases. At the recent session, the partnership welcomed its 17th member, Ecuador, and now represents over 60 percent of global methane emissions. This Partnership includes an extensive project network comprised of 190 private sector, governmental and non-governmental organizations. Methane to Markets currently targets four major methane sources: landfills, underground coal mines, and natural gas and oil systems, and animal waste management. By 2015, the Partnership has the potential to deliver annual reductions in methane emissions of up to 50 million metric tons of carbon equivalent or recovery of 500 billion cubic feet of natural gas.

• World Summit on Sustainable Development Partnerships:[9] The United States has been at the forefront of efforts to move multilateral bodies toward a practical, results-focused actions centered around partnerships among governments, businesses and other organizations. Among over 20 U.S.-initiated partnerships launched at the 2002 World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa, the United States established a "Clean Energy Initiative." The Initiative consists of four market-oriented, performance-based partnerships, including:

  • the Global Village Energy Partnership (GVEP),[10] an international partnership with over 700 public and private sector partners with a leading role for the U.S. Agency for International Development;

  • the Partnership for Clean Indoor Air,[11] led by the Environmental Protection Agency, addressing the increased environmental health risk faced by more than 2 billion people in the developing world who burn traditional biomass fuels indoors for cooking and heating;

  • the Partnership for Clean Fuels and Vehicles,[12] led by the Environmental Protection Agency, which will help to reduce air pollution in developing countries by promoting the elimination of lead in gasoline and encouraging the adoption of cleaner vehicle technologies;

  • Efficient Energy for Sustainable Development (EESD),[13] led by the Department of Energy, which aims to improve the productivity and efficiency of energy systems, while reducing pollution and waste, saving money and improving reliability through less energy intensive products, more energy efficient processes and production modernization.

The United States is actively involved in other international technology development and deployment partnerships as well, including the Renewable Energy and Energy Efficiency Partnership, a WSSD partnership initiated by the United Kingdom. As the world's largest producer and consumer of renewable energy, and with more renewable energy generation capacity than Germany, Denmark, Sweden, France, Italy, and the United Kingdom combined, the United States is one of 17 partner countries in REEEP.

The United States continues to participate in the UN Framework Convention on Climate Change. The Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change will hold its 11th Session in Montreal from November 28 to December 9, 2005. I will head the U.S. delegation to this meeting. As the Kyoto Protocol entered into force on February 16 of this year, the Montreal meeting will also be the first "meeting of the Parties" (MOP) under that instrument, to which the United States will be an observer. We will continue to highlight the importance of collaborative partnerships developing and deploying technologies to meet the long-term challenge of climate change.

I am very pleased that a technology-focused approach that puts climate change in the context of broader development goals is finding favor in many parts of the world. In July, at the Group of Eight Leaders meeting, President Bush and his counterparts agreed to a Plan of Action on Climate Change, Clean Energy and Sustainable Development.[14] The Plan is based on over 50 specific, practical activities—mostly focused on technology development—that put climate change goals in the

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the United Kingdom. The Republic of Korea became the 15th member in June, 2005 Canada the 16th member in July 2005, and Ecuador the 17th member in November 2005.

[9] http://www.sdp.gov/sdp/initiative/cei/28304.htm

[10] http://www.sdp.gov/sdp/initiative/cei/44949.htm

[11] http://www.sdp.gov/sdp/initiative/cei/29808.htm and http://www.pciaonline.org/

[12] http://www.sdp.gov/sdp/initiative/cei/29809.htm and http://www.unep.org/pcfv/main/main.htm

[13] http://www.sdp.gov/sdp/initiative/cei/28304.htm

[14] http://usinfo.state.gov/ei/img/assets/4756/Post_Gleneagles_Communique.pdf

context of other development imperatives. I had the opportunity to attend a follow-up Ministerial Dialogue on November 1 that included not only Group of Eight ministers, but also ministers from 11 other key developing and developed countries. I was struck both by the strong participation from ministries responsible for energy—something that has sometimes been lacking in climate discussions—and by the very practical nature of our discussions in this setting.

ASIA-PACIFIC PARTNERSHIP FOR CLEAN DEVELOPMENT AND CLIMATE[15]

In keeping with the concept of practical actions and multiple benefit approaches, I would like to turn now to the Asia-Pacific Partnership for Clean Development and Climate. The Partnership is our most recent effort to promote greenhouse gas intensity reduction and other clean development goals, and we are quite excited about its potential. Deputy Secretary of State Zoellick announced plans to create the Asia-Pacific Partnership for Clean Development and Climate in July 2005. The Partnership will build on and deepen the already strong relationships we have with our five Partners: Australia, China, India, Japan, and the Republic of Korea. The six countries that currently make up this Partnership represent about half of the world's economy, population, and greenhouse gas emissions—which gives us a tremendous opportunity to find practical approaches to address these issues with our partners in a focused setting. We intend to use this opportunity to ensure that the Partnership delivers real and significant results in energy security, clean development, and greenhouse gas intensity reduction.

The Partnership's vision statement has identified a broad range of near- and long-term technologies and practices that are designed to improve energy security, reduce pollution and address the long-term challenge of climate change. The Partnership will focus on voluntary practical measures to create new investment opportunities, build local capacity, and remove barriers to the introduction of clean, more efficient technologies. It is critically important to build on mutual interests and provide incentives to tackle global challenges such as climate change effectively.

We are united with our partners in recognizing that the ingenuity and energy of the private sector is crucial to our success in addressing these issues over time. This effort cannot succeed without strong private sector involvement. Working closely with the Department of Commerce and other agencies with export-oriented functions, we are actively discussing ways of ensuring that the private sector is engaged in a meaningful way in the Partnership at every stage of its work. We expect the Ministerial launch to have strong participation from the private sector.

Energy Policy Act of 2005

The administration welcomes the Hagel-Pryor amendment to the Energy Policy Act of 2005, which we believe will lend considerable focus and force to our efforts to address climate change. This legislation is fully in line with the administration's view that reducing greenhouse gas intensity is the best metric for measuring progress in climate change policy. In 2002, President Bush committed the United States to a comprehensive and innovative program of reducing greenhouse gas intensity by 18 percent by 2012. It is estimated that meeting this commitment will prevent the emission of more than 500 million tons of carbon equivalent greenhouse gases.

The approach embedded in this legislation is that the answer to the long-term challenge of climate change lies in promoting, rather than impeding, economic growth, which can in turn fuel the kinds of technology innovations and capital stock turnovers needed to deploy cleaner, more efficient technologies. The legislation identifies the need to work with the major developing nations to promote cleaner technologies as they continue to work to deliver modern energy services to their people.

We are now actively working to fulfill the initial requirements of Title XVI, Subtitle B—Climate Change Technology Deployment in Developing Countries. The bill requests that we identify the major emitters of greenhouse gases, and provide a range of baseline information to the Congress on progress on greenhouse gas intensity reduction projects, obstacles to implementation, and opportunities for greater advancement. We expect to have this report to you in February, and we will use it as a basis for developing our strategy on these issues. We have active collaboration already in many of these countries, but in many cases that collaboration can be considerably strengthened. In implementing the Act we want to ensure that our cooperation with countries is based on the practical, collaborative approach that we have developed with our partners to date. I look forward to working with your staff

[15]http://www.state.gov/s/d/rem/50326.htm

and that of other interested committees to ensure that we are taking a sensible and robust approach as we move forward with implementation.

The bill also requires the Secretary of State to establish an interagency working group, chaired by the Secretary, to coordinate activities under the Subtitle. We have been actively working with other agencies to ensure that this work is undertaken in a manner that complements that of other administration efforts, including that of the National Security Council's Policy Coordinating Committee and the Trade Promotion Coordinating Committee. In addition, we expect to work closely with our colleagues at the Department of Energy and other agencies in their efforts to fulfill Subtitle A of this title.

We expect the Asia-Pacific Partnership to be one of the key means through which we implement our actions under the Energy Policy Act. In his statement at the signing ceremony for the Act, President Bush highlighted the Partnership as an innovative program that is authorized by the Act. The initiative targets the kind of fast-growing, middle-income industrializing countries on which the Act asks us to focus. China, India and Korea rank first, second, and third respectively among fast-growing industrializing economies in 2003 carbon dioxide emissions—the latest data available—from the consumption and flaring of fossil fuels. In fact, depending on the data set used, these three countries alone account for roughly half of the greenhouse gas emissions among the 25 countries that we will focus on in implementing the Title. The Partnership explicitly references greenhouse gas intensity reduction among its clean development goals. We also see that a range of existing programs can contribute to these efforts, and that we can strengthen these programs and develop new strategies for achieving the objectives of the Title.

Concluding Remarks

Mr. Chairman and Members of the committee, I hope that my testimony this afternoon conveys the extent to which the United States is working with our partners to reduce greenhouse gas intensity, promote energy efficient technologies and advance climate science, while also placing primary importance on supporting economic growth and prosperity.

Meeting the challenge of the expected future growth in global energy demand and reducing greenhouse gas emissions will require a transformation in the way the world produces and consumes energy over the next generation and beyond. It will require new ways of collaborating with our partners to break through long-standing stalemates. This is why we are leading global efforts to develop and deploy breakthrough technologies for both the developed and developing world.

I thank you for this opportunity to testify before this committee. I look forward to responding to any questions you may have.

RESPONSES BY DR. PAULA J. DOBRIANSKY TO QUESTIONS FROM SENATOR JOSEPH R. BIDEN, JR.

Question. The Canadian government is proposing, and other governments' support, a decision by the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) to initiate a process under the UNFCCC to consider possible next steps in addressing climate change. I understand the administration opposes this.

Is this true? If so, why? Given the lead time between the Kyoto Conference and the first reporting period under the Kyoto Protocol, on what grounds would it be premature at this time to discuss a replacement or follow-on post-2012 regime?

Answer. The United States is participating in the UN Climate Change Conference, which will be the eleventh session of the Conference of the Parties to the UN Framework Convention on Climate Change (COP 11) in Montreal, Canada, from November 28 through December 9, 2005, as a Party to the Framework Convention. The Conference will also serve as the first Meeting of the Parties to the Kyoto Protocol.

The Conference is an opportunity for the U.S. to advance our climate change policies through the Framework Convention. We will also seek to protect U.S. interests as Parties to the Kyoto Protocol move ahead on their agenda.

The United States and our partners around the world believe that effective actions to meet energy needs, advance clean development and address climate change require integrated solutions that achieve sustainable development.

We are moving forward on a multitude of local, regional and global energy, clean development and climate change initiatives that support the broader goals of promoting economic growth, meeting the need for greater energy resources for poverty eradication, enhancing social conditions and protecting the environment.

The U.S. strategy is built around the following five key ideas. First, a successful international response to climate change requires developing country participation. Second, we believe that climate change falls within a broader development agenda—one that promotes economic growth, provides energy security and mitigates greenhouse emissions. This is a primary objective of the Asia-Pacific Partnership for Clean Development and Climate, announced by Deputy Secretary Zoellick in July 2005. Third, promoting the development and deployment of technology is key. Fourth, we need to pursue our international efforts in a spirit of collaboration and a true sense of partnership. Over the past 4 years, the Bush administration has pursued a constructive, practical and realistic approach to international action on clean development and climate change. Fifth, engaging the private sector is critical to success. We have established strong partnerships for action with the private sector, including the Department of Energy's Climate VISION program and the Environmental Protection Agency's Climate Leaders program.

Given the existing wide divergence of views by participating COP members, progress would not be achieved through commencement of negotiations. One size does not fit all. Developing countries have made it clear they will not take on additional commitments to reduce emissions while, at the same time, they want developed countries to continue with a target-based approach. We are convinced that a post-2012 process would encompass the same political dynamic that existed in 1997 during the climate change negotiations in Kyoto, Japan. Under these circumstances, we are opposed to entering into negotiations on a post-2012 regime.

Senator HAGEL. It will be included for the record. Secretary Dobriansky, thank you.

Under Secretary of Energy Garman.

STATEMENT OF HON. DAVID GARMAN, UNDER SECRETARY FOR ENERGY, SCIENCE AND ENVIRONMENT, DEPARTMENT OF ENERGY

Secretary GARMAN. Thank you, Mr. Chairman. I will summarize my testimony as well.

As a party to the United Nations Framework Convention on Climate Change, the United States of course shares with many countries its ultimate objective, the stabilization of greenhouse gas concentrations in the atmosphere at a level that prevents dangerous interference with the climate system. To help meet that objective, President Bush has established a robust and flexible climate change policy that harnesses the power of markets, of technological innovation, maintains economic growth, and encourages global participation.

To meet our ultimate goals while at the same time providing energy for a growing world, we are going to have to develop new and cost-effective transformational technologies. Of course, the administration has been laying a strong technological foundation to meet this challenge. Our initiatives, the President's initiatives, include the President's Hydrogen Fuel Initiative and the Freedom CAR program, carbon sequestration, the FutureGen coal-fired zero emission power generation project, the next generation nuclear energy program, and fusion. Such efforts can put us on a path to ensuring access to clean, affordable energy supplies while reducing greenhouse gas emissions.

Complementing these domestic endeavors are a number of multilateral collaborations that were initiated by the United States: the Carbon Sequestration Leadership Forum, the International Partnership for the Hydrogen Economy, the Gen IV International Forum on Nuclear Power. All are vehicles for international collaboration to advance these technologies. In addition, the United States, as has been mentioned, has joined the ITER project to help

us realize the promise of fusion energy. We believe that well-designed multilateral collaborations such as these, which focus on achieving practical results, can accelerate development and commercialization of new technologies.

Central to meeting the challenge of climate change is the participation of developing countries, which the Energy Policy Act recognizes. The Energy Information Administration projects that between 2015 and 2020 carbon dioxide emissions from developing countries could surpass those from industrialized countries. Moreover, if forecasts are accurate developing countries will account for 69 percent of the total increase in global carbon emissions from energy between 2001 to 2025.

The Bush administration believes that the most effective way to engage developing countries is to focus, not solely on climate change, but rather on a broader development agenda that promotes economic growth, reduces poverty, promotes energy security, reduces pollution, and mitigates greenhouse gas emissions. Indeed, concern about meeting these fundamental needs helps explain the reticence of developing countries to take on Kyoto-style emissions caps that would stifle their economic development.

An emissions intensity approach to limiting greenhouse gas emissions, such as that endorsed in the Energy Policy Act, can lead to greater engagement from the developing countries because it encourages reductions without threatening economic growth and development. This intensity approach is working well here in the United States. In 2002, the President set an ambitious goal, a national goal to reduce the greenhouse gas intensity of the United States economy by 18 percent by 2012. Recent data from the Energy Information Administration detailed in my written testimony suggest that we are making substantial headway in meeting that goal.

One of the biggest barriers to economic progress in developing countries is the lack of access to affordable modern energy services. Through its multi-agency Clean Energy Initiative and the United Kingdom-led Renewable Energy and Energy Efficient Partnership, the U.S. is working to mobilize private sector investment and create self-sustaining markets for financing energy efficiency, renewable and infrastructure projects in developing countries.

The administration also believes that the international climate change provisions of the Energy Policy Act are broadly consistent with the Asia-Pacific Partnership for Clean Development and Climate, which was announced in July by the United States and five large Asian economies. Through this partnership, we hope to create new investment opportunities to build local capacity and remove barriers to the introduction of clean, more efficient technologies. The APP is also designed to help each country improve energy security, reduce pollution, and address the long-term challenge of climate change.

In closing, the President is committed to reducing the Nation's greenhouse gas emissions and we are taking action to help meet that goal. Further, we believe that cooperation among developed and developing countries must combine action on greenhouse gasses with action to meet larger and other public urgent needs for increased energy resources. We are fully engaged internationally and

will continue to lead multilateral and bilateral climate change science and technology initiatives and further cooperate with all Nations.

Thank you very much, Mr. Chairman. I will be happy to answer any questions you have either today or in the future.

[The prepared statement of Mr. Garman follows:]

PREPARED STATEMENT OF DAVID GARMAN, UNDER SECRETARY FOR ENERGY SCIENCE AND ENVIRONMENT, DEPARTMENT OF ENERGY

INTRODUCTION

Mr. Chairman and members of the subcommittee, thank you for the opportunity to appear before you today to discuss ways in which the administration is working internationally to address the challenge of climate change. My testimony today will cover what the administration is doing in the climate change technology area both domestically and internationally, the international climate change provisions of the Energy Policy Act of 2005 (EPAct2005), the importance of engaging developing countries, and the Asia-Pacific Partnership for Clean Development and Climate.

As a party to the United Nations Framework Convention on Climate Change (UNFCCC), the United States shares with many countries its ultimate objective: stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. In February 2002, President Bush reaffirmed his administration's commitment to this central goal of the Framework Convention.

Meeting the UNFCCC objective will require a sustained, long-term commitment by all nations over many generations. To this end, the President has established a robust and flexible climate change policy that harnesses the power of markets and technological innovation, maintains economic growth, and encourages global participation. Major elements of this approach include implementing near-term policies and measures to slow the growth in greenhouse gas emissions, advancing climate change science, accelerating technology development, and promoting international collaboration.

ACCELERATING DEVELOPMENT OF "TRANSFORMATIONAL" TECHNOLOGIES

Looking to the future, it is increasingly apparent that to provide the energy necessary for continued economic growth and to reduce greenhouse gas emissions, we will have to develop new cost-effective "transformational" technologies that alter fundamentally the way we produce and use energy. By 2100, more than half of the world's energy may have to come from low- or zero-emission technologies to attain the UNFCCC goal.[1]

The Bush administration is laying a strong technological foundation to develop cost-effective and realistic mitigation options to meet clean development and climate objectives. The administration's Climate Change Technology Program (CCTP) was created to coordinate and prioritize the Federal Government's approximately $3 billion annual investment in climate-related technology research, development, demonstration, and deployment (RDD&D), including voluntary partnerships. We are pleased that EPAct2005 includes an authorization for this program, which is the technology counterpart to the Climate Change Science Program.

CCTP is assessing different technology options and their potential contributions to reducing greenhouse gas emissions over the short, mid, and long term. In August 2005, CCTP released its Vision and Framework for Strategy and Planning. This document provides an overall strategy to guide and strengthen our technical efforts to reduce emissions. In September, CCTP released its draft Strategic Plan for public comment, which builds on the guidance in the Vision and Framework. The Plan articulates a vision of the role for advanced technology in addressing climate change, defines a supporting mission for CCTP, establishes strategic direction and guiding principles for Federal R&D agencies to use in formulating research and development portfolio, outlines approaches to attain CCTP's six strategic goals, and identifies a series of next steps toward implementation.

CCTP's strategic vision has six complementary goals: (1) reducing emissions from energy use and infrastructure; (2) reducing emissions from energy supply; (3) capturing and sequestering CO_2; (4) reducing emissions of other greenhouse gases; (5)

[1] See, for example, K. Caldeira, A.K. Jain, and M.I. Hoffert, Science, 299, 2052–2054 (2003).

measuring and monitoring emissions; and (6) bolstering the contributions of basic science.

The administration continues strong investment in many strategic technology areas. As the President's National Energy Policy requires, efforts with respect to energy production and distribution focus on ensuring environmental performance, as well as dependability and affordability.

• Energy Efficiency and Renewable Energy: Energy efficiency is the single largest investment area under CCTP and it provides tremendous short-term potential to reduce energy use and greenhouse gas emissions. Renewable energy includes a range of different technologies that can play an important role in reducing greenhouse gas emissions. The United States invests considerable resources in wind, solar photovoltaics, geothermal, and biomass technologies. Many of these technologies have made considerable progress in price competitiveness, but there remains a need to reduce manufacturing, operating, and maintenance costs of many of these technologies.

• Hydrogen: In his 2003 State of the Union address, President Bush made a commitment to the development of a hydrogen economy, pledging $1.2 billion over 5 years for his Hydrogen Fuel Initiative to develop hydrogen fuel cell-powered vehicles. The transition to hydrogen as a major energy carrier over the next few decades could transform the nation's energy system and create opportunities to increase energy security by making better use of diverse domestic energy sources for hydrogen production and to reduce emissions of air pollutants and greenhouse gases.

• Carbon Sequestration: Carbon capture and sequestration is a central element of CCTP's strategy because for the foreseeable future, fossil fuels will continue to be an important source of energy. One realistic approach is to find ways to capture and store the carbon dioxide produced when these fuels are used. DOE's core Carbon Sequestration Program emphasizes technologies that capture carbon dioxide from large point sources and store it in geologic formations. In 2003, DOE launched a nationwide network of seven Regional Carbon Sequestration Partnerships, involving State agencies, universities, and the private sector, to determine the best approaches for sequestration in each geographic region represented and to examine regulatory and infrastructure needs. Approaches being pursued include carbon capture and geologic storage, and carbon sequestration in trees and soils.

• "FutureGen" Coal-Fired, Zero-Emissions Power Generation: The FutureGen project—a 10-year, $1 billion government-industry cost-shared effort to design, build, and operate the world's first near-zero atmospheric emissions coal-fueled power plant—will employ the latest technologies to generate electricity, produce hydrogen, and sequester carbon dioxide from coal. Through this research, coal can remain part of a diverse, secure energy portfolio well into the future.

• Nuclear Fission and Fusion: The administration also is pursuing next-generation nuclear energy as a zero-emissions energy supply choice, and DOE's Generation IV Nuclear Energy Systems Initiative is working on reactor designs that are safe, economical, secure, and able to offer additional capabilities such as reducing nuclear waste and producing, such as hydrogen. And though the technical hurdles are high, the administration sees great potential in fusion as a future energy source.

These initiatives and other technologies in the CCTP portfolio could put us on a path to ensuring access to clean, affordable energy supplies while dramatically reducing greenhouse gas emissions.

INNOVATIVE INTERNATIONAL PARTNERSHIPS

In addition to these domestic programs, the administration is working internationally with a broad range of partners. We believe that well-designed multilateral and bilateral collaborations focused on achieving practical results can accelerate development and commercialization of new technologies.

Under President Bush's leadership, the United States has brought together key nations to tackle jointly some tough energy challenges we face. These collaborations mirror the main strategic thrusts of our domestic technology research programs, and they address a number of complementary energy concerns, such as energy security, climate change, and environmental protection.

• International Partnership for the Hydrogen Economy (IPHE): Recognizing the common interest in hydrogen research that many countries share, the United States called for an international hydrogen partnership in April 2003, and in November 2003, representatives from 16 governments gathered in Washington, D.C. to launch

IPHE.[2] IPHE provides a vehicle to organize, coordinate, and leverage multinational hydrogen research programs that advance the transition to a global hydrogen economy. It reviews the progress of collaborative projects, identifies promising directions for research, and provides technical assessments for policy decisions. IPHE also will develop common recommendations for internationally recognized standards and safety protocols to speed market penetration of hydrogen technologies.

• Carbon Sequestration Leadership Forum (CSLF): CSLF is a U.S. initiative that was established formally at a ministerial meeting held in Washington, DC in June 2003.[3] CSLF is a multilateral initiative that provides a framework for international collaboration on sequestration technologies. The Forum's main focus is assisting the development of technologies to separate, capture, transport, and store carbon dioxide safely over the long term, making carbon sequestration technologies broadly available internationally, and addressing wider issues, such as regulation and policy, relating to carbon capture and storage. In addition to these activities, CSLF members are invited to participate in the FutureGen clean coal project. There are 22 members of the CSLF, including the United States, European Commission, China, and India.

• Generation IV International Forum (GIF): In 2002, nine countries and Euratom joined together with the United States to charter GIF, and multilateral collaboration to fulfill the objective of the Generation IV Nuclear Energy Systems Initiative.[4] GIF's goal is to develop a fourth generation of advanced, economical, safe, and proliferation-resistant nuclear systems that can be adopted commercially no later than 2030. A technology roadmap developed by the GIF and the Department of Energy's Nuclear Energy Research Advisory Committee in 2003 identified six technologies as candidates for future designs. Based on the roadmap, GIF countries are jointly preparing a collaborative research program to develop and demonstrate the projects.

• ITER: In January 2003, President Bush announced that the U.S. was joining the negotiations for the construction and operation of the international fusion experiment ITER.[5] The negotiations are now advancing rapidly and we hope to have a near-final agreement for both Congress and the administration to review in early 2006.

• Methane to Markets Partnership (M2M): In November of last year, the United States and representatives from 13 countries[6] launched M2M, which is led on the U.S. side by EPA. M2M is an international initiative that focuses on advancing cost-effective, near-term methane recovery and use as a clean energy source to enhance economic growth, promote energy security, improve the environment, and reduce greenhouse gases. Since the launch, the Partnership has expanded to include 17 countries, representing over 60 percent of global methane emissions, as well as almost 200 representatives from the private sector, financiers, and non-governmental organizations. The Partnership now actively supports near-term project development in four major methane sources: landfills; underground coal mines; natural gas and oil systems; and livestock waste management.

• Bilateral Activities: Since 2001, the United States has established 15 climate partnerships with key countries and regional organizations that, together with the United States, account for almost 80 percent of global greenhouse gas emissions.[7] These partnerships encompass over 400 individual activities, and joint projects have been initiated in areas such as climate change research and science, climate observation systems, clean and advanced energy technologies, carbon capture, storage and sequestration, and policy approaches to reducing greenhouse gas emissions.

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[2] Founding IPHE member governments include the United States, Australia, Brazil, Canada, China, European Commission, France, Germany, Iceland, India, Italy, Japan, Norway, Republic of Korea, Russia, and the United Kingdom. In January 2005, New Zealand became the 17th member.

[3] CSLF member governments include the United States, Australia, Brazil, Canada, China, Colombia, Denmark, European Commission, France, Germany, Greece, India, Italy, Japan, Republic of Korea, Mexico, Netherlands, Norway, Russia, Saudi Arabia, South Africa, and the United Kingdom.

[4] GIF member countries include the United States, Argentina, Brazil, Canada, France, Japan, Republic of Korea, South Africa, Switzerland, and the United Kingdom.

[5] ITER member countries include the United States, China, European Union, Japan, Russia, and the Republic of Korea.

[6] M2M member governments include the United States, Argentina, Australia, Brazil, Canada, China, Colombia, Ecuador, India, Italy, Japan, Republic of Korea, Mexico, Nigeria, Russia, Ukraine, and the United Kingdom.

[7] Partners include Australia, Brazil, Canada, China, Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama), European Union, Germany, India, Italy, Japan, Mexico, New Zealand, Republic of Korea, Russian Federation, and South Africa.

MARKET DEVELOPMENT FOR COMMERCIALIZATION OF NEW TECHNOLOGIES

One of the biggest barriers to economic progress in developing countries is lack of access to affordable, modern energy services, such as electricity. Such services are instrumental to economic growth, social development, and alleviation of poverty, and their availability can amplify the impact of investments in public health, education, sanitation, clean water, agriculture, and others. Nations that develop strong, market-based institutions and the rule of law will be in the best position to make the sustained investments necessary to provide clean energy and adapt to climate change over the long term.

Therefore, an important objective of U.S. participation in many international collaborations is to mobilize private sector investment by supporting economic reforms and institutional capacity building in the energy sector to strengthen markets and strengthen the rule of law while promoting innovative financing that reduces risks and transaction costs. These efforts are aimed at developing new policies and business models to create self-sustaining markets for financing energy efficiency, renewable, and infrastructure projects.

At the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002, the United States launched a Clean Energy Initiative (CEI). CEI consists of four market-oriented, performance-based partnerships: Global Village Energy Partnership, led by the U.S. Agency for International Development; Partnership for Clean Indoor Air and Partnership for Clean Fuels and Vehicles, led by EPA; and Efficient Energy for Sustainable Development, led by DOE. The mission of CEI is to bring together governments, international organizations, industry and civil society in partnerships to alleviate poverty and spur economic growth in the developing world by expanding access to and modernizing energy services.

The United States is also one of 17 countries that participate in the Renewable Energy and Energy Efficiency Partnership—REEEP. REEEP was initiated by the United Kingdom as a WSSD partnership to assist market development of renewable and energy efficiency systems. The United States also actively participated in the Renewables 2004 conference sponsored by the German Government in June 2004 and submitted five action items to provide specific technology plans and cost targets for renewable energy technologies using solar, biomass, wind, and geothermal resources.

INTERNATIONAL CLIMATE PROVISIONS OF EPACT2005

The international climate provisions of EPAct2005 recognize the importance of developing countries in mitigating climate change. Indeed, central to achieving the objective of the UNFCCC will be the participation of developing countries.

In passing unanimously the Byrd-Hagel Resolution in 1997, the Senate then made its views quite clear that any approach to climate change must involve developing countries. However, under the terms of the Kyoto Protocol to the UNFCCC, only industrialized, mature market economies are required to reduce emissions. The emerging economies of the developing world—including large emitting countries such as China and India—can continue business as usual despite their rapidly growing emissions.

Total carbon dioxide emissions from fossil fuel consumption from the emerging economies soon will outstrip those from mature market economies. Projections in the Energy Information Administration's (EIA) International Energy Outlook 2005 suggest that by 2010, carbon dioxide emissions from emerging economies could surpass those from the mature market economies. According to EIA, in 2002, carbon dioxide emissions from mature market economies were 49 percent of the world total while emerging economies accounted for 39 percent and the transitional economies of Eastern European/former Soviet Union (EE/FSU) countries 13 percent. EIA projects that in 2025, mature market economies will account for 39 percent of world carbon dioxide emissions, emerging economies 50 percent, and the EE/FSU countries 11 percent. IEO 2005 projections also suggest that the emerging economies and EE/FSU countries combined will account for 77 percent of the total projected increase in global emissions from 2002 to 2025.

These EIA projections are consistent with recent projections from the International Energy Agency. Its World Energy Outlook 2004 suggests that well over two-thirds of the projected increase in energy-related carbon dioxide emissions between now and 2030 will be from developing countries.

The Bush administration believes that the most effective way to engage developing countries is to focus not solely on climate change, but rather on a broader development agenda that promotes economic growth, reduces poverty, provides access to modern sanitation, enhances agricultural productivity, provides energy security, reduces pollution, and mitigates greenhouse gas emissions.

Developing countries made these needs clear at WSSD, and the international community agreed, in the Johannesburg Plan of Implementation, on the primacy of the development agenda over an agenda exclusively focusing on decarbonizing economies. Given these considerations, the reluctance of developing countries to take on Kyoto-style emissions caps—which could nuke achieving economic and social development goals much more difficult—is well founded.

An emissions intensity approach to limiting greenhouse gas emissions can lead to greater engagement on climate change from developing countries because it encourages reductions without threatening economic growth and development. This is a clear advantage over the Kyoto Protocol approach, which focuses on short-term reductions.

This intensity approach is working here in the United States. In 2002, President Bush set an ambitious but achievable national goal to reduce the greenhouse gas intensity of the U.S. economy by 18 percent by 2012, which represents about a 30 percent increase in the rate of improvement projected by EIA over this period. The administration estimates that this commitment will achieve about 100 million metric tons of reduced carbon-equivalent emissions in 2012, with more than 500 million metric tons of carbon-equivalent emissions in cumulative savings over the decade.

To this end, the administration has developed an array of policy measures, including financial incentives and voluntary programs. For example, the Department of Energy's (DOE) Climate VISION program and the Environmental Protection Agency's (EPA) Climate Leaders and SmartWay Transport Partnership programs work in voluntary partnership with industry to reduce emissions. The Department of Agriculture is using its conservation programs to provide incentives to increase carbon sequestration in soils and trees, and to reduce methane and nitrous oxide emissions from crop and animal agricultural systems. DOE, in partnership with EPA, USDA, and other Federal agencies, also is pursuing many energy supply technologies with comparatively low or zero carbon dioxide emissions profiles, such as solar, wind, geothermal, bioenergy, and combined heat and power. The Bush administration also has increased fuel economy standards for new light trucks and sport utility vehicles by 1.5 miles per gallon over the next three model years.

We expect these programs will make significant contributions toward meeting the President's 18 percent 10-year goal, which represents an average annual rate of about 2.0 percent. Recent data show we are already making headway. The average annual reduction of greenhouse gas emissions intensity from 1990 to 2003 was 1.9 percent. A June 2005 EIA flash estimate of energy-related carbon dioxide emissions—which account for over four-fifths of total greenhouse gas emissions—suggests an improvement in carbon dioxide emissions intensity of 2.6 percent in 2004. This follows on the EIA's Emissions of Greenhouse Gases in the United States 2003 report showing that the total U.S. greenhouse gas emissions intensity was 2.3 percent lower in 2003 than in 2002. Overall, then, the Nation appears to be ahead of schedule in meeting the President's goal.

We believe that certain aspects of the international climate provisions authorized under Title XVI Subtitle B of EPAct2005 are broadly consistent with the administration's approach. Specifically, the provisions call on DOE to lead an effort to identify technology options that could reduce greenhouse gas emissions intensity and are suitable for transfer to developing countries DOE also is authorized to carry out fellowship and exchange programs under which officials from developing countries can gain experience and knowledge of best practices to reduce greenhouse gas emissions intensity in their countries.

The Department is working with the Department of State and the U.S. Agency for International Development on a framework to execute those aspects of the international climate change provisions that it can readily accomplish. The Department is currently evaluating provisions authorizing demonstration projects for cleaner, more efficient technologies. Conducting demonstration projects in developing countries would likely raise issues and complexities involving legal, regulatory, trade, intellectual property, and other questions. Also, without complementary economic reforms in partner countries to strengthen markets for cleaner technologies, their replication and deployment will be inhibited.

ASIA-PACIFIC PARTNERSHIP FOR CLEAN DEVELOPMENT AND CLIMATE

The administration believes the international climate change provisions of EPAct2005 are also consistent with the Asia-Pacific Partnership for Clean Development and Climate, which was announced in July by Deputy Secretary of State Robert Zoellick and his counterparts representing five large economies—Australia, China, India, Japan, and Korea.

Together, the six nations that make up the Partnership account for about half of the world's greenhouse gas emissions and a significant amount of total global economic output. So while the partnership initially is at a manageable size, it nonetheless can have a significant impact. Moreover, it is significant that among the partners are countries with targets under the Kyoto Protocol, countries without targets under the Kyoto Protocol, countries not party to the Kyoto Protocol, and both industrialized and emerging economies.

The one characteristic all the countries have in common is a willingness to take practical measures to address the complementary challenges of energy security, clean development, and climate change. The Partnership's focus will be activities to create new investment opportunities, build local capacity, and remove barriers to the introduction of clean, more efficient technologies. It is designed to help each country meet nationally designed strategies for improving energy security, reducing pollution, and addressing the long-term challenge of climate change. The Partnership also will cooperate on longer-term "transformational" energy technologies that can drive economic growth while enabling significant reductions in greenhouse gas intensities.

CLOSING OBSERVATIONS

The administration remains committed to the UNFCCC and to the mutual goals of sustainable development and economic growth. The President has an ambitious near-term goal to reduce the Nation's greenhouse gas emissions intensity, and is taking many actions to help meet that goal. We are investing billions of dollars on advancing climate science and accelerating the development of advanced technologies—such as hydrogen, carbon sequestration, advanced nuclear reactors, and fusion energy—that have the potential to transform energy systems. And we are fully engaged internationally and lead major multilateral and bilateral climate change science and technology initiatives, and will continue to co-operate with all nations.

The administration believes that co-operation among developed and developing countries must combine action on greenhouse gases with action to meet societal needs for increased energy resources to fuel economic growth and reduce poverty, and to do so in a way that reduces pollution, improves energy security, and avoids greenhouse gas emissions.

Significant portions of the approach outlined in Title XVI Subtitle B of EPAct2005 are conceptually in agreement with the approach adopted by the administration on climate change, particularly in the emphasis on technology, innovation and improving markets to support the deployment of improved technologies. The framework set out in the legislation avoids many of the very real problems with the emissions cap approach of the Kyoto Protocol, and it complements many of the administration's ongoing international initiatives described in this testimony.

We appreciate the careful thought that has gone into EPAct2005, and we stand ready to work with the Senate and this subcommittee to explore these ideas further.

RESPONSES BY HON. DAVID GARMAN TO QUESTIONS FROM SENATOR JOSEPH R. BIDEN, JR.

Question. In response to a question by Senator Hagel about the Asia-Pacific Partnership, Mr. Garman responded: "We realize that, for instance, China or India might not quite be ready for an integrated, gasified, combined-cycle coal plant, but updating a 1940s technology or fifties technology to a 1970s or eighties technology coal plant would be a very good thing and an efficiency boon for them. Those are plants that we have a great deal of experience building. Our companies are involved in that. And that is, in fact, the type of technology that is being employed and deployed today in countries such as that. But we want to ratchet that up."

Is it the administration's intention to use the Asia-Pacific Partnership to subsidize at taxpayer expense or otherwise promote the deployment in developing countries of, among other things, out-of-date 1970s and eighties coal-burning technologies?

Answer. The point of the example cited above is that existing technologies in widespread use in the United States, even those that have been around for many years, could nonetheless dramatically improve the efficiency of energy systems in India and China, and thus the emissions profiles of those countries. The statement also notes that "we want to ratchet that up," and the Asia-Pacific Partnership on Clean Development and Climate aims to promote significant improvements in clean energy technologies in these and other partnering countries by helping them develop and commercialize even more advanced clean energy technologies, such as today's Integrated Gasification Combined Cycle (IGCC) technology.

Question. Are there other examples of out-of-date technologies the administration intends to subsidize or otherwise promote through the Asia-Pacific Partnership?

Answer. The intent of the Asia-Pacific Partnership is to promote the cleanest energy technologies available that can be readily adopted by the economies of Asia-Pacific Partnership countries.

Question. Is it not true that supporting construction of new fluidized bed combustion power plants will irreversibly lock in new higher GHG emissions for the life of each such plant, at the expense of accelerating deployment of more advanced coal technology, such as IGCC, that has higher efficiency and from which the greenhouse gases can later be captured and stored underground?

Answer. Modern fluidized bed combustion power plants would lock in higher greenhouse gas emissions only if they were less efficient than existing plants, which would not be the case in countries such as China and India. There is a great deal that can be done to improve the efficiency of existing plants and to promote relatively new coal technologies that exhibit far greater efficiency that existing plants. Such steps can improve markedly the emissions profile of these two countries almost immediately, not years from now. IGCC clearly has many attributes that make it attractive vis-a-vis fluidized bed combustion, but there are a number technical and market challenges that need to be addressed before it can be readily commercialized in China and India, not least of which is its cost premium. Nevertheless, we expect that in the future IGCC can and will play a significant role. Indeed, IGCC will be a key aspect of the Asia-Pacific Partnership's Clean Fossil Task Force, one of eight task forces announced at the just completed Asia-Pacific Partnership ministerial meeting. Through this task force, we will be working with our partners on approaches to accelerating IGCC penetration into the marketplace.

Question. I am concerned that by supporting export of equipment for the outdated FBC plants, we may miss opportunities for U.S. firms to capture lasting market leadership in technologies that have much greater revenue potential over the long term. Please comment.

Answer. While in the short term, modern fluidized bed combustion technology may represent a tremendous improvement over existing technologies in use in some countries, we agree that over the long term, it is important for the U.S. to have leadership in advanced technologies, such as IGCC. The Department's Office of Fossil Energy supports research, much of it in partnership with the private sector, into an array of advanced clean coal technology options. Through this kind of research, U.S. firms are and will remain well-poised to take advantage of market opportunities in a variety of advanced clean coal technologies.

Question. I am also concerned that, by locking in a baseline with those higher emissions, that we will create further barriers to getting China, India, and other large emitters ultimately to take on GHG reduction commitments. Please comment.

Answer. It follows that the commercial adoption of technologies that demonstrate improved efficiency over technologies currently in use in China and India will reduce, not increase, the emissions baselines of these countries below what they would have been otherwise. Obviously, IGCC technology can have a big impact, and we will be working through the Asia-Pacific Partnership on ways to accelerate the use of this technology in these and other partnering countries.

There is a reason China, India, and other developing countries have shown no inclination to take on binding emissions reduction commitments. As my testimony noted, Kyoto-style emissions caps are perceived rightly by many countries, industrialized and developing alike, as barriers to economic growth. It is noteworthy, therefore, that China, India, and Korea—three countries that have adopted the Kyoto Protocol but have no emissions reduction obligations under it—have joined with the United States, Australia, and Japan—which would have obligations under the Kyoto Protocol—in the Asia-Pacific Partnership, the purpose of which is to address energy security, climate change, and other environmental challenges such as air pollution in the context of economic growth. Promoting and maintaining economic growth creates market conditions favorable to investing in advanced technologies, such as IGCC, that can have even greater impacts on greenhouse gas and pollutant emissions over time.

Question. Sen. Alexander raised the example of Shell's investment in Australia in an IGCC/ICCS power plant intended to be in operation by 2010. Please provide the market volume and market share by country for low carbon energy supply technologies.

Answer. The Department does not keep a record of market volume and market share by country for low carbon energy supply technologies and therefore can not provide the committee with such information.

Question. Are you aware of other examples of investment in major climate-friendly technologies occurring in other countries at higher levels of investment than in the United States?

Answer. The Department does not track investments in climate-friendly technologies occurring in other countries and therefore can not provide the committee with this data.

Question. Please explain why the United States is not in the position to prevail in aspect of the race to develop and deploy climate-friendly technology.

Answer. The United States leads the world in the development of climate-friendly technologies. The Bush administration is laying a strong technological foundation to develop cost-effective and realistic mitigation options to meet clean development and climate objectives. The United States spends more on climate change technology development and deployment than any other country. For Fiscal Year 2005, the Federal Government invested nearly $3 billion in such programs. The research conducted through the Climate Change Technology Program (CCTP) is designed to help provide the marketplace with cost-effective options that can reduce greenhouse gas emissions and thereby address long-term climate change concerns. We are pleased that EPAct2005 includes an authorization for this program.

In August 2005, DOE released the CCTP Vision and Framework for Strategy and Planning and in September it released its draft Strategic Plan for public comment, which builds on the guidance in the Vision and Framework. These documents articulate a vision of the role for advanced technology in addressing climate change, defines a supporting mission for the multi-agency CCTP, establishes strategic direction and a framework of guiding principles for Federal R&D agencies in formulating a CCTP research and development portfolio, outlines approaches to attain CCTP's six strategic goals, and identifies a series of next steps toward implementation. Our approach recognizes the importance of maintaining a broad and balanced R&D portfolio across a range of technologies, but it also identifies a process for setting priorities in strategic areas with great potential.

The administration's emphasis on international collaboration is another way to accelerate technological progress. The U.S. has initiated a number of multilateral technology collaborations, including the Carbon Sequestration Leadership Forum, the International Partnership for the Hydrogen Economy, the Generation IV International Forum, and the Methane to Markets Partnership, and it rejoined the ITER fusion project. The administration believes that well-designed multilateral collaborations, by avoiding duplication and leveraging resources, can accelerate development and commercialization of new technologies. The Asia-Pacific Partnership, which was just launched formally in Sydney, Australia, will be looking at ways to accelerate the commercialization of advanced technologies that can help reduce greenhouse gas emissions, contribute to energy security, and promote a cleaner environment.

We believe that these and other efforts will ensure that the United States maintains its leadership role in developing and commercializing advanced energy technologies.

Question. What factors make Germany, Japan, and other countries more successful than the U.S. in commercializing advanced energy technology?

Answer. These countries are not more successful in commercializing advanced energy technologies. However, in some cases, markets in these countries experience increased demand for advanced energy technologies because of government policies or inherent price differentials. For example, generous subsidies (over $0.50/kWH in the case of Germany) and higher electricity prices in Japan and Germany encourage the deployment of higher cost renewable energy in those markets. Our approach is to lower the cost of these technologies through continued research and development so they will be widely adopted in mainstream energy markets.

Senator HAGEL. Secretary Garman, thank you.

Because Senator Alexander has commitments on the floor of the Senate shortly, I am going to ask Senator Alexander for whatever questions he would like to ask, and take as much time as you need.

Senator Alexander.

Senator ALEXANDER. Thanks, Mr. Chairman. That is very generous of you. I will just ask one or two questions and hope I can return.

First let me thank the administration witnesses for coming. I believe that the energy bill that was passed in July represented a real change in direction for the United States Senate. Its entire focus almost was on shifting our attention to the way to produce low-carbon and no-carbon energy in the large amounts that we are going to need in the United States. That is why it focused on conservation and efficiency. That is why it focused on advanced nuclear power. That is why it focused on coal gasification and carbon sequestration, the other things that you have mentioned.

My concern is that I would like for it to have been more aggressive. I think it is the right model, but I favor more aggressive conservation and efficiency, more aggressive support for advanced nuclear, more aggressive coal gasification and carbon sequestration. That is why I voted along with the majority of Senators for Senator Bingaman's resolution, which basically recognized that there is a growing scientific consensus that human activity is a substantial cause of greenhouse gas accumulation on the atmosphere and mandatory steps will be required to slow or stop the growth of greenhouse gas emissions into the atmosphere.

In order to get my support and I think that of several other Senators, Senator Bingaman took out that the mandatory controls would have to be there in this session of Congress. I am reluctant to vote for any such mandatory caps until I have a clear picture of exactly how they would affect this big complex economy of ours, and I do not think we know yet. Secondly, I much prefer the Hagel approach, which is to innovate our way out of this problem rather than cap our way out of the problem.

This leads me to my question. Of the several areas that you discuss, the one I would like to focus on is coal gasification and carbon sequestration. It seems to me that after advanced nuclear technology, which exists today and produces 70 percent of our carbon-free electricity, that waiting in the wings for the next way to produce large amounts of carbon-free or low-carbon technology is a combination of coal gasification and carbon sequestration. It is actually preferred by many of the large environmental organizations who are looking at the worldwide consequences. They want us to do it early, not just for ourselves, but because it would avoid the rest of the world building all the conventional coal plants or as many conventional coal plants. If they can build coal plants that are cleaner, then our chance of having cleaner air and less effect from global warming are greater in the United States.

On November 9th the President of Shell Oil told the Senate Energy Committee, on which I serve, that Shell is working with the Queensland government in Australia—several of you mentioned Australia—on the feasibility of building an IGCC power plant, coal gasification plant, with 85 percent of the carbon dioxide sequestered underground. The goal is to have it in operation by 2010. If I am not mistaken, our U.S. climate change technology program has a goal of having commercial plants with carbon capture and sequestration by 2015 or later. That would give us a few years to work on this.

I do not want us to get into the position of leasing this advanced technology from the rest of the world. I would like for us to lead the world in terms of this. I especially wonder therefore if we should not be putting more emphasis on coal gasification, especially on industrial gasification, given the high prices of other energies. There are a great many industries around the country who are more interested in that. I am looking for a way to break open the market and make coal gasification with sequestration more of an option for us as we deal with global warming.

How could we be more aggressive about that and what could we in Congress do to encourage you to do that or get out of the way of interfering with your doing that?

Mr. CONNAUGHTON. Senator Alexander, I will begin with your last part of the question, which is the policy framework, and then I will hand it off to Under Secretary Garman to talk to you about the technology development aspects of that. I think I need to begin, when I came into my job 4 years ago, almost 5 years ago, coal gasification was a project of the Energy Department, not a project of the market. In fact, the best indicator that there was not much interest in coal gasification is the private market was not putting a lot of their own money into it. They were following the good research work that was going on at DOE.

So one of our challenges was how do we create a policy environment that creates the incentive for the private sector to invest and for our communities to request the use of this technology in the marketplace. There were a few impediments. First of all, it is really expensive to build a coal gasification plant. If your choice is to build a natural gas plant or a conventional clean coal plant, they are much less costly enterprises. That is just a straight issue that we have to confront.

But secondly, at the time, 5 years ago, there was great uncertainty about the future of coal in power production. Most of the investment was headed toward natural gas, with the consequences that we are seeing today, which is huge natural gas prices, in part because the utilities are using natural gas when it should be reserved for our manufacturers and for our consumers, especially those least able to afford their energy.

So we sat down and said, how do we create this certainty? The phrase I like to use is you cannot have clean coal without coal. You need a policy that creates a strong signal to the market that we will continue to use coal as an energy source in America and we want to use it cleanly. That is issue one and that is getting your air pollution rules right.

Then issue two, you cannot get zero-emission coal without clean coal. Your first step is to get the technology that cleans up the conventional harmful air pollutants and then you want to apply the technology that holds the greatest promise of capturing the carbon. Certainly gasification is the leading contender for that equation.

You also cannot scare people away from the technology. I think your notion of waiting on carbon mandates is dead on because if we put in place a carbon mandate and somebody is thinking about spending a lot of money on a coal plant, well, if we have not perfected the technology for capturing coal they are not going to spend

that money. They are going to move to something other than coal. It is all about sequencing.

So that brings us full circle. As a result of the President's clear new rules under the clean air interstate rule, we have created a platform where we will cut the air pollution from coal by about 70 percent. Because that framework is based on a market-based framework about performance, we are now seeing emerging a number of large technology providers talking about going beyond the DOE research proposal and building for themselves large conventional integrated gasification combined cycle power plants.

We just had an announcement this summer that Bechtel, GE, and one other—who am I leaving out—AEP, thank you. It was AEP, Bechtel and GE have announced that they are pulling together a commercial scale design for this technology and they are going to seek approval. In fact, they are in a competition right now for approval among a number of States. Cinergy, now subsumed under Duke Power, is pursuing similar authorities, as is the Southern Company. So we now have three of our major coal-fired utilities who have put this technology that you seek back on the table in a commercial setting where we can get investment.

From that standpoint—and then I will turn it over to Under Secretary Garman——

Senator ALEXANDER. Mr. Connaughton, my question is why is Shell making a deal in Queensland to have something open by 2010 and not in the United States? What about our conditions here make it more attractive in Australia to do that?

Mr. CONNAUGHTON. I will hand off to Dave and then I will pull back and add to that.

Secretary GARMAN. I am not precisely sure why Shell is moving ahead in Queensland, to move ahead with a sequestration project there. As Chairman Connaughton indicated, there are several IGCC, integrated gas combined cycle, plants, actually two in operation today in the United States and others that are coming into being in the near future.

There is some basic science, though, that we need to do on the sequestration side. Gasifying the coal is not the sum total of the effort to make sure that the project is going to be a success. We have to be sure that we can separate that carbon dioxide from the flue stream cost effectively and geologically sequester that carbon dioxide and have the confidence of both the science community and the public that the carbon dioxide is going to stay where we put it.

There is some fundamental science that has to be done. Now, Australia is of course our partner in the Carbon Sequestration Leadership Forum to undertake some of this pre-commercial scientific research that does need to occur. But I think Jim put it very well. The efforts to compete and to market this technology are already well under way and I think the consensus is that IGCC plants are the way to go, that, as you mentioned, coal has to be a player and it will be a player. If we are serious about carbon dioxide, we have to recognize the developing countries with an extremely large amount of coal are going to use coal and we should endeavor to develop those technologies that let them do it in a near-zero carbon emission framework.

We have substantially increased funding for carbon sequestration work and coal gasification work in our budgets and we take it as a very serious research activity that we have under way.

Senator ALEXANDER. I want to thank the witnesses for your answers and excuse myself. I have to be on the floor right now. I want to thank the chairman for his courtesy in letting me ask the first question.

Senator HAGEL. Senator Alexander, thank you.

Let me start with you, Chairman Connaughton. All three in your testimony noted the Asia-Pacific Partnership on Clean Development. How did that come about? What was the impetus to bring that group together?

Mr. CONNAUGHTON. The partnership actually grew out of a long series of international dialogues related not just to climate change, but related to the partnerships that we had developed, especially in the Asia region, in following up on the World Summit on Sustainable Development, which was focused on more the classic development issues such as reducing water pollution and reducing air pollution and promoting agricultural productivity, as well as emerging dialogues about our shared concerns about energy security, because we are six countries representing 50 percent of the economy, those economies are driven by energy and we are competing on the world stage for those sources.

We found ourselves dealing with each of these issues individually and yet recognizing that you cannot treat them apart. If you want a sensible path forward, we need to link our government to government policy dialogues, our private sector to private sector dialogues, and then our technology research and development dialogues.

So we had a jam session, if you will, internally within the administration to figure out how we could better consolidate our efforts and make them more effective. Then we also recognized the last 4 years was really about technology development and the real imperative then emerged, now let us get focused and even more serious about technology deployment.

Our conclusion internally was it is not enough to do projects any more. We have technology development, we have USAID and other, the banks, doing projects that prove some of these highly efficient technologies, these low pollution technologies. But we really need to figure out how to open up markets.

We thought we would start small with a small number of countries with a shared economic zone and see if we could identify some key priority sectors where we can advance these three goals of energy security, air pollution reduction, and greenhouse gas reduction in a coherent way. So it was sort of evolutionary. We reached out to them over the course of last winter.

I must say, Mr. Chairman, that a lot of our dialogue was predicated on the exchange that we had and some of the thinking that you and Senator Pryor brought to the table, as well as Senator Alexander. We worked hard to incorporate that into our discussions internationally, and in fact in record time we found common ground on a vision where there had been a struggle for that in the years past. I think the time was particularly ripe for that.

Senator HAGEL. Thank you.

Any of the other witnesses want to add? Secretary Dobriansky?

Secretary DOBRIANSKY. Thank you. I would like to add to that. Jim mentioned the original discussions, if you will, at the World Summit on Sustainable Development. It became I think very apparent coming out of those discussions and going to the COP meeting in New Delhi there was a declaration that in fact was issued which I think in many ways clearly and directly enunciated that these issues are integrated and that there is a vital need to try to work more closely on the advancement of economic growth and on the advancement of energy security and in particular the development of clean and efficient energy technologies.

I would start back with the linkage and the discussions that took place very broadly at that time among a wide variety of countries. Then I would add to that by looking at over the years leading up to just this past summer that it really became even more apparent how crucial this integration in fact is and how it is being very much accepted, not only by the developing world and urged by the developing world, but I think even what we saw in Gleneagles with the G-8 plan of action it also really codified the importance of this integrative approach. In fact, we see the Asia-Pacific Partnership, if you will, as linked to those discussions.

Senator HAGEL. Thank you.

What countries outside this partnership in your opinion would be potential leapfrog countries to work with and ground them with this new concept of technology and partnership?

Secretary DOBRIANSKY. I will respond from this perspective. I would rather not mention specific countries because, quite frankly, there are quite a few that actually have expressed an interest in the Asia-Pacific Partnership. But one of the things that I can say to you is that I think, first of all, the interest is very welcome. It comes from both other developing and developed countries, those that also would fit in the category of large emitters, and then thirdly those that are in dire need as well of economic growth and a need for the opening of markets.

But one of the things that we have thought about with the launch in January is, in addition to the formal launch, to hold a meeting with the diplomatic corps and particularly, not only those that have directly and already expressed an interest in coming into the partnership, but with others who might want to know more, and to see where we go from there.

I do not know if you want to add further.

Mr. CONNAUGHTON. Yes, I just want to underline the fundamental behind the partnership is looking for these opportunities on a large scale to open up markets for environmental goods and services that will promote efficiency, reduce air pollution, and thereby reduce greenhouse gasses as well. So when we look at candidate countries for real progress, it actually turns on the fundamentals of development, too.

Clearly, the Millennium Challenge countries have been identified by the President under the authority of the Congress as countries that are really getting their acts together to get the economic foundation and the human capacity foundation to create the value chain and the markets for these kinds of developments. They are also the more dynamic economies, so they are the ones that we ex-

pect to see growth and investment at a level that is quite substantial.

We are really talking about the countries where the private sector sees a real opportunity to enhance the quality of life, and that comes from the fundamentals, the fundamentals of investing in people and stable economic institutions. It is very difficult to make substantial progress in countries that are not establishing those norms.

So I think we look at our new trading partners. They are clearly in the realm of opening up trade, sharing technologies and experiences, while protecting intellectual property rights and providing a good stable foundation for those investments. These are the kinds of countries that make the most sense. Of course, you have the large ones, too. You know who they are. I put the chart up earlier, and it is pretty clear where the opportunities lie in that list that EIA put together for us. From that we want to then select the countries where we actually think our private sector stands a good chance of working their way into their economy, and at the same time these are countries that can come and invest here, because this country will spend tens, actually into hundreds of billions of dollars in the next couple decades on efficiency upgrades and pollution reduction upgrades. That is a global market that some of these countries can invest in and gain some experience in and bring that home, bring that experience home. So it is a two-way street is what we are trying to establish.

Senator HAGEL. Thank you.

Secretary Garman, what key U.S. technologies are available today for deployment with not only some of these partnership countries, but other countries that may be at that stage that Chairman Connaughton was talking about?

Secretary GARMAN. The technologies that come to mind is of course underpinning the need for large amounts of dispatchable baseload electricity for growing economies, and that would include nuclear technology, which is important but controversial in some realms, but also some of the more advanced fossil technologies such as circulating fluidized bed coal. We realize that, for instance, China or India might not quite be ready for an integrated gasified combined cycle coal plant, but updating a 1940s technology or fifties technology to a 1970s or eighties technology coal plant would be a very good thing and an efficiency boon for them. Those are plants that we have a great deal of experience building. Our companies are involved in that and that is in fact the type of technology that is being employed and deployed today in countries such as that. But we want to ratchet that up.

Senator HAGEL. Chairman Connaughton? Thank you.

Mr. CONNAUGHTON. If I could add, we also are seeing a great and nice emergence of wind in appropriate settings, although around the world there is still a lot of resistance to the siting of wind projects and that remains something that we should work, dedicate ourselves much more to, because it is a plague here in America and it is in other parts of the world as well.

But I would also underline the interests in some of the major economies in bio energy systems, that again require a lot of work to figure out and make sure you have the total balance right. But

I did want to underline, I just returned from a visit to China and they are now sending a clear, a clearer regulatory signal and a clearer market signal toward the application of the technologies that Under Secretary Garman just described. They in their new plan are dedicating themselves to desulfurizing, taking the sulfur out of, 46 percent of their existing coal-fired power plants. Some of these are 40 years old. That is a big deal. They are going to retire a couple hundred of small—they have these small, little coal plants. They are just going to retire them, so they go to a bigger baseload plant on which they can install pollution control technology. Nearly every new plant, coal plant, they build, they are going to—it is their now set policy that they are going to desulfurize it and require the installation of burners that have low nitrogen oxide emissions.

These are conventional technologies that we know how to do well in America which, if deployed on the scale the Chinese have publicly stated they are going to deploy it, will be hugely consequential. How do we help them to implement that, accelerate that, is the challenge that is before the partnership. But we now have a clear goal.

I will add that they also want to do it while improving their efficiency by 20 percent. They have a goal of a 20 percent efficiency improvement. Some of these technologies take power to use them and so their investment in efficiency becomes critical because they do not want running air pollution control equipment to take away from the energy available to the people they are trying to lift out of poverty.

It is really an exciting time for this kind of international discussion because we are getting clearer goal-setting by each of our countries.

Senator HAGEL. Thank you.

Under Secretary Dobriansky, would you like to add anything?

Secretary DOBRIANSKY. No.

Senator HAGEL. Let me ask you, Madam Secretary, where do you think the most cost-effective areas are in the world today for implementing some of this technology?

Secretary DOBRIANSKY. Clearly we are looking at those areas where there is a market opportunity, that you do have an ability for the private sector to engage and to be able to invest. At the same time, I think what also is very crucial in this area, and which I think is the underpinning of the Asia-Pacific Partnership, for example, is the importance of building capacity. So we are also looking at that aspect, in other words the infrastructure and the capacity to actually be able to go in and to help.

I also think what is crucial to this is relationships and the breaking down of barriers as well. Those are some of the kinds of criteria, if you will, and factors that we are looking at. I think this means not only the engagement of some countries that would not necessarily be categorized as developing countries in the truest sense of the term, but those which have an infrastructure where change is required and there are opportunities for actual development and deployment of technologies.

But then you have the other side, which is those countries that really are lacking a complete capacity and have the willingness to

open themselves and to try to change. So there is a type of a two-tiered approach. I know that in the process of our looking at, for example, the 25 countries we have been grappling with that issue in defining specific criteria of what we look at, looking at also the question of greenhouse gas emissions, CO_2 emissions, looking at the factors I have just mentioned, and we look very much forward to sitting down with you and sharing some of our thoughts after we have sifted through that.

Senator HAGEL. Thank you.

Anyone else want to? Secretary Garman?

Secretary GARMAN. I just would not want—we have not mentioned a lot about end use technologies and efficiency technology and I would not want that to be construed as a technological opportunity that we should miss. As an example, last week I sat down, speaking of China, with 20 individuals from around China from the Ministry of Buildings to talk about something as simple and seemingly untechnical as insulation. The Chinese built a lot of concrete buildings with no thermal breaks or insulation whatsoever, and if we can employ very simple, available technologies we can have tremendous impact that involves not having them build more power plants, but having them build fewer power plants, and that is in everybody's interest.

Senator HAGEL. Thank you.

Secretary Dobriansky, what are we doing through the State Department to encourage these countries, developing countries, to adopt these standards and invest in technologies and partner with us?

Secretary DOBRIANSKY. We have a range of programs, some of which I have mentioned, that really tap into the private sector, which we see as very crucial in the implementation of these strategies. Public-private sector approaches are absolutely crucial.

Secondly, one of the areas that I think we really need to be looking at more closely are what are some of the financial incentives that could be provided and what are some of the barriers that could be broken down. Those are areas that we are exploring and we hope to be able to come forward with some more concrete information in those areas as to what we can specifically do.

We think as part of the legislation that you have put forth you quite rightly identify those areas as being crucial to move forward with these technologies.

I also would highlight something that you featured and that is exchanges. I think that it is not only about the financial side, but it is also very much about the personal relationships, the expertise that is in fact shared, the information that is shared, which is also I think a very crucial underpinning and component here in working together, the whole importance of joint projects, that this is not just a one-way street, it is a two-way street.

Senator HAGEL. Would you say this is a high priority at the State Department in achieving this objective?

Secretary DOBRIANSKY. Absolutely, it is absolutely a high priority in trying to achieve this objective. I think the framework of your provisions really identify a number of crucial areas that we feel underpins, if you will, some of the current initiatives that we have,

but as I also suggested in my testimony, the need for us to go further in a number of areas in collaboration with our partners.

But this is absolutely a priority for us. We think that these kinds of steps will make a difference, a fundamental difference in impact, not only in terms of economic growth, but also in terms of addressing the issue of energy security and climate change.

Senator HAGEL. Thank you.

Anyone wish to comment?

Mr. CONNAUGHTON. Just on the priority point, this has come together as we would have liked, but it has come together largely because the President has put a lot of his own personal initiative into this with the other leaders in the partnership, as he did in the context of what was a substantively successful G-8 outcome in working very closely with Prime Minister Blair, who has been extremely thoughtful on these issues, in trying to find that common ground.

I would also note that Secretary Rice herself is personally engaged on a regular basis with respect to this. This actually grows out of some of her own efforts and thinking right after the last election as we were trying to shape the agenda going forward on how, again, how we advance our broader development objectives in a way that envelops this initiative.

The other thing I would add, Senator, is we talk about identifying the countries. Perhaps one part of the question really needs to be identifying the opportunities. The best opportunities still are the ones that make the most money, as opposed to cost the most money. I can assure you that as we do some of our road mapping in the power generation sector and a few other sectors I could think about, there are clear near-term opportunities with appropriate national policies to be sure that investments in efficiency, for example, occur for some of the end use opportunities that Under Secretary Garman said would occur.

The second, which is clearly the case in countries like India and China, when you ask them their top priorities in the environment, they nearly universally say it is reducing water pollution and cleaning their air. So if you can quantify public health benefits, which we are very good at doing in America, we can share that analytical work.

The addition to GDP by making real improvements in air pollution reduction and water pollution reduction are enormous in these countries. Just the math is still coming forward.

Then of course, in a political sense this energy security issue is a big motivator for action. So the more we swim with the current of these high priorities, the more that we can obtain in the area of greenhouse gas reduction as well.

[Room lights fade out, then return.]

Senator HAGEL. We may have an energy issue here.

Secretary DOBRIANSKY. In the dark, may I just add?

Senator HAGEL. Secretary Dobriansky, in the dark.

Secretary DOBRIANSKY. I wanted to underscore the top leadership at the State Department, Secretary Rice, sees this as a priority. She personally is engaged in it, and also with regard to the Asia-Pacific Partnership Deputy Secretary Zoellick also has been very engaged. He in fact announced it in ASEAN over the summer. So

we have a very strong and robust support of our top leadership in this.

Senator HAGEL. Thank you.

You each mentioned this to some extent, but I would like to hear from the three of you specifically where you think in your particular areas of responsibility with your portfolios are the biggest barriers to greater use of these technologies and technological solutions with these countries. Start with you, Chairman Connaughton.

Mr. CONNAUGHTON. First of all, obstacles to trade. We still have very significant tariffs and we still have inconsistent rules of the road when it comes to the provision of these goods and services, and we still have a huge issue with intellectual property rights. These are advanced technologies. They are very effective. They can be mass produced. But if there is not a protection of the original intellectual property creating these technologies the people who have them are not going to be deploying them. So this is fundamental.

The other barrier from my perspective in terms of what I am going to be working hard on is what I call the peer-to-peer barrier. We have a lot of government-to-government dialogues. A subset of our technology vendors talk to each other internationally. But what is missing are the CEO level, manager level exchanges, because largely where we need to make progress are big domestic-based industries, such as power generation. There is not a reason for our CEOs to sit down with their equivalent counterparts in China and India on a regular basis and exchange their own best ideas for financing, for how you manage these outcomes, for which range of technologies is delivering the goods.

That kind of exchange we can do a lot more of and actually that is a fairly low-cost taxpayer exchange to stand up and the dividends could be enormous in terms of inspiring innovation and investment opportunity.

I guess I will stop there and turn it over to Under Secretary Garman.

Senator HAGEL. Secretary Garman?

Secretary GARMAN. One of the issues that comes up quite frequently is an innovative novel technology that looks very good on paper, say a cellulosic biorefinery that could turn wheat straw and corn stover into fuel, but because one has not been built a banker is unlikely to finance that first of a kind technology. Sometimes there is a regulatory uncertainty in a country. Before the passage of the energy bill, for instance, there was new nuclear power—the new regulatory regime that is in place by the Nuclear Regulatory Commission has never been test driven, as it were, and again people are very apprehensive about committing multibillion dollar investments against a rate of return that is not going to happen for many years into the future when there is uncertainty.

That financeability issue looms in instances both in this country and around the world. Sometimes it is just a simple lack of information. I am surprised at the number of times where, through the convening power of government, we sometimes inadvertently bring together partners that find that they have a mutual self-interest, a financial interest, in doing something together. This has constantly surprised me. Maybe these two have seen it before, but it

is one of the things that I have learned in my brief tenure, is that government does have a convening power and when ministers meet to discuss these kinds of opportunities the private sector watches and listens and quite often they invest.

Senator HAGEL. Thank you.

Secretary Dobriansky?

Secretary DOBRIANSKY. I too would have identified, as Jim started off with, from the international standpoint, definitely international—intellectual, excuse me, property rights; trade barriers. Two others that I think to add to the mix that can come into play here are laws, the legal aspects of dealing with technologies and having to grapple with that internationally, because the laws of one country are different from the laws of another country and how you sift through that.

Then the third area is in some countries, particularly those that are very sizable, when you have Federal structures versus local structures, and how one also gets through that; that certain decisions are made at a Federal level, but how it gets translated to the local level, and which you can actually develop capacity-building. Those would be some additional ones I would add.

Senator HAGEL. Thank you.

Chairman Connaughton.

Mr. CONNAUGHTON. Let me actually give you two examples to make this a little more tangible. In the Methane to Markets context, we have identified at least one, probably a couple of countries that historically have state-owned coal reserves and you can get a lease from the state to take the coal and you share the economic profit with the government for taking the coal. But the legal regime required you to treat the methane from coal mining as a waste to be managed and you could not get a legal right to capture the methane and sell it.

Just a simple, sort of outdated law because they did not—because the methane used to be thought of as a safety hazard and a waste. Just by working with the country to fix that law and create the same legal regime for the methane as for the coal, all of a sudden can unleash a multi-billion dollar capital investment without any further work by the government. That is a very tangible one.

Senator HAGEL. Before you go to the next one, how are we doing that, working with the government of a foreign country to deal with a law like that? Take me through generally the process?

Mr. CONNAUGHTON. Well, let us start with the starting point. We are doing methane based on 10 years of enormous success by the U.S. Environmental Protection Agency of doing what Dave described, which is linking people who know how to handle methane with the people that are accidentally or intentionally releasing it. USEPA created this methane, domestic methane partnership to get them to talk to each other about the opportunity for capturing the methane.

Then from that we have a pretty good legal regime in America, whether it is on public lands or in privately owned lands, where we have an enforceable contract right to get a lease and it is enforceable in court so your contract is protected. What we would do, for example, with the countries I am talking about, we would sit

down with them at their government-to-government level and say: The private sector has identified this as a major legal impediment and if you make a relatively simple change in your law—and we sit down and we describe it for them, what it would be—then we have capital investors who have been looking at this for some time. We show them real money sitting on the table.

That is a good incentive for them to update their legal regime, and that is where the government to government piece is important. Some of the countries we deal with, our private sector has a hard time accessing some of these government dialogues, but we can achieve that.

Then as soon as the change in law occurs, then it is important for our Commerce Department to get engaged, for our Energy Department to get engaged, and our multilateral development financing banks to get engaged and say, hey, a new market has just been created, and get that word out, because, believe me, sometimes—what I just told you about China, very few people in America know even now, the fact that they are going to install, spend huge amounts of money installing pollution control equipment. Most of our people in America do not know that yet. We can help get that word out.

This is very roll up your sleeve kind of stuff. It is not grand work. It is the work in the weeds that can make the difference.

Senator HAGEL. Is that your office that would initiate that government-to-government conversation as you have just described?

Mr. CONNAUGHTON. My office helped pull together the high-level leaders' commitment to this framework in the Asia-Pacific Partnership, for example, that we are going to unfold. We then hand that off to State, working with DOE and Commerce, and then we are going to have work plans. What happens then is we get the leaders to get a better—more clarity on the priorities for each of their countries. So I can help facilitate that. Then once their agencies and our agencies get a clearer direction of where they are going, then my function at that point is to monitor that and report to the boss, report to the President, as to where we are seeing the best opportunities.

Our goal is to mass produce the outcome, and especially deliver more for the U.S. taxpayer dollar, because again, as I indicated, projects are good, demonstration projects are good, mass-produced markets are even better. That is where under the leadership of Secretary Rice and certainly Secretary Bodman, who knows a lot about business—I think it is designing those dialogues in a way that is results-oriented, is where our real challenge lies. We have not done a lot of that in the years past. That is what we need to do a lot more of.

Senator HAGEL. Thank you. Did you have another example that you wanted to share with the committee?

Mr. CONNAUGHTON. I think Dave said the information piece and let me offer this example. Many of our new opportunities, especially in the energy area, are cross-sectoral. It used to be you had the energy providers. These are the guys who knew how to take a pot of water and light a fire under it and produce an electron. It is hundreds years old technology. And they rarely talked to their

counterparts in the petrochemical sector, they rarely talked to their counterparts in the agriculture sector.

Then meanwhile the chemical sector, for example, invested gasification and they have been using it for decades on a small scale in chemical plants. It is just there was never the cross-sectoral dialogue to say, hey, we have this chemical sector technology that would actually be perfect for a future of coal.

It is these cross-sectoral pieces that I think the government can play a very important role in seeing because we operate horizontally, whereas many of these sectors operate vertically.

The same is true on human capacity. We have electrical workers who work in power plants. We have a different set of workers who train to work in chemical plants. If we want to do something like coal gasification we actually need cross-sectoral training of our work force so that those who work in chemical plants can now work in power plants. This is, by the way, a great new opportunity for labor, for American labor, but it does require a rethinking of the structure of training and what we expect of these work forces to provide these cross-sectoral opportunities.

So it is the day-to-day worker, it is the manager, and it is the finance people that we need to start talking to each other across sector. Big challenge, but a huge opportunity.

Senator HAGEL. Thank you.

Secretary DOBRIANSKY. I was just going to add before, Jim mentioned the overall structure as relevant to the Asia-Pacific Partnership in terms of the U.S. Government. We have had quite a bit of diplomatic engagement with these other partners. They have either been in the context of international fora on the sidelines or, for that matter, also at the UNGA meeting. We have had a number of opportunities at my level.

We also have a working level, too, with all of the countries involved. I would also want to underscore the fact that we have, as I mentioned in my testimony, bilaterals with some 15 countries and regional organizations. That too has I think really afforded a great opportunity, not only to focus on a broad range of programs and projects, but many of them are linked to and associated with not only Asia Pacific, but many of the other initiatives that we have mentioned here: methane for example, renewables, energy R and D, climate monitoring, and so forth.

Senator HAGEL. Thank you.

Let me go back to a point that a couple of you made in your opening remarks on measurement by gas, greenhouse gas intensity, that greenhouse gas intensity approach that not all countries have subscribed to. Do you see a movement toward that measurement, toward that being incorporated, integrated into their climate change policy?

Let us start with you, Chairman Connaughton.

Mr. CONNAUGHTON. Yes, Mr. Chairman. All the measures are important, so let me start there. We need to know our absolute emissions. That is fundamental. We need to know our emissions per capita because it gives us a good sense of how much each individual is using and consuming.

By the way, when I say emissions I include greenhouse gasses, but I am also very personally worried, as others should be, about

air pollution. We need to know that, too. What the intensity metric, though, does is it ensures that your progress is mostly based on the kind of desired outcomes you want.

Let me sort of unpack that a little bit. What intensity—because it compares your emission per unit of growth, it is a clearer signal of investments in efficiency and productivity, and those are the kinds of investments we prefer to see. It does not credit as much reductions that come, for example, by putting people out of work, because you get economic loss associated with that and so you do not get rewarded by achieving your goals by putting people out of work. It does not recognize moving economic activity and polluting or emitting activity from your country to another country, because not only is that sort of bad economically and therefore it subtracts from this metric, but from an environmental perspective if you have merely shifted your air pollution or your greenhouse gas emission to another country you have not done anything to advance the environmental outcome either. So it softens that. It is not a complete answer to it, but it softens that as a metric.

It also is a good indicator of a diversifying economy because you are getting—if I look at the metric I put up before, Mr. Chairman, this flattening of greenhouse gasses that we just experienced in the last 4 years, they were the result of desirable improvements of efficiency and the deployment of advanced energy technologies.

It is the intensity improvement that I am even more interested in than the fact that we are flat, because we have this much more efficient and productive economy. Also we have continual structural shifts. We are adding new elements to our economy that do not use very much energy, and that is good for our overall security. Those are the kinds of outcomes that we prefer to favor.

It is interesting because we are now at the point where all the Asia-Pacific Partnership countries have embraced intensity. Even our counterparts in Europe, Prime Minister Blair and others, have included intensity as an important way of looking at our progress in understanding where we are making the greatest gains.

I would note the final piece to the advantage of intensity is we have a growing population and so we have to account for the fact that growing population is carrying an even greater economic load as well as creating economic opportunity. There are other parts of the world where they are experiencing a decline in population. So again, the intensity metric helps work some of those out of the equation so we have a clearer sense of where we are getting investment, real investment in technology and efficiency and productivity.

Senator HAGEL. Madam Secretary?

Secretary DOBRIANSKY. I would have picked out the fact that the Asia-Pacific Partnership, that a fundamental aspect of it is embracement of the greenhouse gas intensity approach. Secondly, I would cite the fact that many developing countries have for quite some time especially expressed interest in it, because again it is the desire and the need to advance economically and at the same time to be environmentally responsible and also to look at ways of providing for it citizens and providing opportunities for investment.

I go back to the discussion in the COP in Delhi in 2002. There was a very active discussion about the greenhouse gas intensity

metric and what it exactly affords for developing countries, so starting with that backdrop.

Senator HAGEL. Thank you.

Secretary Garman, would you care to add anything?

Secretary GARMAN. No.

Senator HAGEL. Secretary Garman, let me ask you a couple of questions. We covered one of these to some extent, technologies that would be available, specifically technologies at our national laboratories. Maybe you could give us a little inventory of those technologies, where we could actually apply those or they are being queued up to apply to these partnerships.

Secretary GARMAN. I am very excited about future opportunities through the work that has been unfolding at the Department of Energy national labs. They are quite voluminous. In fact, we have a technology opportunity, if you will, book—it is actually a little thicker than this one [indicating]—that goes through individual technologies that are out there. Let me mention just a few.

I think we are on the threshold of tremendous advancement in solar technology due to the pending commercialization of new deposition technologies that make thin film solar an extremely attractive option in many, many areas of the world, to make it a low-cost player that can fit into the developing world very nicely. This is a market opportunity for the United States that I think if it pans out would be extremely exciting. That is just one example and there are literally hundreds.

As a consequence, I am often mindful of the fact that we have some 800 million vehicles on the road consuming ever-increasing amounts of oil, compounding the geopolitical problem of oil, while at the same time emitting more and more greenhouse gasses into the atmosphere—230 million vehicles in the United States alone. As a consequence of the President's Hydrogen Fuel Initiative, we are bringing down the cost of fuel cell technology and increasing the durability substantially, to the point where we can envision a much simpler vehicle that provides all of the attributes of today's vehicles affordably, but with no greenhouse gas emissions and requiring no oil at all for fuel. That would be a tremendous breakthrough around the world.

Contrast that with the business as usual approach of Beijing adding a thousand new cars per day to its roads and it strikes me there are two kinds of people in the world, those who have cars and those who want cars. We have to deal with the transportation and oil issue, and again because of the President's initiative I think we have some exciting times ahead on that one as well.

But if I could provide for the committee the compendium of our technologies under our U.S. climate change technology program that we are looking at. They are quite expansive, several hundred, and it may be too voluminous to include in the hearing record, but it is quite impressive.

Senator HAGEL. We would appreciate that list and it would be included in the hearing. Thank you.

[The information previously referred to follows:]

LIST PROVIDED BY THE CLIMATE CHANGE TECHNOLOGY PROGRAM[1]

CCTP TECHNOLOGY OPTIONS FOR THE NEAR AND LONG TERM

Reducing Emissions From Energy End Use and Infrastructure

Transportation

- Light Vehicles—Hybrid, Fuel Cell, and Alternative-Fuel Vehicles
- Heavy Vehicles
- Fuels for Advanced Combustion Engines
- Intelligent Transportation Systems Infrastructure
- Aviation
- Transit Buses—Urban-Duty Cycle, Heavy Vehicles

Buildings

- Building Equipment, Appliances, and Lighting
- Building Envelope (Insulation, Walls, Roof)
- Whole Building Integration
- Urban Heat Island Technologies

Infrastructure

- High-Temperature Superconductivity
- Transmission and Distribution Technologies
- Distributed Generation and Combined Heat and Power
- Energy Storage
- Sensors, Controls, and Communications
- Power Electronics

Industry

- Energy Conversion and Utilization
- Resource Recovery and Utilization
- Industrial Process Efficiency
- Enabling Technologies for Industrial Processes

Reducing Emissions From Energy Supply

Low Emissions Fossil-Based Fuels and Power

- Coproduction/Hydrogen
- Advanced Power Systems
- Distributed Generation/Fuel Cells

Hydrogen

- Hydrogen Production From Nuclear Fission and Fusion
- Hydrogen Systems Technology Validation
- Hydrogen Production and Distribution Using Electricity and Fossil/Alternative Energy
- Hydrogen Storage
- Hydrogen Use
- Hydrogen Infrastructure Safety

Renewable Energy and Fuels

- Wind Energy
- Solar Photovoltaic Power
- Solar Heating and Lighting
- Concentrating Solar Power
- Biochemical Conversion of Biomass
- Thermochemical Conversion of Biomass

[1] In September 2005, the Climate Change Technology Program (CCTP) issued an updated compendium of technology profiles and ongoing research and development at participating Federal agencies. The report, entitled Technology Options for the Near and Long Term, is quite lengthy. What follows is a list, organized by CCTP strategic goal, of technology research areas highlighted in the report. Those interested in learning more about these technologies are invited to view the full report, which is available on the CCTP website at *www.climatetechnology.gov*.

- Biomass Residues
- Energy Crops
- Photoconversion
- Advanced Hydropower
- Geothermal Energy

Nuclear Fission
- Research Under the Generation IV Nuclear Energy Systems Initiative
- Research on Nuclear Power Plant Technologies for Near-Term Deployment
- Advanced Fuel Cycle Initiative

Nuclear Fusion
- Fusion Energy

Capturing and Sequestering Carbon Dioxide

Geologic Sequestration
- CO_2 Capture and Separation
- CO_2 Storage in Geologic Formations
- Novel Sequestration Systems

Terrestrial Sequestration
- Land Management
- Cropland Management and Precision Agriculture
- Converting Croplands to Reserves and Buffers
- Advanced Forest and Wood Products Management
- Grazing Management
- Restoration of Degraded Rangelands
- Wetland Restoration, Management, and Carbon Sequestration
- Carbon Sequestration on Reclaimed Mined Lands
- Biotechnology
- Biotechnology and Soil Carbon
- Improved Measurement and Monitoring
- Terrestrial Sensors, Measurements, and Modeling
- Measuring and Monitoring Systems for Forests

Ocean Sequestration
- Ocean Sequestration—Direct Injection
- Ocean Sequestration—Iron Fertilization

Reducing Potential for Climate Effects of Non-CO_2 Greenhouse Gases

Methane Emissions From Energy and Waste
- Anaerobic and Aerobic Bioreactor Landfills
- Conversion of Landfill Gas to Alternative Uses
- Electricity Generation Technologies for Landfill Gas
- Advances in Coal Mine Ventilation Air Systems
- Advances in Coal Mine Methane Recovery Systems

Measurement and Monitoring Technology for Natural Gas Systems
- Methane and Nitrous Oxide Emissions from Agriculture
- Advanced Agricultural Systems for NO_2 Emission Reduction
- Methane Reduction Options for Manure Management
- Advanced Agricultural Systems for Enteric Emissions Reduction

Emissions of High Global Warming Potential Gases
- Semiconductor Industry: Abatement Technologies
- Semiconductor Industry: Substitutes for High GWP Gases
- Semiconductors and Magnesium: Recovery and Recycle
- Aluminum Industry: Perfluorocarbon Emissions
- Electric Power Systems and Magnesium: Substitutes for SF 6
- Supermarket Refrigeration: Hydrofluorocarbon Emissions

Nitrous Oxide Emissions From Combustion and Industrial Sources

- Nitrous Oxide Abatement Technologies for Nitric Acid Production
- Nitrous Oxide Abatement Technologies for Transportation

Emissions of Tropospheric Ozone Precursors and Black Carbon

- Abatement Technologies for Emissions of Tropospheric Ozone Precursors and Black Carbon

Enhancing Capabilities To Measure and Monitor Emissions

- Hierarchical MM Observation System
- MM for Energy Efficiency
- MM for Geologic Carbon Sequestration
- MM for Terrestrial Carbon Sequestration
- MM for Ocean Carbon Sequestration
- MM for Other GHG

Senator HAGEL. Let me go back to the solar example. Can you give us any kind of a time frame on when that is going to be relevant to the marketplace?

Secretary GARMAN. It is conceivable in the next 5 to 10 years you could see the first of these products, these new products. Basically what they are—it is a thin film product that just can be produced similar to today's thin film products, but at a much lower cost. That is the key. Thin film photovoltaics today cost anywhere from 25 to 30 cents per kilowatt hour and that makes it a nonstarter except for in a few high electricity cost countries like Japan. But if you can make that 10 cent or even 5 cent per kilowatt hour peak flowing electricity, that makes it a huge market opportunity all around the world.

Senator HAGEL. Thank you.

Chairman Connaughton, would you like to add anything to this?

Mr. CONNAUGHTON. I just want to echo the fact that I think we are on the threshold. These things happen every generation or so and what I have seen in the last several years has been an uptick in this activity. But the most important signal I have been looking for has been the private sector venture investment, and that is increasing. It was very low 4 years or 5 years ago.

I think it was the President's State of the Union on hydrogen and then followed by the EU, the President of the EU and Prime Minister Koizumi making similar announcements in the same basic cycle, that has unleased a whole effort that goes beyond hydrogen in terms of interest in the energy sector.

I think it is also driven by the fact that there is a hopeful aspiration for growth around the world. So when you have the private sector, especially our venture capitalists, the guys who are doing some risk-taking, it is a good sign when they are investing because what they are really seeing is, they are saying, you know what, there will be greater economic growth, more people will be coming out of poverty around the world, and we want to be part of that investment. That is a very positive sign, too.

Right now it is going under the radar screen, but just watch in the next coming years. These breakthroughs are really quite something and they are backed by private sector support.

Senator HAGEL. Thank you.

Secretary Dobriansky, anything for you?

Secretary DOBRIANSKY. No.

Senator HAGEL. Well, we have kept you here for an hour and a half and that means that you have not been productive for an hour and a half to the American taxpayer, and we apologize to the taxpayers for this, but we know that you will not go home before midnight tonight to catch up. We are grateful for the good work that you are doing and your colleagues. Please extend our best wishes and thanks to your colleagues.

I think Secretary Garman's point about being at an exciting time, all three of you have noted that we have a long way to go, but I think we have broken through here. Like always, it will be the private sector and technology and innovation and leadership that will drive this. I too am encouraged with not just what I heard today, but the kind of progress that we are making. So even though we have a long way to go, thank you all very much.

If we have additional questions from any of my colleagues, we will keep the record open for a couple of days, if you would respond to those questions. And any additional information you would want to submit for the record, we would allow that as well. Thank you very much.

[Pause.]

Senator HAGEL. Secretary Claussen, welcome. We are glad that you are here. When you say "Secretary Claussen," those who are observing this hearing should note that you are not a secretary in the current government, but in a past government you were Assistant Secretary of State, and we are once again very grateful for your willingness to come before the Senate Foreign Relations Committee and offer some important thoughts in your present capacity as President of the Pew Center on Global Climate Change.

You have been a leader on this issue for many years. You know exactly what you are talking about and have very definite opinions and perspectives. We are always grateful to receive those, and we are pleased again that you have taken the time to come before the committee. So please provide your testimony, and if you would care to abbreviate it or read it all, either way. Then we will have an opportunity to exchange thoughts.

Ms. CLAUSSEN. Thank you.

STATEMENT OF EILEEN CLAUSSEN, PRESIDENT, PEW CENTER ON GLOBAL CLIMATE CHANGE

Ms. CLAUSSEN. Thank you very much, Mr. Chairman. If I may, I would just like to summarize a few key points from my written statement.

The Hagel climate provisions of the energy bill go to a very important issue, how best to develop and deploy climate-friendly technologies urgently and on a global scale. Standards of living and energy demand are expected to rise dramatically in the developing world over the next few decades. China expects to build 544 gigawatts of new coal capacity over the next 25 years and the city of Shanghai—and these are just examples—predicts a quadrupling of cars and trucks by 2020.

If we are going to address the climate change problem, the huge growth in energy demand in developing countries must be as climate-friendly as possible. We believe the Hagel provisions, if implemented properly, can help achieve that outcome. First, we would

urge that assistance provided to developing countries be tailored to their specific needs. Rather than seeing climate-friendly technology deployment as an exercise in funding demonstration projects or increasing technology exports, our goal should be to integrate climate-friendly activities into national strategies for economic growth, poverty reduction, and sustainable development. This is the only way they will make a lasting difference, that is by becoming a part of the recipient country's own economic plans and programs.

Second, the Hagel provisions, like the many technology initiatives launched before it, can only be effective to the extent that they are adequately funded and managed. Time and again in the past we have launched initiatives to much fanfare, but then provided inadequate funding and failed to manage them as a coherent whole. It would be a shame if the same happened to the Hagel program.

More important than any of this, though, is the need to establish a fair and effective international framework to engage all major emitting countries in the effort against climate change. We do not believe that technology initiatives in and of themselves will make a significant difference and we do not believe that an international framework necessarily means putting countries on an energy diet. A greenhouse gas emissions diet, yes; an energy diet, no.

But in order for countries to undertake and sustain ambitious efforts to limit or reduce greenhouse gas emissions, they need to be confident that other countries, and in particular their major trading partners, are also contributing their fair share to the overall effort. We need therefore some form of mutual assurance and some certainty. This is best accomplished in a common framework within which countries can take on commitments commensurate with their responsibilities and capabilities and appropriate to their national circumstances. Technology cooperation should be a part, but only one part, of such a global framework.

Through an initiative called the Climate Dialogue at Pocantico, the Pew Center has engaged with policymakers and stakeholders from around the world to look at options for creating such a framework. Dialogue members who participated in their personal capacities included policymakers from Australia, Brazil, Canada, China, Germany, Japan, Mexico, the United Kingdom, and the U.S. Senate, senior executives from Alcoa, BP, Dupont, Eskom of South Africa, Exelon, Rio Tinto, and Toyota, and experts from the Pew Center, India's Energy and Resources Institute, and the World Economic Forum.

The final report of the dialogue will be released tomorrow, actually in this room, with Senators Lugar and Biden and will be presented to government ministers at the upcoming climate change negotiations in Montreal.

We believe we have come up with some ideas for a path forward. Now what we need is for the United States to be constructively engaged in negotiating a framework, based perhaps on some of the ideas we will be suggesting. The climate negotiations taking place next month in Montreal would be an excellent place to start that engagement and we know that nearly every country there would welcome U.S. leadership.

Unfortunately, we understand that the administration is opposing efforts by other countries to initiate a process to begin considering next steps under the framework convention. We believe it is essential that such a process go forward. So my final recommendation would be for the Senate to revisit and update the 1997 Byrd-Hagel resolution, advise the executive branch to work with other nations both under the framework convention and in other international fora with the aim of securing U.S. participation in agreements consistent with the following four objectives:

First, to advance and protect the economic and national security interests of the United States;

Second, to establish mitigation commitments by all countries that are major emitters of greenhouse gasses;

Third, to establish flexible international mechanisms to minimize the cost of efforts by participating countries;

And fourth, to achieve a significant long-term reduction in global greenhouse gas emissions.

Doing that, if it leads to constructive U.S. engagement in the development of an international climate policy framework, is far and away the most important thing the Senate could do to create a positive context for implementation of the Hagel provisions.

Thank you very much.

[The prepared statement of Ms. Claussen follows:]

PREPARED STATEMENT BY HON. EILEEN CLAUSSEN,
PEW CENTER ON GLOBAL CLIMATE CHANGE

Mr. Chairman and members of the subcommittee, thank you for the opportunity to testify on climate change technology deployment in developing countries, and, in particular, on the implementation of Section 1611 of the Energy Policy Act of 2005, authored by the chairman. My name is Eileen Claussen, and I am the President of the Pew Center on Global Climate Change.

The Pew Center on Global Climate Change is a non-profit, non-partisan and independent organization dedicated to providing credible information, straight answers and innovative solutions in the effort to address global climate change.[1] Forty-one major companies in the Pew Center's Business Environmental Leadership Council (BELC), most included in the Fortune 500, work with the Center to educate the public on the risks, challenges and solutions to climate change.

Global climate change is real and likely caused mostly by human activities. While uncertainties remain, they cannot be used as an excuse for inaction. To quote the National Academy of Sciences, in a statement signed by the academies of 10 other nations, as well: "The scientific understanding of climate change is now sufficiently clear to justify nations taking prompt action. It is vital that all nations identify cost-effective steps that they can take now, to contribute to substantial and long-term reduction in net global greenhouse gas emissions."

The Pew Center believes there are three things we in the United States must do to reduce the real and growing risks posed by global climate change: First, we must enact and implement a comprehensive national program to progressively and significantly reduce U.S. emissions of greenhouse gas emissions in a manner that contributes to sustained economic growth. While I am happy to elaborate on this point, that is not my intent today. Second, we must strengthen our efforts to develop and deploy climate-friendly technologies and to diffuse those technologies on a global scale. That is the primary thrust of Section 1611. And third, the United States must work with other countries to establish an international framework that engages all the major greenhouse gas-emitting nations in a fair and effective long-term effort to protect our global climate. I would like to return to this point later in my testimony. First, though, let me discuss the specifics of Sen. Hagel's law and its implementation.

[1] For more on the Pew Center, see www.pewclimate.org.

We must strengthen efforts to develop and deploy climate-friendly technologies on a global scale, and to do so quickly. Standards of living are expected to rise in developing countries over the next few decades, and, as they do, energy demand will rise. China, for example, expects to build 544 gigawatts of new coal capacity between 2003 and 2030, far more than current coal capacity in the United States. If these plants are not designed and operated to capture their carbon dioxide emissions, we could well lock ourselves into a level of climate change no one would want. Similarly, Shanghai predicts a quadrupling of cars and trucks by 2020, and car sales in Delhi have risen 10 percent per year since the mid-1970s. If we are going to address the climate change problem, the huge growth in energy demand in developing countries has to be as climate-friendly as possible.

Section 1611 is intended to address that challenge. The provision requires the Department of State to identify the top 25 energy users among developing countries, describing among other things the quantities and types of energy they use, and the greenhouse gas intensity of their energy, manufacturing, agricultural and transportation sectors. The provision also requires the development of a technology strategic plan, and authorizes at least 10 demonstration projects to promote the adoption of technologies and practices that reduce greenhouse gas intensity in developing countries. Finally, the provision requires an identification of potential barriers to the export and adoption of climate-friendly technologies. All of these are useful activities.

The State Department is still at the early stages of implementing Section 1611. I believe the first deadline they face is production of the report on the 25 countries, due in February. Given this early stage, I would like to offer a few suggestions.

First, we should tailor the assistance provided to developing countries to their needs. The reality is that the highest priority for most developing countries is economic growth and development. Rather than viewing climate-friendly technology deployment solely as an exercise in increasing exports or funding demonstration projects, our objective should be to integrate climate-friendly activities into national strategies for economic growth, poverty reduction, and sustainable development. For instance, energy policies and plans are critical to achieving economic and development objectives. Making climate change one of the drivers of energy policy, as the United Kingdom has done, will move us toward meeting our goal of a stable climate. We should help developing countries build their capacity to assess clean energy options and establish policy frameworks that will favor such options even after our funding assistance is gone.

We also should support and promote efforts by the largest developing countries to identify specific goals for limiting their emissions of greenhouse gases—recognizing that their goals may vary in form, content and timing. One way to do that would be to require that the largest developing countries, in agreeing to receive assistance under this provision, establish goals consistent with their development strategies, and periodically report progress toward meeting them.

Second, we would recommend tracking progress under Section 1611 not only in terms of greenhouse gas intensity, but in terms of actual greenhouse gas emissions. Measuring intensity is useful in that it allows us to distinguish a change in emissions that results from a genuine improvement in practices and technology from a change due to reduced production. Intensity reduction, however, is not a surrogate for emission reduction, and our objective of achieving a stable climate must entail actual emission reductions. We therefore should be tracking our progress in those terms, as well.

Third, like the many technology initiatives launched before it, Section 1611 can only be effective if it is adequately funded and managed, and implemented with some urgency. Section 1611 joins an already large crowd of climate-friendly technology initiatives. In addition to the programs with a largely international focus—the Methane-to-Markets Partnership, the Carbon Sequestration Leadership Forum, and the Partnership for a Hydrogen Economy—several other programs are intended to advance the climate-friendly technologies we would want deployed in developing countries, including: Climate VISION, Climate Leaders, Climate Challenge, Clean Cities, the Hydrogen Fuel Initiative, SmartWay Transport Partnership, FreedomCAR, Energy STAR, Generation IV Nuclear Initiative, Vision 21, 21st Century Truck, Nuclear Power 2010, ITER22, FutureGen, Future Fuel Cells, Industries of the Future, and Turbines of Tomorrow.

While it is difficult to tell exactly how much has been budgeted for each of these programs, according to the administration's Federal Climate Change Expenditures Report to Congress (March 2005), the total fiscal year 2005 budget authority for all initiatives that have direct relevance to climate, as well as programs that benefit the climate indirectly (like grants to help low-income people weatherize their homes), amounts to about $5.2 billion.

Related to this is the challenge of implementing so many initiatives on a timely basis. Because it is far easier to explain to the press and public the launch of an initiative than to explain the boring details of its implementation, the political rewards of launching initiatives greatly outweigh those of implementation. The tendency of every recent administration has been, accordingly, to launch initiatives to much fanfare, but then provide them inadequate funding and management attention. Moreover, it would be an enormous challenge for any administration to manage such a collection of initiatives as a coherent whole or with any real urgency.

It would be a shame if 3 years from now, in another oversight hearing, we learned that Section 1611 had became one of several disjointed, underfunded and indifferently implemented initiatives. We simply can not afford to lose the time.

Fourth, an international technology deployment program, such as that established under Section 1611, can only be effective if complemented by an international framework that engages all major emitting countries in the effort against climate change. Therefore, most critical of all is the third challenge I identified at the outset: establishing a fair and effective international framework to engage all major emitting countries in the effort against climate change.

Through an initiative called the Climate Dialogue at Pocantico,[2] the Pew Center has engaged with policymakers and stakeholders from around the world in a wide-ranging examination of specific options for advancing the international climate effort. The Pocantico dialogue was convened by the Pew Center to provide an opportunity for informal discussions among 25 participants from government, business, and civil society. Dialogue members, who participated in their personal capacities, included policymakers from Argentina, Australia, Brazil, Canada, China, Germany, Japan, Malta, Mexico, Tuvalu, the United Kingdom, and the United States; senior executives from Alcoa, BP, DuPont, Eskom (South Africa), Exelon, Rio Tinto, and Toyota; and experts from the Pew Center, The Energy and Resources Institute (India), and the World Economic Forum. The final report of the Dialogue will be released tomorrow in this hearing room with Senators Lugar and Biden, and presented to government Ministers at the upcoming climate change negotiations in Montreal.

I would like to share with you some of the insights and observations emerging from this ongoing dialogue.

First, there is no getting around national interest. Climate change is a collective challenge. However, the political reality is that nations will join in meeting this collective challenge only if they perceive it to be in their national interests. A multilateral framework must therefore recognize and accommodate the very real and significant differences among nations. The key here is flexibility. We need a framework flexible enough to allow different countries to undertake the different types of strategies best suited to their national circumstances. To accommodate different types of strategies, we must allow for different types of commitments. For instance, a quantified emissions limit may be appropriate for some countries, while for others some form of non-quantified policy commitment may be more feasible and effective. Also, commitments could apply economy-wide, or they could be structured around specific sectors.

There are many possibilities and the time to begin considering them is right now. In its present form, the Kyoto Protocol commitments expire after 2012. In Montreal, governments will consider initiating a formal process to consider next steps in the international climate effort. Under the terms of the Protocol, Kyoto parties must begin consideration of new commitments this year. There is broad international support for simultaneously initiating a parallel process to consider next steps under the Framework Convention, to which the United States is a party. Other countries would very much welcome the United States' engagement. Most have come to accept that the United States will never be a party to the Kyoto Protocol. And they understand that a truly effective international approach—one with the full engagement of the United States and the major developing countries—will require moving beyond Kyoto. It is our understanding that the administration opposes any decision to consider next steps under the Convention, maintaining that it is premature to

[2] The Climate Dialogue at Pocantico is a series of off-line discussions among 25 senior policymakers, business leaders, and NGOs from 15 countries exploring options for next steps in the international climate effort. The dialogue provides an off-line opportunity for participants to consider specific options with the objective of identifying a set of options to be recommended for consideration by the broader policy community. Participants in the dialogue include policymakers from Australia, Brazil, Canada, China, Germany, Japan, Mexico, the United States and the United Kingdom; senior executives from Alcoa, BP, DuPont, Exelon, Rio Tinto, and Toyota; and NGO representatives from India and Switzerland. Recommendations from the dialogue, which concludes this fall, will be presented at numerous international fora. For more on the Dialogue, see http://www.pewclimate.org/pocantico.cfm.

discuss post-2012 options. Quite to the contrary, it is essential that we begin now, with the United States fully and constructively engaged.

Toward that end, we believe the most powerful step the Senate could take to reestablish U.S. leadership on this vital global issue would be to revisit and update the sense of the Senate on the future of the international climate effort. As we all know, Senate Resolution 98 of the One Hundred Fifth Congress—the Byrd-Hagel resolution—has had a profound influence on the climate debate here and abroad. As the international climate effort enters a new stage, a new Senate resolution can again shape the debate. It can help ensure that the United States is at the table and define the terms of U.S. engagement; and, in so doing, it can help achieve the best possible outcome.

As you will recall, the Senate in June approved a resolution sponsored by Senator Bingaman recognizing the need for mandatory steps to limit and reduce U.S. greenhouse gas emissions. This was an important statement. However, we believe it represents only half the equation. While meant to encourage comparable efforts by key trading partners, the resolution provides no guidance on the terms of an equitable climate agreement. Standing on its own, it might even be interpreted as supporting unilateral mandatory action by the United States.

Given all this, we would strongly encourage the Foreign Relations Committee to consider, and to report to the full Senate, a resolution advising the Executive Branch to work with other nations, both under the Framework Convention and in other international fora, with the aim of securing U.S. participation in agreements consistent with the following four objectives:

First, to advance and protect the economic and national security interests of the United States. Potential climate change impacts such as chronic drought, famine, mass migration, and abrupt climatic shifts may trigger regional instabilities and pose a growing threat to our national security interests. Addressing climate change, on the other hand, can greatly strengthen U.S. security by reducing our reliance on energy imports. Sea-level rise and other climate impacts pose a direct economic threat as well, to U.S. communities and to U.S. businesses. On the other hand, our response to climate change, if not well conceived, could pose a different sort of economic burden. It is imperative that we both avoid the economic consequences of climate change, and minimize the costs of addressing climate change.

Second, to establish mitigation commitments by all countries that are major emitters of greenhouse gases. Ideally, a global challenge such as climate change should be met with a fully global response. What is most critical at this stage, however, is getting the largest emitters on board. Twenty-five countries account for 83 percent of global greenhouse gas emissions. Seventeen of them are also among the world's most populous countries, and 22 are among those with the highest GDPs. To be truly effective, these major emitters must be part of the solution. While we cannot expect all these countries to act in the same way, or necessarily in the same timeframe, we believe that all must commit to take action.

Third, to establish flexible international mechanisms to minimize the cost of efforts by participating countries. The United States has led the world in demonstrating that well-designed market-based approaches can achieve the greatest environmental benefit at the lowest cost. U.S. negotiators fought rightly and successfully to build market mechanisms into the Kyoto architecture. U.S. economic and business interests will be best served by an international climate strategy that uses emissions trading and other mechanisms to ensure that our efforts are as cost-effective as possible.

And, fourth, to achieve a significant long-term reduction in global greenhouse gas emissions. Our initial efforts to address climate change, both domestically and internationally, can be at best first steps. But in taking these steps, we must remain cognizant of our ultimate objective—stabilizing the global climate—and we should craft policies and agreements robust enough to drive and sustain the long-term efforts needed to achieve it.

We believe these four principles form a solid foundation for constructive U.S. engagement and urge that they be incorporated in a new Sense of the Senate resolution.

In closing, the most important thing Sen. Hagel has done in writing Section 1611 of the Energy Policy Act of 2005, and that the subcommittee has done in holding this hearing, is to join the question of how best to address climate change. As Senator Hagel has said, "Achieving reductions in greenhouse gas emissions is one of the important challenges of our time." And: "We all agree on the need for a clean environment and stable climate. The debate is about solutions. The question we face is not whether we should take action, but what kind of action we should take."

I thank and commend Sen. Hagel for placing these issues before you, and thank the subcommittee for the opportunity to testify. The Pew Center looks forward to working with the committee and Sen. Hagel on the implementation of Section 1611 and on the development, enactment and implementation of any future climate change legislation.

Senator HAGEL. President Claussen, thank you as always for your comments and your entire statement will be included in the record.

I am going to bounce around a little bit on some questions based on your testimony and some things that you did not specifically mention, but are in your statement, and then also based on some of the things that the previous witnesses mentioned. First, Kyoto's cap-and-trade system. In your opinion, is it working for the European countries?

Ms. CLAUSSEN. Let me put it this way. I think it is much harder than most of them thought it would be to actually implement the targets they negotiated. But I do think it has spurred a lot of activity, a lot of which is really positive in terms of reducing greenhouse gas emissions. So has it been helpful in educating people and getting them on the right path? I think the answer is yes. Is it going to fulfill the dreams of many of those that signed? Probably not.

Senator HAGEL. Meaning that many will not meet their targets?

Ms. CLAUSSEN. I think many will not meet their targets. Not all, but many.

Senator HAGEL. Do you believe a cap-and-trade system is necessary to force new technologies onto the market?

Ms. CLAUSSEN. No. I think a cap-and-trade system is one approach that can work quite effectively, but I think it is not the only approach, and it is certainly my vision that we need some different paths forward, of which that could be one, and that could be chosen by some countries, but I think we need others as well.

Senator HAGEL. You sat and carefully listened, as I noted, to the testimony of the first panel, and they referenced some of these areas, in particular Secretary Garman. How do you respond to what you heard? Do you think that is too far out? Is it too much on the periphery? Were you encouraged by what you heard? Give me your thoughts on that?

Ms. CLAUSSEN. I think we are at—this is something that Jim Connaughton said at the end. I think we are at a point where many in the private sector are starting to think very seriously about long-term strategies that move us toward climate-friendly greenhouse gas technologies. So I think that is right.

I think what he thinks spurred that development is maybe helpful, but I think not what actually did. If I look at what has changed in the world that would result in that kind of activity, I think it is much more likely to be implementation of Kyoto, warts and all, the efforts in California and along the West Coast of the United States, the efforts in the Northeast and the Mid-Atlantic, where they are developing and will soon announce their cap-and-trade system there, lots of other activities at the State level, 21 States with renewable requirements. I think that activity is really what is spurring the change in the private sector, more investment in climate-friendly technologies.

But I do think it is happening. I do agree with that. I just see different reasons for it.

Senator HAGEL. Would you generally say you agree with what you heard as the objectives of this administration from the three representatives of the administration?

Ms. CLAUSSEN. On the assumption that what we are all after is a world where emissions are reduced pretty substantially in the next 50 or so years, I think the answer is yes. I just do not think you can get there only by a push. I think you need a pull to get the technologies into the market as well, and some kind of certainty and some kind of policy that is more than the current administration seems to be interested in.

Senator HAGEL. But if we are seeing a significant increase in the potential and the technologies coming on line, then what additionally would that do, mandates or caps or government regulation?

Ms. CLAUSSEN. What it would do? I think it would move the technologies much faster in the development stage and much, much faster in the deployment and diffusion stage, which is I think what we need to do. I think we need to get moving faster than just a little bit of push. Again, I think your provisions will be very helpful. I just think they need to be complemented with something that helps get those technologies into the marketplace.

Senator HAGEL. Thank you.

You mentioned international dialogue and how you think maybe something could come out of that. Would you expand on that a little bit?

Ms. CLAUSSEN. Well, I do not want to expand too much because I do not want to talk about what we are going to announce tomorrow. But I will give you a little——

Senator HAGEL. What you can.

Ms. CLAUSSEN [continuing]. A little flavor. In the course of this dialogue—and I think the fact that we had such a diverse group of people around the table and they actually reached a consensus was pretty good. We agreed on a set of elements that we think are really important. We talked about adaptation and we talked about long-term targets, but when we started to focus on mitigation we thought that there were four elements that were really important.

One of them is technology. One of them is targets and trading. One of them was sectoral approaches and one of them was what we called policy-based approaches. We looked at that sort of range of elements because we think some may be more appealing to some countries than others, and what we are really interested in in the long term is getting everybody on the right path. So we are looking at something that is sort of maximum flexibility with real results.

That is why when you asked me about targets and trading, yes, I think it is important and I think it is a path that many will want to go down, but I think there are other ones as well.

Senator HAGEL. Let me ask you a question I asked Secretary Dobriansky, about geographically, regionally in the world, areas where you think we have the most significant opportunity for cost-effective development of these technologies.

Ms. CLAUSSEN. Let me put it a slightly different way. Twenty-five countries are responsible for 83 percent of global greenhouse gas emissions. These countries are also among the most populous and they are also the countries with the largest GDPs. But on the

other hand, per capita emissions range by a factor of 14 and per capita incomes within that group by a factor of 18.

So while they are the countries that absolutely have to be at the table and we feel very strongly that all of that group needs to be at the table, we do need to have some kind of a flexible approach that allows each of those countries to do what is in their national interest, but that is also moving us on the right path on greenhouse gas emissions. I would look at it in terms of sort of major emitters, major economies, the people who have to be at the table.

Senator HAGEL. You mentioned your idea about revisiting the Byrd-Hagel amendment, if I understood your point, to essentially update it.

Ms. CLAUSSEN. Yes.

Senator HAGEL. And you mentioned four specific areas. Would you care to embroider on any of that or expand on that point?

Ms. CLAUSSEN. Yes. Our interest is in doing some of the things that you have in the Byrd-Hagel resolution, but instead of putting them in sort of a negative context, what you should not do, we think they should be put in a positive context of what the U.S. Government should do. I think it is really important for the U.S. Government to be engaged in this and I think it is important for our private sector, too, to see the U.S. at the table shaping the solutions.

I think many, many in the private sector would feel that our views, our analysis, the way we look at these things, is really important and should be a part of the process if we are going to have an outcome with which we can live. I think it is really important to urge engagement, and so I would sort of see this—I understand the context for the Byrd-Hagel, but I think the context is different now and it is really important for the U.S. to be at the table, at the table with ideas and at the table with solutions.

Senator HAGEL. You do not think what you heard in the last hour and a half from three senior administration officials talking about at the table, technologies, engagement, not only what some of the legislation I sponsored that is now law, but even beyond that, you do not feel that is enough?

Ms. CLAUSSEN. I do not, because I think most other countries, while they will participate in all of these initiatives that the last three witnesses talked about, and I think many of them have the potential to be effective, so I am not trying to sort of denigrate what contribution they can make, I think most countries are interested in a policy framework, not just a technology framework.

As far as I understand—and I may be wrong here, but I do not think so—the U.S. has essentially said they do not want to participate in discussions about the future in a policy sense. I think that is a mistake because I think the world needs both mutual assurance and certainty, and I think you have to do that in some kind of a policy framework, and I think the U.S. should participate.

Senator HAGEL. Thank you.

Staying with your three colleagues here for a moment, let me give you an opportunity to respond to anything that you care to respond to that you heard while they were at the table.

Ms. CLAUSSEN. I talk to them all the time and we agree on a fair number of things. I think the vision does not go where it needs to

go if we are really going to address this, because I think we have to start with a much greater sense of urgency, not to do things that are bad for economic growth. That is not our interest at all. But I think we can do things that are good for economic growth that also result in much greater, much sooner reductions in greenhouse gas emissions.

It is interesting when you look at the companies that have taken on targets, and there are probably 35 or 38 of them. Many of them have targets that are much more stringent than, let us say, the U.S. Kyoto target. Thirteen of them have already met the targets and not one of them has spent money doing it, because they found efficiency opportunities that would result in reductions in greenhouse gas emissions.

I do not want not to take those while we can take them, while we are developing the technologies that would be good in a decade or two decades. I agree with that. We do need some long-term technologies, but why would we not take opportunities that exist right now to put us on the right path? I just do not see the administration sort of moving in that direction. I see them focused on the long term. I do not want to see us miss opportunities in the short term.

Senator HAGEL. You were here for the exchange, the question that Senator Alexander asked the panel about why would Shell invest in the Australian project with the time line as it is versus a time line here. Do you know anything about that?

Ms. CLAUSSEN. I do not know any of the specifics about that, but I do know that the private sector is really interested in advancing the technology, and I see them marketing a lot of technologies abroad because they feel that the policy climate is more certain abroad, whether it is in a Kyoto country or a country that is more committed to long-term emissions reductions.

If you talk to the CEO of General Electric, for example, who has just started to really focus in a major way on greenhouse gas-reducing technology, he views a lot of his markets abroad rather than here because he does not think we are at the same stage in our policy development and implementation. He is very much focused on abroad, and of course he wants to sell his technology, but it is interesting that he sees the markets there, not here. I think he should be seeing them here as well.

Senator HAGEL. But you do not know anything about——

Ms. CLAUSSEN. I do not know the specifics of the Shell.

Senator HAGEL [continuing]. Why they would make that decision?

Ms. CLAUSSEN. No, I do not. But I am happy to try to find out and maybe answer it for you.

Senator HAGEL. I will tell Senator Alexander that you will take that assignment on.

Ms. CLAUSSEN. Absolutely, we will look into it.

Senator HAGEL. He will be very pleased about that. As you know, he is very engaged in this overall issue and very knowledgeable.

Ms. CLAUSSEN. Yes. Coal is, on a scale, coal and transportation are the two things we really need to focus on, because we are going to burn a lot of coal and China and India and Australia are going to burn a lot of coal and we have to find a way to do it with capture and sequestration.

Senator HAGEL. For a long time to come.

Ms. CLAUSSEN. Yes, for a long time to come.

Senator HAGEL. We are going to vote shortly, so I will adjourn our committee hearing. But let me also say, as I did to the first panel, that we may have additional questions, if that is acceptable to you——

Ms. CLAUSSEN. Absolutely.

Senator HAGEL [continuing]. If you would agree to answer those. And we will get those to you in the next 2 days if we have some members that would require that. If not, your full testimony of course will be included in the record. Again, I personally appreciate all of the time that we have had over the years to exchange views on this issue and your continued leadership. Thank you very, very much.

Ms. CLAUSSEN. Thank you very much.

Senator HAGEL. The committee is adjourned.

[Whereupon, at 4:53 p.m., the subcommittee was adjourned.]

APPENDIX

PREPARED STATEMENT BY SENATOR JOSEPH R. BIDEN, JR.

I am pleased that with this hearing today Senator Hagel, with the support of Chairman Lugar, will continue the dialogue on the issue of global climate change in the Senate Foreign Relations Committee.

Since the United States signed the United Nations Framework Convention on Climate Change in 1992, the persuasiveness of the science, the sophistication of our climate models, and the measurable evidence of climate change and its effects have grown every year. Those effects mean that this is not just an environmental issue. The dislocations caused by climate change will shift growing seasons, water resources, habitats, and other fundamental building blocks of economic, social, and political arrangements around the world. With those shifts will come political conflict, migrating populations, the spread of disease—threats to international stability.

The challenge to find cleaner, more efficient sources of energy also offers us one of the great opportunities of this new century. By moving us toward greater energy independence, lowering our energy costs, and promoting new products and markets, a well-designed climate policy can create jobs and enhance economic growth. Senator Hagel's legislation—The Climate Change Technology Deployment in Developing Countries Act of 2005, incorporated into the Energy Bill and now part of our national policy—shows us one way we can employ constructive climate policy to promote the goals of economic development abroad and innovation here at home.

Here in the Senate, we have inched closer in recent years to recognizing the need for a bipartisan domestic mitigation program, marked by the recent adoption of Senator Bingaman's Sense of the Senate Resolution calling on the United States to undertake a program of binding domestic greenhouse gas emission targets. However, that kind of program will make the most sense as part of an international agreement that can establish the coordination—and the trust—needed for effective, shared commitment to reducing human impact on our climate.

This is a global challenge, and it will require an international response.

Unfortunately, the United States, the largest current per capita source, and the largest historical source of greenhouse gases, has retreated to the sidelines of international efforts to meet this global problem. We have taken ourselves out of the game.

The Kyoto Protocol that now guides international climate change efforts has major flaws. Most obviously and fatally, it lacks the participation of the United States, and of the key emerging industrial giants such as China, India, Mexico, and Brazil. But instead of leading efforts to make international efforts more comprehensive, more realistic, and ultimately more effective, the United States is largely absent from the search for a global solution.

We must begin the debate on a post-Kyoto regime to guide international efforts. We must return to the table, and help to lead the way toward a post-Kyoto agreement. Time is not on our side. In our hearing room tomorrow, Senator Lugar and I will welcome a report by the Pew Center on Global Climate Change that can help us begin that debate. Eileen Claussen, the President of the Pew Center, is with us today.

Senator Hagel is right to identify new technology as one of the keys to mitigating climate change. His legislation promotes technology transfer as a potentially profitable and effective way for us to engage with developing countries. But with expanding populations, economic growth, and more intense energy use in those developing nations, there is much more to be done. Greenhouse gas intensity—the focus of his legislation—is a measure of energy efficiency. Our goal, however, must be ultimately to affect overall greenhouse gas concentrations in the atmosphere. That is our nation's commitment under the Framework Convention on Climate Change.

I hope we can build on Senator Hagel's initiative to fashion a robust international strategy to confront the issue of global warming, and to the restore the United States to the leadership role in that effort that is our duty and our historical respon-

sibility. In recent years the Foreign Relations Committee has twice, with its unanimous endorsement of Resolutions on climate change negotiations, declared its support for renewed U.S. participation and leadership in the search for a global solution to this global problem. I hope our committee and the full Senate can once again take up a new Resolution, to restate the Senate's interest in renewed action on the international front.

PREPARED STATEMENT BY CHEVRON

Chevron appreciates the opportunity to submit testimony for the record supporting the implementation of Title XVI of the Energy Policy Act of 2005. This important section of the Energy Policy Act originates from S. 883, "The Climate Change Technology Deployment in Developing Countries Act of 2005."

Title XVI, specifically Subtitle B, charges the Secretaries of State, Energy, and Commerce and the U.S. Trade Representative to carry out activities that promote the adoption of technologies to address greenhouse gas intensity in developing countries while at the same time promoting economic development. The provisions advance projects by the appropriate government agencies using bilateral agreements, identifying and negotiating removal of trade barriers, developing strategic plans, and providing overall coordination to transfer technology to developing countries. In addition, it requires that an inventory be developed of those technologies which could be transferred and used by developing countries as well as establishing demonstration projects.

Title XVI is consistent with broader policy efforts which recognize globalization, and initiatives such as this one are important in our interdependent world. Specifically, we believe there are many positive provisions that would facilitate the use of technology overseas to address climate change concerns as well as help with economic development. Private sector resources and ingenuity need to be harnessed in a coordinated fashion and implementation of Title XVI furthers that effort. However, it should be noted that some technologies are currently available while others may be viable longer term and that this distinction needs to be made in considering which technologies to transfer.

As one of the leaders in the energy industry in technology development and deployment, Chevron believes that technology is key to addressing many of the world's problems, including energy and environmental issues. We are involved in developing and commercializing a whole host of advanced clean energy and fuel technologies, many of which address climate change concerns. For example, our subsidiary Chevron Energy Solutions (CES) is one of the largest energy service companies in the nation. CES works successfully with both the public and private sectors to install a range of energy efficiency technologies and renewable energy sources (such as solar and biomass) as well as stationary fuel cells. For example, CES is working with the U.S. Postal Service throughout the Northern California area on several projects involving solar systems, energy efficient lighting systems, energy management systems and other energy efficiency upgrades that is expected to reduce electricity purchases by $1.2 million annually and reduce greenhouse gas emissions by about 6,600 tons annually. In early 2004, CES was awarded contracts from the U.S. Department of Defense and the U.S. Department of Energy to engineer and install facility improvements at three military bases. The improvements are guaranteed to save U.S. taxpayers at least $150 million and expected to reduce greenhouse gas emissions by about 1.5 million tons.

We are also actively involved with numerous international projects on carbon sequestration and associated promising technologies. Geologic sequestration may be the best option for reliable storage of carbon. The Gorgon Project in Western Australia, in which Chevron and its partners are developing large natural gas reservoirs, would be the largest carbon sequestration project in the world. We are also participants in a number of major carbon sequestration projects globally, including using CO_2 for enhanced oil recovery such as in Weyburn, Canada. We are active stakeholders in the international Carbon Sequestration Leadership Forum, an initiative developed by the State Department and the Department of Energy for carbon sequestration technology development. The Forum includes developing country participants, such as China and India.

In terms of longer term technologies, Chevron Technology Ventures (CTV) is involved with a host of research and development activities on advanced energy technology to address the challenges facing hydrogen as a fuel for the future. As part of these efforts, CTV was awarded a Department of Energy cost-share contract under the government's "Controlled Hydrogen Fleet and Infrastructure Demonstra-

tion and Validation Project." CTV, in collaboration with Hyundai Motor Co. and UTC Fuel Cells, intends to build up to six energy demonstration stations over the next 5 years.

At the UN Conference of Parties, organized international meetings as part of the UN Framework Convention on Climate Change proceedings to negotiate the Kyoto Protocol, developing countries have continually asked for assistance with technology transfer from developed countries. The U.S. should lead this effort with other developed countries. This would help address climate change concerns while promoting economic development here and abroad as technology is deployed. We believe that Title XVI will facilitate in providing the opportunity to share the strength of the U.S. private sector and assist developing countries.

We appreciate the opportunity to submit testimony for the record, and look forward to working with the Congress and the administration to implement these important provisions of the Energy Policy Act of 2005.

PREPARED STATEMENT OF DR. S. JULIO FRIEDMANN, DIRECTOR, CARBON MANAGEMENT PROGRAM, LAWRENCE LIVERMORE NATIONAL LAB

UNDERGROUND COAL GASIFICATION IN THE USA AND ABROAD

1. Technology Overview of Underground Coal Gasification

Currently, the U.S. faces substantial challenges in providing large volume supplies in energy at a reasonable cost. Paired with that challenge is the increasing recognition of a human influence on global climate and increased concern about large potential risks associated with greenhouse gas emissions such as CO_2, methane, and NO_X. Because CO_2 has a long residence time in the atmosphere, current choices in energy technology in the U.S. and other countries will affect future generations in terms of climate change risk.

Underground Coal Gasification (UCG) is a gasification process carried on in nonmined and unmineable coal seams. Using injection and production wells drilled from the surface, it converts coal in situ into product gas (syngas) that can be used for many energy applications. The process has produced commercial quantities of gas for chemical processes and power generation; at one site in Uzbekistan, UCG has produced syngas without interruption for over 46 years.

During the UCG process, as in conventional gasification methods, coal in the ground reacts with an oxidant, and part of the released sensible heat is used in coal drying, pyrolysis and the endothermic reactions that reduce the combustion products. The resulting mixture is UCG gas (syngas). The UCG syngas can be used for power generation in an Integrated Gasification Combined Cycle (IGCC) configuration or as a supplement and substitute fuel in the existing coal-fired and natural gas power plants. The syngas can be also used for chemical syntheses resulting in manufacturing of synthetic liquid fuels (diesel and jet fuel), synthetic natural gas, ammonia-based fertilizers etc.

UCG can be applied to coal deposits that are not amenable to conventional mining methods. It is estimated that UCG can nearly triple coal resources available to conventional mining. It has been demonstrated that UCG can be performed with extremely limited environmental impacts, much less than conventional mining and combustion. The main environmental concern is the possibility of contaminating ground water; however, it has been shown in a field program in Australia that groundwater can be effectively protected. Importantly, UCG has technical advantages that allow for low-cost carbon sequestration and decarbonization of emissions, permitting substantial reductions in greenhouse gas emissions.

2. Economic Advantages to UCG

UCG can be applied to coal and lignite deposits across the United States. It has been estimated that in the USA, there is 1.6 trillion tonnes of unmineable coal that is recoverable by UCG. This technology can be readily deployed today to at very competitive costs for a variety of reasons:

1. Reduced capital expense: Unlike traditional surface gasification facilities (e.g., Integrated Gasification Combined Cycle plants or IGCC's), there is no need to purchase gasifiers or build ash and slag management facilities. Due to syngas stream continuity, there is also no need for gasifier redundancy.

2. Reduce operating expense: Unlike conventional plants, there is no need to purchase, transport, store, or prepare coal. There is no need to re-brick the gasifier linings. Due to syngas stream continuity, plans have high capacity factors comparable to pulverized coal or natural gas plants, reducing down time.

3. Reduced environmental management costs: Due to the gasification environment underground, UCG facilities produce no SO_X or NO_X. Particulate streams are half of their surface equivalents, and there is no production of ash. Roughly ½ of the mercury is generated compared to traditional plants. These present reductions in operational and capital costs, as well as increased ease of regulatory compliance and reduced environmental impacts.

4. Fuel supply certainty: Because the supply of UCG syngas is local and continuous, operators are not faced with risks in terms of changes in fuel availability or supply costs. There is no risk of supply disruption, providing clear advantages in secure fuel supplies.

For these reasons, there is renewed interest in this technology, with commercial demonstrations proceeding in 6 countries, including the U.S. While the local costs will vary, conservative estimates suggest a minimum 25 percent cost and price reduction compared to conventional coal power, with reasonable expectations of a 50 percent cost reduction based on projects in Australia, Canada, and Uzbekistan.

3. UCG for the U.S. Energy Market

UCG can be technology can be readily deployed today to produce the following important high-value energy products and very competitive costs:

1. Synthetic natural gas
2. High-efficiency electricity through an IGCC configuration
3. Liquid fuels (e.g., Fischer-Tropsch liquids, diesel fuel, methanol)
4. Hydrogen

The technology can be deployed to produce synthetic natural gas (SNG) in the process similar to the one used at Dakota Gasification Company in North Dakota. Ergo Exergy internal estimate of cost of SNG produced in North Dakota based on UCG can be in the range of $2.10–$2.50/million BTU. This application could be duplicated in the coal basins of Illinois, Appalachia, the southeastern U.S., and the central and northern Rocky Mountains.

UCG can be applied to generate electricity in IGCC configuration. A wide range of gas turbines can be used for UCG-IGCC applications. The power block efficiency reaches 55 percent, while the overall efficiency of the UCG-IGCC process can reach 43 percent. A UCG-IGCC power plant will generate electricity at a much lower cost than existing or proposed fossil fuel power plants (above). Importantly, there is no energy penalty for operation at high altitudes (e.g., above 3000'): the weight of the rock and water overburden produces a stream of syngas that is naturally high in pressure.

UCG can be used to produce syngas suitable for manufacturing of liquid automotive and aviation fuels via Fischer-Tropsch synthesis (a gas-to-liquid or GTL technology). The use of UCG technology would create an opportunity to deploy GTL plants in the areas where conventional mining and traditional GTL technologies are not feasible. It has been estimated that UCG-GTL can produce diesel fuel at the cost as low as $20.00/bbl, and a new UCG coal-to-liquids project has begun in Australia to provide 24,000 bbl/day of liquid fuel.

UCG shows the potential for producing hydrogen at a low cost, comparable with that targeted by the U.S. DOE "Hydrogen from Coal" program. The high-pressure of the subterranean stream makes pressure swing adsorption and water-gas shift reactions easier and cheaper to execute. Based on multiple estimates, it appears that the cost of hydrogen from UCG syngas is roughly ⅔ that of other fossil fuel supplies and ⅙th that of electrolysis. This process has a substantial additional advantage; it would create a pure CO_2 stream in an environment conducive to CO_2 sequestration.

Two new commercial projects are under current consideration in the U.S. The first is in Wyoming and is based on a resource of approximately 14 billion ton held by a private developer in Powder River Basin. The likely end products targeted include SNG and synthetic diesel fuel suitable for secure military fuel supplies. The other project is planned in North Dakota with SNG as proposed end product. There are several other UCG projects under consideration in the U.S. at the moment. It is worth noting that Ergo Exergy is engaged in these efforts as a technology provider, and is currently discussing a formal relationship with LLNL.

4. The History of UCG in the USA

Research and Development in UCG has been conducted since mid-1940s. It became especially active during the energy crisis starting in 1973. Before winding down in early 1990s, the program had produced 33 field trials conducted by DOE, the National Laboratories, and several industry entities. The $350 million program

has been a technical and environmental success but had not reached commercialization, in part due to the dramatic drop in oil and natural gas prices in the mid-1980s.

5. UCG and Carbon Dioxide Management

In the interest of greenhouse gas emission reduction, CO_2 sequestration (also called carbon capture and storage) has emerged as a key technology pathway. UCG provides inherent synergies to CO_2 separation and geological sequestration. The high-pressure stream of UCG syngas provides extra energy that can be used to separate out CO_2 at extremely low costs. This only partly reduces the CO_2 flux, but at a very low cost. In an IGCC configuration, CO_2 emissions of the plant can be reduced to a level 55 percent less than those of a supercritical coal-fired plant and 25 percent less than the emissions of NG CC. The calculated incremental operating and capital cost of CO_2 separation would be small, resulting in a wholesale price for electricity below today's levels.

Underground coal seams are naturally located with saline aquifers and depleted oil and gas fields. As such, CO_2 can be sequestered in the same location as the UCG facility, making transportation costs zero and removing the need for new CO_2 pipelines. It also appears that some of the CO_2 may be stored within the cavity created by the gasification.

Importantly, partial CO_2 removal is necessary for liquid fuel and synthetic natural gas applications. By taking advantage of the high-pressure streams, this separation can occur nationwide at low costs relative to equivalent surface gasification facilities. This application can also help the U.S. develop expertise in CO_2 storage that could be used in many industrial and power generation sectors, helping place the U.S. on a pathway to substantial greenhouse gas reductions. Given the spatial distribution of potential UCG sites in the U.S., partial separation of CO_2 would be consistent with the current DOE goals of the Regional Carbon Sequestration Partnerships. Similarly, hydrogen from UCG requires 100 percent decarbonization and CO_2 separation. The storage of CO_2 from hydrogen production would be consistent with the goals of the DOE's Carbon Sequestration and Hydrogen Production programs.

6. Other Environmental Benefits of UCG

Surface production and combustion of coal can create environmental problems. These include atmospheric pollutants such as SO_X, NO_X, and mercury, solid wastes such as fly ash or slags, and direct environmental concerns such as surface mining, mountaintop removal mining, and acid-mine drainage. UCG faces none of these issues.

1. No SO_X is produced: Sulfur in the coals is converted to H_2S or COS, which are easily gettered and converted to solid form.

2. No NO_X is produced: The gasification reaction takes place underground at relatively low temperatures, so no NO_X is generated.

3. No ash is produced: All ash remains underground.

4. Reduced mercury and particulate streams: roughly ½ the equivalent flux reaches the surface, and are readily managed there using conventional approaches.

5. Reduced plant footprint: The lack of ash management, coal storage, and surface gasifiers reduce plant size and operational complexity.

6. Reduced environmental footprint: The only surface expression of syngas production is well heads and connecting pipelines. There is no surface mining.

These advantages provide the opportunities for lower capital cost, improved regulatory compliance, substantial emissions reduction of criteria pollutants, and reduced surface footprint and legacy.

7. UCG and Environmental Concerns

Two potential environmental consequences of UCG should be considered: groundwater quality, and subsidence. Subsidence of the land surface does occur due to production and operation. However, the total effect is comparable to or less than the effects of conventional underground mining or oil and gas production.

Groundwater quality concerns are more substantial, but are by no means overwhelming. Out of the 33 UCG trials in the U.S., only 2 have resulted in environmental issues like groundwater contamination. Both trials involved serious operator error that resulted in contamination and do not reflect the environmental credentials of the technology itself. In addition, those sites were extremely shallow, in fresh water aquifers, and interbedded with highly permeable strata; in other words, the sites themselves were high-risk locations. It should be said that no UCG effort

overseas, including the 46-year project in Uzbekistan, shows any evidence of environmental contamination.

To help demonstrate the efficacy and environmental integrity of UCG, additional and early due diligence should be considered in future deployments. For example, the Chinchilla project in Australia monitored groundwater with 19 wells. That effort was led by Australia's EPA and executed through a transparent third party. After 4 years of syngas production, the groundwater quality had actually improved. Other technologies to monitor the burn, monitor water quality, and to simulate potential environmental effects could be applied as needed. Public-private partnerships may provide a mechanism for such due diligence; for example, Lawrence Livermore National Laboratory (LLNL) and Ergo Exergy have agreed to co-operate on new UCG projects in the U.S. to ensure that the state-of-the-art environmental practices are employed. Regardless, the risks of groundwater contamination appear limited and manageable through appropriate planning, oversight, and technology application.

8. UCG and World Energy Market

Current energy market can be characterized by the following general features:

1. Rapidly growing energy demand
2. Depleting resources of natural gas
3. High prices of oil and natural gas
4. Growing concerns about global warming
5. Inability of renewable energy to replace the use of fossil fuel
6. Relative abundance of coal, especially deep and low grade coal
7. Continuous suspicion toward environmental credits of coal
8. Likelihood of expanded coal conversion in developing countries, especially China and India

In that context, there has been expanded and renewed interest in this technology worldwide. One company, a Canadian technology company (Ergo Exergy) is currently providing UCG ignition and management technology to several commercial projects worldwide, namely Australia, India, South Africa, New Zealand, Canada. These projects include IGCC power generation, conventional natural gas combined cycle electric plants, production of liquid transportation fuels, and carbon capture and storage (CCS).

Due to the low cost and environmental benefits, UCG hold particular promise for developing countries with large coal reserves, including China, India, and Indonesia. In the case of India and China, UCG could provide substantial environmental benefit in the form of reduced particulate, NO_X, and sulfur emissions. It would allow both nations to exploit their high-ash coals using advanced conversion technologies like IGCC generation. Finally, it would minimize the risk of mining deaths, degradation of the surface environment, and provide a low-cost option for CO_2 sequestration.

9. UCG and Energy Security

Due to the ability to generate electricity, natural gas substitutes, liquid fuels, and hydrogen from coal at low cost, UCG has clear benefits regarding secure domestic fuel supplies. Naturally, UCG provides on technology pathway to secure production of domestic liquid fuels for military supplies, similar to the goals of the TED and JBUFF programs within the Dept. of Defense. In addition, the accelerated adoption of UCG in developing countries could reduce future demands on liquid fuels and extend the current international reserves of oil and natural gas. Both could substantially reduce the risks to supply disruptions faced by the U.S. while enhancing stability and economic growth in rapidly growing nations of interest.

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PREPARED STATEMENT OF W. DAVID MONTGOMERY, PH.D., VICE PRESIDENT, CRA INTERNATIONAL

Mr. Chairman and members of the subcommittee:

Thank you for your invitation to submit testimony in today's hearing. I am David Montgomery, and I am Vice President of CRA International,[1] where I am co-leader of the global Energy and Environment Practice. This testimony is a statement of my own research and opinions, and does not represent a position of CRA International.

I am particularly pleased by this opportunity to submit testimony on provisions of the Energy Policy Act of 2005 (EPACT 2005) that deal with technology transfer and the role of developing countries in climate change. I believe, based on studies that I and others have conducted over the past few years, that these provisions represent the most important step to advance global climate policy taken by the U.S. Congress. It is critical that they be implemented effectively. This testimony is organized in three parts. The first section discusses the opportunities that exist for cost-effective emission reductions in developing countries, and the role of technology transfer and foreign direct investment in taking up these opportunities. The second part of my testimony provides the reasons why these opportunities exist, and the critical importance of a policy designed to attack the root causes of both poverty and high CO_2 emissions, which in both cases are found in economic institutions. Fundamental reform of economic institutions is required before any attempts to reduce the greenhouse gas intensity of developing economies can succeed, and that reform can be expected on its own to stimulate greater foreign investment and technology transfer. The final section of my testimony reviews the specific provisions of EPACT 2005, and includes both comments on how they appropriately address the key opportunities and suggestions on possible ways in which they could be made more effective.

My overall conclusion is that these provisions represent a significant step forward, that would enable the United States to take the lead in international discussions of what should follow or replace the Kyoto Protocol. Although other countries are not willing to admit the failure of the Kyoto Protocol publicly, there are very promising signs of interest in the ideas embodied in EPACT 2005: the use of technology, the role of developing countries, and discussions among "large emitters." I therefore believe that this is a time when the United States can be effective in changing the direction of international negotiations away from the cap and trade approach embodied in the Kyoto Protocol toward a more technology and growth oriented approach to the climate problem. These program provides the foundation for that leadership.

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[1] On May 6, 2005 the official name of my employer was changed from Charles River Associates, Incorporated to CRA International.

I. OPPORTUNITY

I will make three points in regard to the opportunities that exist in developing countries.

1. Globally, the best opportunities for near-term, cost-effective reductions in greenhouse gas emissions are in China, India, and other developing countries

2. Developing countries are only interested in approaches to reducing their greenhouse gas emissions that will enhance opportunities for economic growth

3. Policies that stimulate greater technology transfer and investment in developing countries have the potential to achieve both economic growth and climate policy goals.

Greenhouse gas emissions are driven by population, income and technology. This fundamental relationship is described in an equation known as the "Kaya Identity."[2] It states that

$$Population * \frac{Income(\$)}{Population} * \frac{CO_2}{Income(\$)} = CO_2$$

The first two terms of this equation show that growth in total income comes from population growth and growth in per capita income. Technology appears in this equation in the third term, which describes CO_2 per dollar of income. The legitimate aspiration of poor countries is to keep per capita income increasing. Population is a separate and divisive issue—and in any event is not likely to be responsive to policies in the short run. Since per capita income growth and population growth are off the table, this leaves technology—CO_2 /($)—as the feasible object for change.

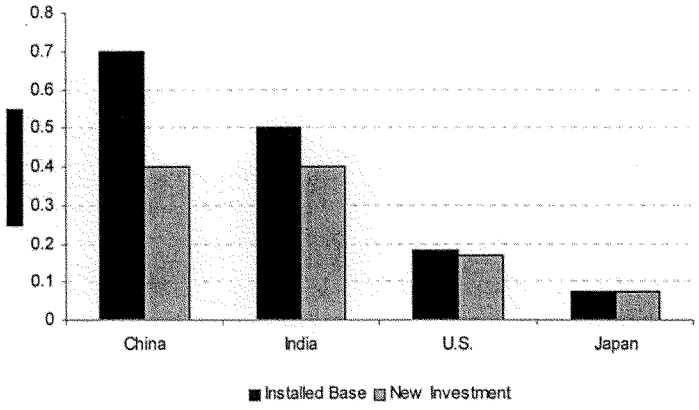
Technology is critically important because emissions per dollar of income are far larger in developing countries than in the United States or other industrial countries. This is both a challenge and an opportunity. It is a challenge because it is the high emissions intensity—and relatively slow or non-existent improvement in emissions intensity—that is behind the high rate of growth in developing country emissions.

Opportunities exist because the technology of energy use in developing countries embodies far higher emissions per dollar of output than does technology used in the United States; this is true of new investment in countries like China and India as well as their installed base (See Figure 1). The technology embodied in the installed base of capital equipment in China produces emissions at about 4 times the rate of technology in use in the United States. China's emissions intensity is improving rapidly, but even so its new investment embodies technology with twice the emissions intensity of new investment in the United States. India is making almost no improvement in its emissions intensity, with the installed base and new investment having very similar emissions intensity. India's new investment also embodies technology with twice the emissions intensity of new investment in the United States.

The United States is a good benchmark of technology that is economic at today's energy prices, without any additional incentives or regulations that would lead to adoption of more costly technologies for the purpose of reducing greenhouse gas emissions. Japan's emissions intensity is about half that of the United States, so that Japanese technology provides a benchmark for more aggressive efforts to reduce energy use.

[2] Y. Kaya, "Impact of Carbon Dioxide Emission Control on GNP Growth: Interpretation of Proposed Scenarios." Paper presented to the IPCC Energy and Industry Subgroup, Response Strategies Working Group, Paris, 1990.

Figure 1: Greenhouse Gas Emissions Associated with Existing and New Investment (Million tons C per $Billion GDP)



Priorities for Economic Growth

Developing countries have made it clear that their highest priorities are dealing with poverty, disease, famine, unemployment and violent conflict,[3] and that sustained economic growth is a prerequisite for dealing with these problems. Therefore, developing countries have also made it clear that they will not accept caps on their greenhouse emissions and have no interest in becoming part of a global emission trading system—at least on terms acceptable to the industrial countries. They see these approaches to climate change policy as threatening their ability to grow and deal with their more pressing problems. Therefore, only approaches to climate policy that combine greater economic growth with reductions in emissions intensity have any chance of attracting the interest of developing countries.

The Importance of Technology Transfer

Technologies that offer lower CO_2 intensity have largely been developed in the industrial countries. Therefore technology transfer, which occurs largely through foreign direct investment, is required to replace carbon-intensive technology.

Technology transfer and increased investment have the potential for achieving large reductions in emissions. The potential from bringing the emissions intensity of developing countries up to that currently associated with new investment in the United States is comparable to what could be achieved by the Kyoto Protocol (See Table 1). These are near term opportunities, from changing the nature of current investment and accelerating replacement of the existing capital stock. Moreover, if achieved through transfer of economic technologies it is possible that these emission reductions will be accompanied by economic benefits for the countries involved.

Table 1.—Greenhouse Gas Emission Reductions Achievable Through Technology Transfer and Increased Investment

	To 2012 (MMTCE)	To 2017 (MMTCE)
Adopt U.S. technology for new investment in China and India	2600	5200
Adopt U.S. technology with accelerated replacement in China and India	4200	7700
Adopt continuously improving technology with accelerated replacement in China and India	5000	9800
EU under Kyoto Protocol (without hot air)	600	1400
All Annex B countries under Kyoto Protocol (including U.S. and hot air)	2800	7300

[3] The World Summit on Sustainable Development (WSSD) reaffirms the need to have balanced economic development, social development and environmental protection. It also reaffirms poverty eradication and preservation of the environment as the overarching objectives of sustainable development (United Nations 2002).

The potential emission reductions estimated in Table 1 are derived from a study my colleagues and I performed using a model of economic growth based on the idea of "embodied technical progress." In the first case, we assumed that in 2005 new investment in China and India immediately moves to the level of technology observed in the United States, and calculate the resulting reduction in cumulative carbon emissions through 2012 and 2017. This is the technology transfer case. In the second case, we assume that policies to stimulate foreign direct investment accelerate the replacement of the oldest capital with new equipment, giving even larger savings. In the third case, we assume that the new technology continues to improve over time, as it will if policies to stimulate R&D into less emissions-intensive technologies are also put in place. It can be seen that even the least aggressive of these policies has potential for emissions reductions as large as possible if all countries (including the U.S.) achieved exactly the emission reductions required to meet their Kyoto Protocol targets.

It is also important to note that given the large difference between emission intensities of China and India and the U.S., and the relatively small remaining distance between the U.S. and Japan, most of the emission reductions achievable through technology transfer can be achieved be moving from current to U.S. technology. Going beyond this in the next decade or so, by pushing developing countries to adopt technology not currently economic even in the United States, entails rapidly increasing costs and smaller emission reductions.[4]

II. CAUSES OF HIGH CARBON INTENSITY AND EFFECTIVE REMEDIES[5]

In a highly developed economy such as the United States, characterized by efficient markets, pricing relatively undistorted by government policies or government-owned enterprises, free trade and free flows of capital, and strong legal institutions and protection of property rights, it is likely that there are few opportunities to improve carbon intensity without causing reductions in economic performance and income per capita. If technologies offering such opportunities exist, market forces and individual economic interest will lead to their adoption. This is not the case in many developing countries, which have economic systems characterized by a lack of incentives for efficient energy use, due to institutional and market failures, and an investment climate that discourages foreign investment and technology transfer. Remedying these institutional and market failures offers the prospect of reconciling economic growth and emissions reduction.

Economic Freedom and Emissions Intensity

The modern literature on economic development emphasizes the role of legal, market and governmental institutions in economic development. The concept of "economic freedom" summarizes a wide variety of conditions that are found to be conducive to individual initiative and economic growth.[6] Indices of economic freedom are based on comprehensive surveys of conditions around the world. The broad indices of economic freedom include specific institutional problems that can lead to high carbon intensity:

- Pricing systems that make energy-efficient technologies less cost-effective
  - Distorted internal pricing mechanisms and lack of markets
  - Subsidies administered through State-run enterprises
- Internal policies that make markets inhospitable to foreign investment with world class technology, including
  - Corruption
  - Excessive bureaucracy and burdensome regulation
  - Weak contract law and protection of property rights

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[4] The potential for emissions reduction through technology transfer is discussed in P. Bernstein, W. David Montgomery and S. D. Tuladhar, "Potential for Reducing Carbon Emissions from Non-Annex B Countries Through Changes in Technology." Accepted for publication, Energy Economics. 2005.

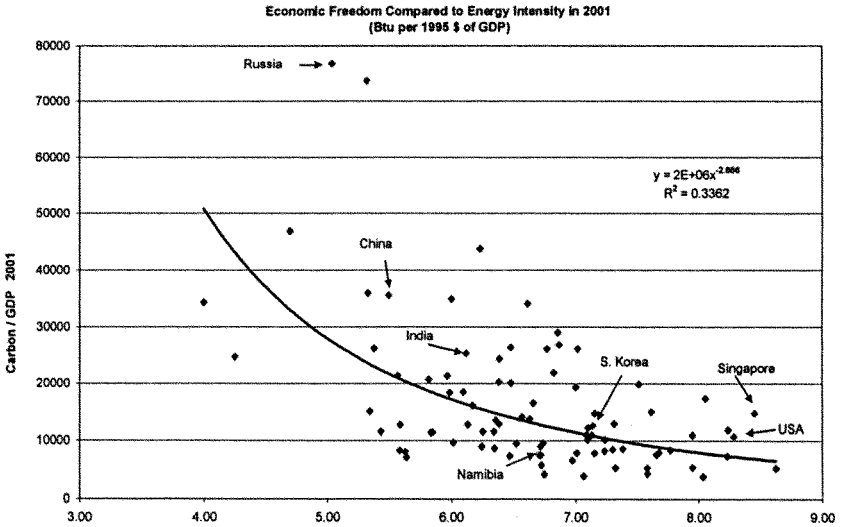
[5] This section is based on W. David Montgomery and Roger Bate. "Beyond Kyoto: Real Solutions to Greenhouse Emissions from Developing Countries." AEI Environmental Policy Outlook, July 1, 2004.

[6] Economic Freedom of the World (EFW) index is published by The Frasier Institute (http://www.freetheworld.com/release.html) and measures the degree to which a country is supportive of economic freedom. The EFW summary index is constructed from five different policy areas: (i) size of government; (ii) legal structure and protection of property rights; (iii) access to sound money; (iv) international exchange; and (v) regulation. Index of Economic Freedom is published by the Heritage Foundation/Wall Street Journal (http://www.heritage.org/research/features/index/) and reports 10 broad measures of economic freedom for 161 countries.

- Lack of protection for intellectual property
- Trade and regulatory policies that protect inefficient domestic firms and industries
- Lack of infrastructure, education and skills required for technology

Lack of these components of economic freedom is clearly associated with high levels of energy use per dollar of GDP. Figure 2 plots scores on the Economic Freedom of the World Index compiled by the Frasier Institute against energy use per dollar of GDP, measured at market exchange rates.

Figure 2: Association Between Economic Freedom and Energy Intensity



Energy intensity is used as a measure because it is directly connected to greenhouse gas emissions from energy use. For example, three of the countries with the relatively poor scores on economic freedom, Russia, China and India, have high energy use and carbon emissions per dollar of GDP. At the other end of the scale, countries like S. Korea, Singapore and Namibia, with relatively free economies have much lower carbon intensities, similar to that of the United States.

The curved line represents the results of a statistical analysis of the association, which shows that about one-third of the variation in energy intensity is explained by differences in scores on economic freedom. This is an unusually clear relationship for this type of cross-sectional data. Studies by the developers of the index also show the economic freedom index to be very closely associated with per capita income and rates of economic growth.

Figure 2 also reveals that there are other factors at work, and examining institutions in more detail reveals that each country has a significantly different collection of institutional issues. This suggests strongly that effective policies need to be designed through a bilateral process, and tailored to remedy the specific institutional conditions in each country.

Design of Policies That Can Be Effective and Engage Developing Countries

Recognizing that high emissions intensity is closely associated with fundamental market and institutional failures leads to possible solutions that can reconcile developing countries' legitimate desires for growth in income with reductions in greenhouse gas emissions intensity. To achieve these dual purposes, it is necessary to start with market and institutional failures directly.

The difference in technology that accounts for the difference in emissions intensity between developing countries and the U.S. will not be eliminated without substantially greater technology transfer. That technology transfer occurs largely through the mechanism of foreign direct investment, as multinational companies bring with them the technology they have developed and use in their current markets. The combination of technology transfer and FDI is one of the strongest engines of

growth. But increasing technology transfer and FDI to countries with poor scores on economic freedom requires removing current defects in their investment climate.

Without remedies for the fundamental institutional problems that underlie poor scores for economic freedom, the continuation of two unfortunate current conditions can be expected:

• A hostile economic environment in developing countries will prevent the technology that is introduced through demonstration projects from spreading throughout the economy

• Emission caps will remain costly because, without new technology, emission reductions will require diverting resources that could otherwise be used for growth

If remedies are found for fundamental institutional problems, two kinds of results can be expected:

• There will be much better prospects for demonstration projects for economic technologies to lead to spillover effects

• The root causes of both poverty and high carbon intensity will be addressed together

The actions required to create fundamental institutional reform must take place within the developing countries themselves, and be designed and carried out by their governments, businesses and citizens. But there is a role for the United States in helping to identify the needed reforms, to provide direct, near-term incentives to carry out the reforms that will be in the long-term interest of the target country, and to encourage greater flows of investment into developing countries that undertake the process of reform. This suggests that the four components of an effective policy to help move developing countries toward institutions more conducive to economic growth and lower carbon emissions are:

1. identification of critical market imperfections and institutional failures
2. agreement on a plan to address them
3. actions by the United States
4. actions by the country involved

I am impressed by the programs established by EPACT 2005 because they provide a framework in which these steps can take place.

The Key Role of Institutional Change Is Widely Recognized

A focus on economic freedom fundamental institutional reform is consistent with the current mainstream in development economics, and is supported by analysis from development agencies, the World Bank, and even the much-maligned Intergovernmental Panel on Climate Change (IPCC).

The World Bank has placed a high priority on institutional reform. For example, a recent survey of the investment climate in India sponsored by the bank identified deficiencies in the investment climate whose correction was necessary for economic growth. All these deficiencies involved aspects of economic freedom. They included

• Corruption, connected to

• Arbitrary and burdensome regulation covering every aspect of economic life, administered by a large and unaccountable bureaucracy

• Inadequate infrastructure due to economic policies and failed government-owned enterprises

This World Bank report provides just the kinds of information needed to develop the programs and projects authorized by EPACT 2005.

The U.S. Agency for International Development has also recognized the central role of institutional change in achieving economic growth. Its policies put high priority on market reform, and the agency has commissioned significant work on the nature and possibility of institutional change.[8]

[8] In particular, the AID "Forum Series on the Role of Institutions in Promoting Economic Growth" has addressed many of the issues I have discussed. See "USAID FORUM Series Problem Statement" by Fred Witthans, USAID, available at http://www.usaid.gov/our_work/economic_growth_and_trade/eg/forum_series/prob-statement.pdf. USAID's overall development goal to stimulate economic growth, promote democracy, good governance, and social transition is based on nine principles rooted in the need for fundamental reform—Ownership, Capacity-Building, Sustainability, Selectivity, Assessment, Results, Partnership, Flexibility, and Accountability (Nine Principles of Development and Reconstruction, USAID, February 2005).

The IPCC has also studied the process of technology transfer in some detail, and its report is instructive in both its contributions and its mistakes.[9] The IPCC report on technology transfer makes a valuable contribution by identifying many of the deficiencies in economic freedom and the investment climate as being specific obstacles to technology transfer, and recommends policy actions by developing countries to remedy them. These actions include:

- Deregulation of the investment regime, and free movement of private capital
- Foreign exchange convertibility and liberalisation of exchange restrictions
- Removal of restrictions on repatriation of profits and of capital
- Reduction of risk of expropriation (especially in hidden form such as abrogation of power purchase agreements)
- Reduction of the role of the public sector in directly productive sectors, through privatisation of state enterprises and overall reduction of the share of state enterprises in total investment, by opening up the public utility sector and other public monopolies to private sector participation and foreign investment
- Provisions for the settlement of disputes ranging from direct negotiation among the disputing parties to third party arbitration
- Removal of mandated local ownership requirements
- Promotion of the development of domestic institutional investors to assuage public fears about excessive foreign presence and to reduce the vulnerability of domestic capital markets to foreign investor herding. The presence of domestic institutional investors also reassures foreign investors about the host country's respect for corporate governance and property rights.
- Reform of opaque regulations that leave much administrative discretion and scope for corruption which discourages investment flows.
- Mobilisation of domestic resources through the gradual reduction of environmentally damaging subsidies.[10]

Unfortunately, the IPCC study buries its frequently wise recommendations about fundamental economic reforms in technical summaries, while focusing the policy summaries on descriptions of advanced technologies and on how to convince developing countries to adopt "environmentally sustainable technologies" that are so costly that even in developed countries they would only be chosen with heavy subsidies or strict regulations.

India Provides a Case Study of Problems and Potential Solutions

I have applied these ideas in a study of the potential for emission reduction through fundamental economic reform in India.[11] This study provides the context for some of the comments I will make, and an example for how some of the studies and projects might be carried out in practice.

I mentioned earlier that the World Bank conducted a study of the investment climate in India, identifying corruption, arbitrary regulation, and lack of infrastructure as the key problems. These problems have direct implications for energy use. First, the prevalence of corruption and arbitrary regulation, combined with a legal system that provides no confidence in enforcement of contracts, leads to a lack of technology transfer through FDI. The unreliability of the Indian power grid leads a majority of businesses to maintain capabilities for on-site generation, a highly inefficient source of power. Excessive energy use is also promoted by the fact that electricity is free in three states to certain segments of the economy, and pilferage of electricity is excessive high in many others. Finally, pervasive protection of domestic industries with outmoded technology reduces the competitive incentive to adopt new technology or use resources efficiently.

Examples of potential solutions applicable to India may help in thinking about how EPACT 2005 could be implemented. Actions that could be productive in India include:

- Reform of regulation in key sectors (power, steel)
- Anti-corruption activities
- Legal reform to create confidence that contracts are enforceable
- Creation of competitive power generation market to attract foreign investment

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[9] IPCC, Methodological and Technological Issues in Technology Transfer, A Special Report of Working Group III of the Intergovernmental Panel on Climate Change, 1999.

[10] Ibid.

[11] W. David Montgomery and Sugandha D. Tuladhar "Impact of Economic Liberalization on GHG Emission Trends in India." Climate Policy Center, May 2005.

• Use of official development assistance to provide income supplements to soften opposition to pricing of electricity at market levels

III. PROVISIONS OF EPACT 2005

EPACT 2005 amended Title VII of PL 101–240 by adding a new Part C dealing with technology deployment in developing countries. Thus the new provisions correspond to sections of the amended Act, beginning (after definitions) with Section 732.

Sec. 732. Reduction of greenhouse gas intensity

The Department of State is designated as the lead agency. This section tasks the Secretary of State to develop a set of reports and co-ordinate projects, and states a focus and priorities for the projects. Reports are to be made on the top 25 energy users among developing countries, and to include information on their energy use, greenhouse gas emissions by sector, progress on greenhouse gas reduction projects, potential for projects to reduce greenhouse gas intensity, and obstacles to further reductions.

This is the right place to start, and the right content. First, to identify the potential for reductions in greenhouse gas intensity it is necessary to compare technology in use in each country to that in use in industrial countries, and in particular to compare the technology embodied in new investment in the developing country to that embodied in new investment in the same industry in industrial countries. This provides the starting point for improving the type of calculation I have offered of the potential for reducing emissions. This information on technology by sector should also be used to establish a baseline, so that any technology that offers improved emissions intensity over the baseline technologies would be eligible for assistance and support in demonstration projects. One minor revision would be to ask for reports on the top 25 countries in terms of greenhouse gas emissions, since in some developing countries methane emissions from agriculture are extremely important and might be missed with an exclusive concentration on emissions from energy.

In order to design effective actions for institutional reform, it is also necessary to develop a clear understanding of the types of institutional and market failure that apply in each sector, so that the removal of these obstacles can be addressed specifically. I am pleased to see that EPACT 2005 specifically mentions "promoting the rule of law, property rights, contract protection, and economic freedom," and "increasing capacity, infrastructure, and training" as the focus for carrying out projects. Reports should also include this type of information.

I strongly recommend that the Secretary of State conduct these studies in consultation with the target countries, multilateral lending institutions, and business groups. It is very important that the developing countries themselves recognize and buy into the diagnosis of their key institutional problems, since the critical need is for change in those institutions. Independent research and academic institutions within developing countries have an important role to play in such studies, as well as governments. Multilateral institutions such as the World Bank can aid in studies, and a World Bank study of the investment climate in India could serve as a model for one of the studies needed to identify the most critical reforms.[12] Finally, multi-national corporations operating in each developing country also have important information and perspectives that should be included.

In co-ordination with U.S. AID, the World Bank, and other institutions, the Secretary of State is directed to provide assistance for projects to reduce emissions intensity, including projects to leverage funds through bilateral agreements, to increase private investment, and to expedite deployment of technology. Although it makes sense to focus efforts on the largest emitters, it would be unfortunate if poorer and smaller countries, in which the potential impacts of much smaller investments might be dramatic, were excluded from eligibility for assistance.

I believe that bilateral agreements and co-ordination with these institutions are the best way to proceed, and recommend that the bilateral approach and co-ordination begin at the stage of studies. This would facilitate a process of understanding a specific country's problems and identifying the most productive uses of official development assistance. For example, after bilateral consultations that lead to studies of baseline technology and institutional issues in a country, the next step could be for the United States and the target country to agree on specific targets for change. These could include:

[12] India: Investment Climate Assessment 2004: Improving Manufacturing Competitiveness Finance and Private Sector Development Unit, South Asia Region, The World Bank

• The critical institutional changes required to facilitate technology transfer, foreign investment and correct incentives

• The industries and sectors with greatest problems and opportunities

• The beneficiaries of the current system, whose potential opposition to reform needs to be addressed

The next steps could be to identify the most productive uses of ODA, including:

• Capacity building projects

• Funding for income supplements or other measures to ameliorate opposition to change

• Specific demonstration projects

• Rewards for successful institutional reform

The final task in bilateral negotiations could be to codify an agreement, including:

• Roles for the U.S., multilateral organizations and the developing country

• Objectives

• Time scales

• Procedures to review process and provide consequences for deviations from the agreement

Sec. 733. Technology Inventory for Developing Countries

The Secretaries of State and Energy shall conduct an inventory of greenhouse gas reducing technologies suitable for transfer, deployment, and commercialization. They will produce a report on the technologies and obstacles to the deployment of the technologies. Benchmarking technologies is a critical step that will provide a bridge from "what is in place" to "what should be in place." So, I believe it would be wise to tie this report more closely to the previous section, on country studies, and the subsequent section on projects. First, obstacles to technology transfer can possibly be identified generically—I certainly have been guilty in this testimony of doing so—but they will in fact vary across countries. Therefore, identification of obstacles to deployment would logically take place in the conduct of country studies as I discussed above.

To be most useful in guiding other mandated activities, the technology inventory should start with the baseline technologies identified in the Secretary of State's reports on the 25 largest emitters. In discussing Sec. 732 I recommended that the 25 large emitters reports should identify the technologies being adopted in new investment in the subject country. The technology inventory should include any technology that offers better greenhouse gas intensity than that of the baseline. Most of the potential reduction in emissions in countries that I have studied comes from bringing their baseline technology up to the level of technology embodied in new investment in the United States. Going further, to more advanced technologies that would improve U.S. emissions intensity if adopted here, provides only a small additional improvement and entail higher costs.

In other words, I strongly urge the administration to keep this technology inventory from becoming another listing of pie in the sky technologies. Too many studies of this type are already on the shelf.[13] Therefore, I also recommend that the technology inventory have substantial private sector involvement, to help it to focus on technologies that are currently economic as demonstrated by their adoption in the US or other countries.

Keeping this focus is very important to marry development and climate goals. The most cost-effective improvements in energy intensity will come from introduction of technologies not now in use in developing countries that are nevertheless economic at market-determined energy prices.

Sec. 734. Trade Related Barriers to Export of Greenhouse Gas Reducing Technologies

The USTR is required to identify barriers to export of greenhouse gas reducing technologies and negotiate for their removal. With my revision to the definition of greenhouse gas reducing technologies to include any technology with better emissions intensity than the established country baseline, I believe this is a potentially effective and critical provision. It provides clear and direct instructions to trade negotiators, but I would add the suggestion that they need to go beyond the types of barriers normally discussed in the context of WTO rules. All disincentives to foreign investment and technology transfer are relevant if the general purpose of improving

[13] H.D. Jacoby, "The Uses and Misuses of Technology Development as a Component of Climate Policy." Climate Change Policy (1996), pp. 151–169

technology transfer is kept in mind. Thus, the USTR should include intellectual property issues, the general burden of regulation and corruption, and protection of industries using inefficient techniques as well as tariffs, quotas, or preferences for domestic suppliers and fuels.

Sec. 735. Technology Export Initiative

An interagency working group is established to

- Promote greenhouse gas reducing technology exports
- Identify priority countries to be targets for exports, based on Sec. 732 reports
- Identify barriers to those exports
- Learn best practices in export promotion

This provision fits quite well with the studies and strategy outlined in sections 732–734. To my mind, those sections largely address issues of how to identify and motivate actions that need to be undertaken by the governments of developing countries, who are ultimately responsible for making the needed reforms. Section 735 looks to what the United States can do, by developing policies to encourage from our side greater involvement on the part of multinational companies in technology transfer. Again, I repeat the caution that greenhouse gas reducing technology should include all technologies that improve on the established baseline technology for a given country.

Sec. 736. Technology demonstration projects

This section states eligibility and selection criteria for countries to be provided assistance, and mentions types of projects that are eligible for funding.

This section turns normal project funding on its head, in a very appropriate way. It authorizes funding for demonstration projects, which is frequently attractive to recipients but rarely produces change or growth outside the project itself, in a way that makes the funding a carrot to bring about increases in economic freedom. This is a creative and highly desirable approach.

In this regard, eligibility criteria are good, but the use of projects as a carrot would be more effective if eligibility were focused on those aspects of economic freedom in which change will produce the largest benefits in terms of facilitating FDI and technology transfer. My case study of India, for example, focuses on just two or three of the multiple institutional problems, such as removing distortions in incentives to use energy and reducing corruption and regulation that discourages foreign investment. This suggests using an assessment of economic freedom as part of the decision about who will win a demonstration project, rather than as an absolute screen for eligibility. This provides a more modulated incentive to make appropriate changes.

IV. OVERALL ASSESSMENT

EPACT 2005 provides a very solid foundation for achieving emissions reductions in developing countries, and a way forward in international negotiations under the Framework Convention on Climate Change. It addresses directly the causes of high emissions per dollar of output in developing countries, and provides a framework under which the necessary bilateral and multilateral negotiations could take place. I see the bill as being fully within the spirit of President Bush's commitment "to seek and support the growth of democratic movements and institutions in every nation and culture," by supporting economic freedoms that can improve both material wellbeing and environmental performance. It clearly carries out the President's statement at his April 28, 2005 press conference that "we must help growing energy consumers overseas, like China and India, apply new technologies to use energy more efficiently and reduce global demand of fossil fuels."

A continued focus on free markets is critical to making all the rest succeed. This approach is consistent with modern development economics and thinking within aid agencies, that project funding cannot make a permanent difference unless it is accompanied by fundamental institutional change.

I believe that EPACT 2005 can be the basis for a new approach to international negotiations on climate change, focusing on involvement of developing countries, development and transfer of technology, and discussions among the largest emitters. Senior officials from Japan, Italy and Australia have all endorsed these ideas as the basis for a new approach, and the staff of the International Energy Agency is attempting to educate its member states on the subject.[14] Thus I believe that this is

[14] Corrado Clini, Director, Italian Ministry for the Environment, "Energy and Emissions: The Challenge of Climate Change," Venice, Italy, June 10, 2004; "Perspectives and Actions to Con-

a time when the U.S. can be effective in changing the direction of international negotiations away from the cap and trade approach embodied in the Kyoto Protocol toward a more technology and growth oriented approach to the climate problem.

Finally, I suggest that the hardest thing in thinking about policies addressing global poverty, oppression and environmental progress is to avoid making the best the enemy of the good. Technology is a critical issue because there is no economic possibility of stabilizing greenhouse gas concentrations without R&D to create technology not available today. In the long term, this technology is required to turn around developing country emissions, just as it is required to turn around emissions from the industrial world. In the long run, new technology for developing countries is clearly critical.[15] R&D to create this technology is therefore also critical, and the technology that is economically successful may be different in the global South than in the global North.

But right now the huge opportunity is replacing technology now being used in the global South with technology now being used in the global North. Therefore, I would broaden the definition of greenhouse gas reducing technologies to include anything that improves carbon and energy intensity over the current baseline for new investment in a country.

It is also important to keep the focus on the most critical market reforms needed to accomplish greater technology transfer and improvements in carbon intensity. Going against my own preferences for promoting all forms of freedom throughout the world, I would focus the administration's efforts on reforming those country and sector specific aspects of economic freedom that inhibit the adoption of energy-efficient technologies and practices identified in the process of identifying the technology gap. Identification of deficiencies in institutions and economic freedom in each country should be a key first step, and done in cooperation with multi-lateral institutions, aid recipients, cognizant multinational businesses and the U.S. Government.

In conclusion, it is my opinion that the provisions dealing with technology transfer and developing countries in EPACT 2005 provide a comprehensive approach to improving the emissions intensity of developing countries, by creating a process that starts with identification of opportunities and goes on to develop and implement effective instruments for bringing about change.

struct a Future Sustainable Framework on Climate Change", Global Environmental Subcommittee, Environmental Committee, Industrial Structure Council (METI, Japan) July 2003; Brian Fisher, Kate Wolfenden, Anna Matysek, Melanie Ford and Vivek Tulpule, "Alternatives to the Kyoto Protocol: A New Climate Policy Framework?" Australian Bureau of Agricultural and Resource Economics (ABARE) 2005; Fatih Birol, Head, Economics Division, International Energy Agency, at the International Energy Workshop, Paris June 2004.

[15] M. I. Hoffert et al., "Advanced Technology Paths to Global Climate Stability: Energy for a Greenhouse Planet" Science, Vol. 298, Nov. 1, 2002, p. 981–7 note that within the next 50 years, the world will require 15–30 TW of carbon-free energy to meet stabilization targets of 550 to 350 ppm, which is more than double the approximately 12 TW of energy consumed today (85 percent of which is fossil-fueled).