

# TECHNOLOGY TRANSFER PROGRAMS AND COMPETITIVENESS IN THE GLOBAL MARKETPLACE

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## HEARING BEFORE THE COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

TO

RECEIVE TESTIMONY ON THE EFFECTIVENESS AND SUSTAINABILITY  
OF U.S. TECHNOLOGY TRANSFER PROGRAMS FOR ENERGY EFFI-  
CIENCY, NUCLEAR, FOSSIL AND RENEWABLE ENERGY; AND TO IDEN-  
TIFY NECESSARY CHANGES TO THOSE PROGRAMS TO SUPPORT U.S.  
COMPETITIVENESS IN THE GLOBAL MARKETPLACE

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# CONTENTS

## STATEMENTS

	Page
Baca, Sylvia, Vice President, Health, Safety and Environment, BP America, Inc .....	21
Bingaman, Hon. Jeff, U.S. Senator from New Mexico .....	1
Logan, Jeffrey, Senior Research Scientist, Advanced International Studies Unit, Pacific Northwest National Laboratory .....	26
Renberg, Dan, Member of the Board of Directors, Export-Import Bank of the United States .....	36
Schochet, Daniel N., Vice President, ORMAT Technologies, Inc., Sparks, NV ..	16
Smith, Carl Michael, Assistant Secretary for Fossil Energy, Department of Energy; accompanied by Robert Dixon, Senior Advisor, Office of Energy Efficiency and Renewable Energy; George Person, Acting Director, Office of American and African Affairs, Office of Policy and International Affairs; and Bill Trapmann, Energy Information Administration, Office of Natural Gas .....	3

## APPENDIX

Responses to additional questions .....	39
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# **TECHNOLOGY TRANSFER PROGRAMS AND COMPETITIVENESS IN THE GLOBAL MAR- KETPLACE**

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**WEDNESDAY, SEPTEMBER 18, 2002**

U.S. SENATE,  
COMMITTEE ON ENERGY AND NATURAL RESOURCES,  
*Washington, D.C.*

The committee met, pursuant to notice, at 9:35 a.m. in room SD-366, Dirksen Senate Office Building, Hon. Jeff Bingaman, chairman, presiding.

## **OPENING STATEMENT OF HON. JEFF BINGAMAN, U.S. SENATOR FROM NEW MEXICO**

The CHAIRMAN. The hearing will come to order. Thank you all for coming.

This morning we are here to consider the general subject of technology transfer, more specifically the role the Government can and should be playing to support private sector efforts to achieve sustainable energy policies in developing countries. Given the positions that have been taken by the Bush administration at the recent World Summit on Sustainable Development in Johannesburg, I felt that it was important to also try to hear from the Department of State. Unfortunately, they declined to testify.

Technology transfer and deployment is one of the most important issues for the health of the world environment and economy. Commitments made today to energy technologies and related infrastructure will influence the world energy system for much of this century. The right public policies can significantly reduce inefficiencies in the system from the source to the end use.

For the most part, governments do not make direct investments. The private sector does. A striking example that I have found disturbing is how poor natural resource development policy is resulting in the complete loss of valuable resources in many countries. I recently was in Africa with the majority leader and other Senators, and became very much aware of this problem, particularly in Nigeria. In the absence of modern technology and sound resource policy, developing nations are building in excessive costs and locking out environmental protection, and diminishing their own development potential.

Cooperation at the international level promotes outcomes that are favorable to U.S. interests, including the sharing of costs and risks of developing new energy technologies. We need to do a better job of focusing on the long term when it comes to energy policies

and greenhouse gas emissions, and the failure to do so means pushing the consequences of global climate change onto future generations.

U.S. participation in the global environmental facility and the many energy initiatives discussed at the World Summit on Sustainable Development has in my view been paltry at best. The United States is behind by about \$210 million in its funding of the Global Environmental Facility. The United States declined several leadership opportunities on clean energy issues at the World Summit on Sustainable Development in August, key issues in which the United States was absent included renewable energy and the World Bank Group's Global Initiative on Global Flaring Reduction.

This World Bank global flaring reduction initiative seeks to support the efforts of the oil industry and national governments to reduce the wasteful venting and flaring of gas by identifying areas where common approaches and collective actions can strengthen existing efforts. The immediate need for oil export revenues often leads governments of oil-producing countries to disregard the importance of developing the associated natural gas resources. This neglect has a high cost for individuals and local communities. I mentioned the circumstance we encountered in Nigeria.

The acceleration of greenhouse gas concentrations from the wasteful venting and flaring of natural gas. That is obviously a major concern as well. Key to making progress in this area is the development of public-private partnership to build local infrastructure. In Johannesburg, the World Bank launched its Global Gas-Flaring Reduction Public-Private Partnership to address this.

Recognizing the World Bank initiative as a good business proposition, the oil and gas industry is an active participant in this. Regrettably, our own government has not been. The Bush administration has chosen to sit on the sidelines and to watch other countries take the lead. As the world's largest importer of crude oil and oil products and user of those, the United States should join with industry and the world community to provide leadership in addressing this problem. I hope we can hear some comments and suggestions from today's witnesses that will help us to move forward in designing a national energy policy that is consistent with the need to develop a consensus on how to improve our government management of greenhouse gas technology programs and allowing the benefits of the technology that we have to be used worldwide.

I want to thank everyone for being here. Our first witness today is Mike Smith, who is the Assistant Secretary for Fossil Energy at the Department of Energy. I think this is the first testimony you have given to our committee, at least in sometime, since we confirmed you, and we are glad to have you here and look forward to hearing your views. Then I will have a few questions. Why don't you go right ahead.

**STATEMENT OF CARL MICHAEL SMITH, ASSISTANT SECRETARY FOR FOSSIL ENERGY, DEPARTMENT OF ENERGY; ACCOMPANIED BY ROBERT DIXON, SENIOR ADVISOR, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY; GEORGE PERSON, ACTING DIRECTOR, OFFICE OF AMERICAN AND AFRICAN AFFAIRS, OFFICE OF POLICY AND INTERNATIONAL AFFAIRS; AND BILL TRAPMANN, ENERGY INFORMATION ADMINISTRATION, OFFICE OF NATURAL GAS**

Mr. SMITH. Thank you, Mr. Chairman, very much. I do have a formal written statement that I would offer for the record.

The CHAIRMAN. We will include that statement, and all of the written statements of witnesses in the record.

Mr. SMITH. Thank you, Mr. Chairman.

The statement I have submitted for the record covers topics that cross virtually the entire Department of Energy. Some go well beyond my area of responsibility in fossil energy, therefore I have with me today several staff members from other organizations within the Department who will assist me in answering some of your more detailed questions.

Mr. Chairman, the Department of Energy takes technology transfer very seriously, both as it applies domestically and as it positions our domestic firms to compete more vigorously overseas. Globally, our aggressive policies of industrial partnering and technology transfer have well-positioned U.S. firms to compete in the world marketplace.

We are still the leaders in technology for producing clean power from coal and exploring and producing oil and natural gas and converting the power of the wind and sun into usable energy, and in producing energy efficient machines and appliances. This technological leadership is especially important, recognizing that in the first half of this century the market for new energy technologies just in the world's developing and transitioned economies could approach \$25 trillion.

In your letter of invitation, Mr. Chairman, you asked that we address several specific elements of international technology transfer. First, you referenced the 1999 report by the President's Committee on Advisors on Science and Technology PCAST that examined the Federal role on global cooperation on energy innovation. The committee recommended that an interagency working group be created. This group would improve the coordination in bringing a new strategic vision to U.S. international energy research, development, demonstration, and deployment.

Subsequent to the PCAST report, the Senate added language to the report accompanying the fiscal year 2001 appropriations bill that directed the formation of the clean energy technology export, or CETE, working group. Although not referenced in the PCAST study directly, the Senate report closely mirrored the recommendations of PCAST.

CETE is co-chaired by the Energy Department, the Department of Commerce, the U.S. Agency for International Development, and six other agencies participate. The President's national energy policy, issued in May 2001, referenced the establishment of CETE, and the President has subsequently cited the importance of this

interagency group in carrying out portions of his climate change initiative.

Last year, the nine CETE agencies submitted their first annual status report to the Congress. In the near future, the 5-year strategic plan for the initiative will be submitted to Congress, which will include possible examples of future projects and time horizons.

You asked, Mr. Chairman, about the actions we are taking to counter low competitiveness in renewable energy technologies from foreign developers. At the recent World Summit for Sustainable Development in Johannesburg, which the chairman mentioned, the administration announced the Clean Energy Initiative, powering sustainable development from village to metropolis. This initiative is intended to be a framework to encompass a large number of key development issues through partnerships with other countries and organizations.

The Clean Energy Initiative has three focus areas, first, new access to energy services through the U.S. Agency for International Development, second, increasing the efficiency of energy generation, supply, and use through the Department of Energy, and third, changing vehicle and domestic energy use patterns through the Environmental Protection Agency. We expect this initiative to further the recommendations of the PCAST study and to help build practical partnerships for implementing clean energy and efficiency projects. This could include gas flaring initiatives, which I will discuss in more detail in a moment.

We also believe that the CETE initiative can be one of the principal means we have for assuring that we are working in support of U.S. industry's competitiveness abroad. The CETE initiative, the Clean Energy Initiative, and the national energy policy are all consistent and complementary.

You asked, Mr. Chairman, about whether export controls or other regulatory impediments hinder or prevent U.S. companies from participating in commercial activities internationally. In our discussion with private sector officials, areas have been identified where the U.S. Government may be able to accelerate the international deployment of clean energy technology.

In many cases, one of the highest priority actions we can take is to assist the governments of developing countries in adapting a policy, legal and regulatory framework that will be more receptive to clean energy technologies and foreign investors. As an example, we are working closely with China in advance of the upcoming Beijing Olympics to identify opportunities for the application of U.S.-developed clean energy technologies.

Finally, Mr. Chairman, you asked about the practice in several nations of venting and flaring natural gas, and the World Bank's initiative to reduce the loss of this valuable energy resource. My formal statement goes into the issues of gas flaring in some detail, but let me summarize it with three major points.

First, about 60 percent of all gas flaring and venting occurs in just eight countries. Second, the global flaring of natural gas as a percentage of total oil production has declined significantly in the last 20 years. In 1977, for example, OPEC nations flared approximately 50 percent of the gas they produced. Earlier this year, the

current president of OPEC reported that today just 8 percent of their total gas production is flared.

Third, the Department is working on two fronts to help reduce gas flaring at home in the programs I oversee. We are developing new technologies that could convert natural gas into high quality fuels like methanol and low sulfur diesel. The advantage is that in many cases these products can be shipped to markets through an existing oil pipeline infrastructure.

Internationally, we have a large number of bilateral and multi-lateral efforts underway to promote the development and commercial use of natural gas resources as an alternative to venting or flaring. Beginning on page 9 of my submitted testimony, I have listed some of those international efforts, although as my formal statement says the list is actually longer than the items cited.

We are actively engaged in discussions with the World Bank and with other U.S. Government agencies, foreign energy ministries, and the private sector regarding the global gas-flaring reduction initiative. We generally support efforts to fully utilize this gas. It is my understanding that at the recent Johannesburg meeting, the issue was discussed in a panel forum held in conjunction with the world summit.

Before committing to specific financial or other support, we want to examine the details of the proposed effort by the World Bank and consult with other potential partners. As Secretary Abraham committed to you in an August 13 letter, we will keep you informed of our progress with the World Bank as details emerge.

Thank you again, Mr. Chairman, for allowing me to testify this morning.

[The prepared statement of Mr. Smith follows:]

PREPARED STATEMENT OF CARL MICHAEL SMITH, ASSISTANT SECRETARY FOR FOSSIL ENERGY, DEPARTMENT OF ENERGY

I am representing several elements of the Energy Department today in presenting this testimony on U.S. energy-related technology transfer programs. The Department takes seriously the importance of transferring federally-supported technologies to the private sector where they can be applied for the public good.

Throughout our agency's existence we have made technology transfer a fundamental part of the Department's overall mission. Over the past 50 years, the U.S. government has financed more of the world's scientific research and technology development than any other nation. These federal investments have paid off handsomely for our Nation. The U.S. economy and technology sectors are the envy of the world, thanks in large part to our unique innovative capacity. From information technology to biotechnology to materials science, U.S. scientists and high tech workers are generating new products and trail-blazing revolutionary discoveries every day.

For example, within the Office of Fossil Energy, the organization I oversee, more than 90 percent of the research and development we pursue is conducted in partnership with the private sector. Almost all of it involves some form of private sector cost-sharing which ensures that the non-federal participant has a vested interest in the successful commercial application of the emerging technology. We also regard the transfer of knowledge and technology from R&D programs at our national laboratories and universities as one of our highest priorities.

TECHNOLOGY TRANSFER FROM AN INTERNATIONAL PERSPECTIVE

It is useful when discussing the important topic of energy technology transfer to consider the current world energy outlook. The clean energy policies the U.S. government adopts today will have profound influence on the shape of the global energy system for many decades to come.

Between now and 2050, the combined growth of the energy sector in developing and transition economies will account for over half of global energy growth. Ninety



percent of the markets for energy efficiency, coal, nuclear, and renewable energy technologies are expected to occur in these countries in the coming decades and investments in new energy technologies in these markets will likely approach \$15 to \$25 trillion.

While energy sector modernization will help improve the standard of living and health standards in these countries, rapid growth in total world energy use will also pose new challenges. If future energy use trends continue, the world could witness increased air pollution problems as well as increased levels of atmospheric carbon dioxide. That is why it is important to encourage international adoption of energy efficient fossil fuel technology, nuclear power, and renewable alternatives.

Strategic investments in advanced clean energy technologies by the U.S. private sector in partnership with the U.S. government will increase U.S. market share and competitiveness in these growing markets while addressing environmental concerns and increasing U.S. jobs.

Public/private cooperation in international clean energy technology development and deployment provides opportunities for U.S. companies to access global markets. By working with government, U.S. companies can gain access to innovative ideas and work to open doors to these world markets. For the U.S. government, this cooperation will help lower the cost of energy for U.S. consumers, spurring economic growth. It could also help reduce international dependence on oil supplies from volatile regions and potentially reduce nuclear proliferation risks.

THE REPORT OF THE PRESIDENT'S COMMITTEE OF ADVISORS ON SCIENCE AND  
TECHNOLOGY ON INTERNATIONAL COOPERATION ON ENERGY INNOVATION

In your letter of invitation, Mr. Chairman, you asked specifically about the 1999 report by the President's Committee of Advisors on Science and Technology (PCAST) entitled *Powerful Partnerships: The Federal Role in International Cooperation on Energy Innovation*. This report was one of the most noted efforts by the government in recent years to address U.S. competitiveness in the international clean energy market.

The report concluded that existing Federal activities in support of U.S. technology transfer were scattered among several agencies, each of which focused on its efforts individually or in certain circumstances engaged with only a small number of other U.S. government agencies.

PCAST determined that a new strategic vision and coordinating structure could link the disparate initiatives of the U.S. government and unite them into a coherent effort. The PCAST report recommended the creation of an interagency working group that would improve the coordination of U.S. international energy research development, demonstration, and deployment.

Senate Report 106-395, on the FY 2001 Energy and Water Development Appropriations Bill, directed the formation of such a working group that would improve the federal government's role in promoting exports of clean energy technologies, working in collaboration with U.S. industry. This working group on Clean Energy Technology Export (CETE) is co-chaired by the Department of Energy, the Department of Commerce, and the U.S. Agency for International Development. Six other agencies of the U.S. government also participate in the working group, including the Departments of State and Treasury, the Environmental Protection Agency, the Export-Import Bank, the Overseas Private Investment Corporation, and the U.S. Trade and Development Agency.

I have included further discussion of the CETE initiative below as it relates to efforts to counter the potential loss of international competitiveness in renewable technology.

ADMINISTRATION POSITION ON COEECT AND CORECT

*COEECT* The Committee on Energy Efficiency Commerce and Trade (COEECT) was an interagency working group formed for the purpose of assisting the U.S. energy efficiency industry to compete in the international market against competitors who received substantial export assistance from their governments and against barriers to entry into foreign markets. COEECT's purpose was to increase energy efficiency exports, thus creating U.S. jobs and reducing global environmental pollution. To accomplish this mission, COEECT consulted and collaborated with representative industry groups and relevant Federal agency heads to coordinate and leverage the actions and programs of the Federal Government affecting the export of energy efficiency products and services.

COEECT produced and distributed specific market assessments of energy opportunities and supported state-level peer-exchanges with a range of countries to help

develop federal and local energy efficiency regulations and programs. COEECT focused on market development, financing, training, education, and management.

COEECT was initially funded in FY 1993 and received peak funding in FY 1995 and FY 1996 with \$1.116 million provided in both years. Congressional appropriations for COEECT declined after FY 1996. Given the desire of Congress to decrease funding for this program, the Department chose, in FY 2002, to fund programs that ranked higher on our priority list.

*CORECT* The Committee on Renewable Energy Commerce and Trade (CORECT) was a 14-member interagency working group of the Federal Government. The primary objective of CORECT was to increase U.S. competitiveness in the export or transfer of Renewable Energy technologies. CORECT worked with U.S. Export Council for Renewable Energy (ECRE) in establishing export strategies and identifying barriers. CORECT's partners also included multilateral and regional development banks, commercial banks, foundations and other non-governmental organizations.

CORECT also worked with Latin America and the Caribbean (LAC), Asia and the Pacific, Africa, and Eastern Europe and the Commonwealth of Independent States. LAC was the highest priority market. In the time since it began in 1984, CORECT built a strong partnership with the U.S. renewable energy industry. This led to the strengthening of U.S. exports in solar, wind, geothermal, hydropower and biomass technologies.

In 1997, the Department's request for funding of CORECT was not approved by Congress, nor was it approved the following year. Given the desire of Congress to no longer fund CORECT, the Department has not requested any funds for this initiative since 1998.

#### IMPROVING COMPETITIVENESS IN RENEWABLE ENERGY TECHNOLOGIES

To improve competitiveness in clean energy technologies, including renewables, the Administration has proposed funding in its FY 2003 budget request to support the Clean Energy Technology Export (CETE) Initiative.

The CETE initiative is a senior-level, multi-agency, multi-technology partnership that combines the resources of the U.S. federal government and the capabilities of the U.S. private sector to facilitate the export of clean energy technologies abroad. The CETE Working Group will approve CETE program activities, approve the framework for assessing program performance, commit agency roles in support of CETE, and submit an annual report to Congress. This body will outline the most effective manner for carrying out the designated activities and establish a detailed timeline for the achievement of project goals and for project completion.

CETE can improve the ability of the United States to respond to international competition, stimulated by market demand, by leveraging the resources of federal agencies effectively and efficiently and by raising policy issues that may hamper the export of U.S. technologies abroad. Because the United States is a leader in clean energy technology, expanding the global markets for clean energy technology and encouraging open competition for these new markets will result in substantially greater gains for U.S. exports.

Senate Report 106-395 requested the preparation of a five-year strategic plan for the CETE program and annual status reports. The first annual status report was prepared in consultation with all the nine participating CETE agencies and submitted to Congress in April 2001. Since the submission of this annual report, the Administration has enunciated a similar vision in the international component of the National Energy Policy and in other official statements by the Office of the President. These Administration statements have called for U.S. national initiatives to promote the development, export and use of clean energy technologies, especially in developing countries and countries in transition. Illustrative examples of possible CETE projects and time horizons are included in the CETE five-year strategic plan, which will be submitted to the Congress in the near future.

#### EXPORT CONTROLS AND REGULATORY IMPEDIMENTS THAT HINDER U.S. COMPANIES

U.S. industries also have expressed the view that they are constrained in some cases by government regulation. Policies such as complex tax rules and trade sanctions against foreign countries often reduce the competitiveness of U.S. industries in foreign markets. Although trade sanctions can be an important U.S. foreign policy tool, competitors often fill the void in these markets, thereby expanding their market share at the expense of U.S. companies.

Consultations with private sector representatives over the past several months indicate that the U.S. private sector has identified areas where the U.S. Government can help accelerate clean energy technology. These areas include assistance to devel-

oping countries in implementing a policy, legal, and regulatory framework that will be more receptive to clean energy technologies and foreign investors.

The U.S. Agency for International Development spends a substantial percentage of its energy budget on policy and regulatory reform in developing countries which helps open energy markets to U.S. industry. The U.S. Department of Commerce is in the best position to address U.S. industry views on the various export controls administered by federal departments and agencies.

THE IMPORTANCE OF PUBLIC-PRIVATE PARTNERSHIPS IN REGARD TO THE WORLD BANK'S  
GLOBAL GAS FLARING REDUCTION INITIATIVE

Your letter of invitation, Mr. Chairman, also asked that we discuss gas flaring reduction.

*Defining Gas Venting and Flaring.* Gas venting and flaring are two ways of disposing of natural gas. Gas flaring refers to gas that is ignited and burned at either the site of production or at the processing plant or refinery. Gas venting involves a release of the gas directly into the atmosphere without burning. Gas venting can occur at several points along the supply chain during field production, during transmission, or at the point of final use. Because released or escaping natural gas, which is predominantly methane, is hazardous and potentially explosive, when gas releases are anticipated, it is safer to flare the gas than vent it.

According to the World Bank, sixty percent of all gas flaring and venting occurs in just 8 countries (Algeria, Angola, Indonesia, Iran, Nigeria, Mexico, Russia, and Venezuela).

In the United States, gas is not allowed to be vented at refineries or natural gas processing plants, but is sometimes permitted at the point of production for testing well productivity at the startup of production. Whenever venting and flaring occur, this represents the loss of a valuable energy commodity.

In addition, some emissions from flaring and the methane emissions from venting pollute the environment and are generally unhealthy to humans and ecosystems. Methane is a more potent greenhouse gas than CO<sub>2</sub>, and its impact on global climate may be 20 times greater than that of CO<sub>2</sub>. Natural gas flaring and venting on a worldwide basis accounts for approximately 1 percent of the carbon dioxide emissions resulting from the consumption of fossil fuels.

*U.S. Gas Flaring Regulations and Data Collection.* In the early 1940's, gas flaring in the U.S. began to decrease largely because states took the lead in addressing gas flaring as a resource conservation and environmental safety issue. All of the state actions to prevent the waste from flaring were subsequently upheld in courts. Blow-out preventers are technology required by states and the federal government for on and offshore wells to prevent blowouts that waste vast quantities of oil and gas. It is important to note that oil and gas producers in the U.S. have embraced these regulations and technologies because conservation of oil and gas is profitable to them. Also, unlike in many other countries where the central government owns all of the oil and gas resources, in the United States it is individual producers under state or federal regulations that control the amount of methane that goes into the air. Notably, the United States has a long history of regulatory practice and technology development to address gas flaring and venting.

In the United States, gas flaring regulations are determined by each state and the relevant state agencies unless the resource is on Federal land. Most states do not allow flaring except in case of an emergency. Offshore on the Outer Continental Shelf (OCS), companies operating on federal leases have to report their production and gas flaring to the Minerals Management Service (MMS). In order to flare gas, companies are required to get a permit from MMS if the flaring is to last longer than 48 hours. In addition, oil wells can flare up to 48 hours when doing equipment change-outs or maintenance.

On Federal onshore and Native American oil and gas leases, the restrictions are less significant because in most cases companies do not flare gas at all but rather sell it commercially through already existing pipelines available in the oil and gas fields. No gas flaring is permitted except in very limited circumstances authorized in advance by the appropriate Bureau of Land Management (BLM) field office, and usually would apply to a new well for cleanup purposes, well testing, and emergency equipment problems. The BLM also monitors gas plants for flaring purposes, which is approved for only a limited amount, for example, when there is an equipment malfunction. In those cases it must be for safety reasons.

Generally, both the Energy Information Administration (EIA) and the Department of Interior's Minerals Management Service (MMS) combine gas flaring and venting data as a single reporting category. Annual data on gas venting and flaring in the United States have been compiled from a variety of MMS and State agency sources

for years beginning with 1936. The EIA has been collecting annual data since 1995 through voluntary submissions from the States and MMS. The underlying producer or reservoir data have not, however, been available to EIA to support data validation or adjustments for standard definitions and procedures. Current data shows that the United States flared and vented an average of 105 billion cubic feet (bcf) of natural gas per year since 1998. This amounts to approximately one-half of one percent of gross natural gas production during the period.

*Status of International Gas Venting and Flaring Data.* It is difficult to get an accurate picture of international trends in gas venting and flaring. There are several sources of data available on international gas flaring and venting in other parts of the world, but statistics are not available for some countries, and much of the existing international data available to the public is uncertain. Given these limitations, the figures that are available from the EIA, the World Bank, and CEDIGAZ (Paris-based gas industry information agency) show that natural gas flaring and venting for the world as a whole declined steeply in the early 1980's, and have since leveled off at approximately 3500-4000 bcf (about 100-110 billion cubic meters) per year since then. In 2000, flaring and venting worldwide was equal to about 3 percent of global gross natural gas production.

On Sept. 4, 2002, at the World Petroleum Congress, Nigeria's Rilwanu Lukman, the president of the Organization of Petroleum Exporting Countries (OPEC) noted that just 8 percent of OPEC's total gas production is burned off today compared with 50 percent in 1977.

The United States generally supports improvements in international energy statistics including natural gas supply, demand, venting and flaring. The U.S. is a member of the International Energy Agency (IEA), the Asia Pacific Economic Cooperation (APEC) and the United Nations (UN) and works with each to support the preparation of sound, reliable international statistics. DOE represents the U.S. at meetings of these organizations, sharing U.S. energy information with member countries through their data programs and working with member countries on a range of statistical issues.

DOE also participates in the global "Joint Oil Data Exercise" that is being led by APEC, the European Union (EU), the IEA, the Organization of Petroleum Exporting Countries (OPEC), the Latin American Energy Organization (OLADE), and the UN. The Joint Oil Data Exercise is an effort geared to the timely reporting of oil information to help make the current markets more transparent. DOE also participates in the International Energy Forum which is also beginning to examine data quality issues. Further, at the recent U.S.-African Energy Ministerial conference held in Casablanca, Morocco, in June 2002, DOE expressed a strong interest in the development of an African-wide energy data initiative currently being supported by the IEA and the World Energy Council.

*Reasons for Gas Flaring.* Worldwide, most gas is flared or vented for economic reasons, generally one of the following: a lack of markets to sell the gas; a lack of infrastructure such as an integrated gas pipeline network to use the gas locally; and an inability to convert the gas to a refinery feedstock or usable fuel such as diesel fuel, liquefied natural gas (LNG) or liquefied petroleum gases (LPG) due to financial, infrastructure, and/or market constraints. Also, development of the gas sector is so costly that in some cases it would take away from resources needed for oil development and therefore retard oil development prospects. Gas associated with oil production cannot always be inexpensively reinjected since in many cases only a very small percentage of gas that would be flared is needed to maintain reservoir pressure.

There are three principal outlets for utilizing gas that would otherwise be flared: international markets, domestic markets, and reinjection to maintain well pressure. All three of these outlets require considerable investments to ensure the gas' commercial viability. International markets for flared gas could include cross-border pipelines or converting flared gas to liquefied natural gas (LNG) for export. LNG is in many respects an alternative to pipelines for monetizing remote or stranded gas resources. Many economies, including the United States, EU, China and others, import LNG to serve restricted market areas. Advances in LNG technologies have reduced costs and improved efficiencies in the LNG value chain: liquefaction, transportation and re-gasification.

Regional cross-border pipelines provide a means to export the gas, such as with the proposed West African Gas Pipeline, for electric power demand. For domestic markets, if an integrated pipeline system is in place, the flared gas could be utilized for electricity for industrial, residential, and commercial purposes. Gas-to-liquids technology is costly, but if available, liquid products could be produced that could be marketed locally, such as diesel fuel.

Flared gas could also be converted to LPG, providing a cooking fuel. However, often the gas market has to be developed in a country in order to be able to use it. The cost of developing a gas infrastructure is high, usually requiring assurances of long-term demand for the gas and policies and regulations in place to support it. Due to the income levels of many developing countries, the population often cannot afford to pay for the gas.

The National Energy Policy (NEP) released in May of last year includes recommendations for expanded development and utilization of natural gas resources. The DOE, in support of the NEP, has been involved in research and development, policy coordination and regulatory activities domestically, bilaterally and multilaterally in this area.

*Department of Energy (DOE) Research and Development.* The Department of Energy is involved directly and indirectly in research and development activities and as a partner with other organizations to assist in gas flaring reduction. DOE has recently spent approximately \$10 million per year on novel conversion concepts and development of ceramic membrane technology to convert natural gas to synthetic gas that can be used to make environmentally superior fuels (i.e. hydrogen, methanol, and ultra-low sulfur diesel). This research is primarily focused on bringing stranded domestic gas to market, but these technologies could also be used to convert flared gas to usable products around the world.

*International Activities Aimed at Reducing Gas Flaring.* Bilaterally and multilaterally, DOE is working with various countries and organizations to promote the development and utilization of natural gas resources, which, in turn, will directly contribute to the reduction of gas flaring and venting.

The examples that follow do not constitute a comprehensive list of all DOE/USG international activities in the natural gas sector. In every case, however, it is our goal to promote international best practices in the establishment of natural gas policies and regulations that will promote sustainable gas development and use and minimize flaring and venting. Only a handful of countries are responsible for the bulk of gas flaring and venting and, whenever possible, we are looking to refocus our international efforts on these countries.

- *World Bank:* DOE has been actively engaged in discussions with the World Bank and various U.S. Government agencies, and others, about the World Bank's initiative to reduce global flaring of natural gas. DOE is supportive of this important initiative in principle. We are considering the appropriate nature and scope of our support for this initiative, including possibly through direct funding, in-kind contributions, and working to enlist greater U.S. and international support.
- *In Nigeria,* through an interagency agreement with the U.S. Agency for International Development (USAID), DOE is providing \$100,000 to the World Bank to assist the Government of Nigeria with developing a downstream gas strategy that will assist in addressing gas flaring. Through this same interagency agreement, DOE is also providing assistance to the Government of Nigeria in reviewing regulations governing the use of pipeline facilities for transport of crude oil, petroleum products and natural gas and developing guidelines for common carrier and open access regulation of new and existing pipelines. These guidelines will be presented in the form of a manual that will be circulated to key Nigerian decision-makers for comments. DOE will also assist in preparing a brochure for investors in the natural gas sector in Nigeria. The brochure will cover key topics of interest to private investors, such as the existing legal, fiscal, and regulatory regime. The USG, through its contractors, is also conducting an analysis of the current fiscal regime for gas development in Nigeria and comparing that with existing practices in other countries.

The West African Gas Pipeline (WAGP), is a proposed gas transmission pipeline project designed to connect Nigeria's gas reserves to markets in Benin, Togo, and Ghana (with Ghana being the primary market for the gas). The Governments of these four countries, together with the Economic Community of West African States (ECOWAS), Chevron and Shell, are partners in the process. The gas supplies from Nigeria will be used to generate electricity and available for sale to other gas producers in the four partner countries. USAID has provided technical advice to the project. Some of the gas from Nigeria that is currently flared will be sold through the West African Gas Pipeline.

- *In Algeria,* DOE, in conjunction with the Government of Algeria, is exploring the expansion of LNG trade between our two nations, and adding to the gas supply of the U.S. while reducing gas flaring in Algeria. On May 29, 2002, we held a Preliminary LNG Roundtable that started the dialogue on expanding this

LNG trade. On November 27, 2002, we are planning a ministerial level round-table that will be led by Secretary Abraham and Algerian Minister Khelil.

- *For Asia Pacific Economic Cooperation (APEC)*, DOE is the United States Government's energy representative to APEC. In 1998, APEC Energy Ministers endorsed a Natural Gas Initiative that recommends policy and regulatory steps to accelerate investment in natural gas supplies, infrastructure and trading networks in the APEC region. APEC members agreed to undertake this initiative because they realized that public financing could not meet the significant increase in demand for natural gas projects over the next twenty years. This initiative was sponsored by the United States and Japan and developed in close cooperation with the business community, and within the context of APEC's overall goals of economic cooperation, trade, and investment liberalization. The initiative suggests thirty-six policy and regulatory reform options to reduce perceived risks for private investors and sponsors. APEC's Energy Business Network has identified ten priority options among the thirty-six. In addition, APEC Energy Ministers have endorsed a program to assist APEC members who request practical advice on the implementation of recommendations. The APEC Energy Business Network provides expert teams, which have visited Thailand, Peru and the Philippines.
- *In India*, DOE has been active in implementing a recommendation in President Bush's National Energy Policy (NEP) directing "the Secretary of Energy to work with India's Ministry of Petroleum and Natural Gas to help India maximize its domestic oil and gas production." Key actions taken include organizing the "Indo-U.S. Conference on Building Natural Gas Markets in India," held April 17-18, 2002, in New Delhi, and having a senior DOE official join the Indian Oil Minister this past June in Houston to help promote U.S. investment in the Indian upstream oil and gas sectors.
- *In Bangladesh*, under a Participating Agency Service Agreement with USAID, DOE has conducted a gas resource assessment with the U.S. Geological Survey. The goal was to assess the technically recoverable undiscovered gas resources of Bangladesh that might be found in a 30-year period (2000-2030). Through this interagency agreement, the Energy Information Administration established a program in energy data collection techniques, dissemination techniques and analysis methods that helped to improve the expertise of the Government of Bangladesh's staff analysts and associated organizations, including Petrobangla. Under a second agreement with USAID, DOE's Clean Cities Program will conduct a workshop in Bangladesh on the development of compressed natural gas technology.
- *In Venezuela*, DOE has commented on draft versions of Venezuela's draft natural gas policy, and is exploring ways to assist with the development of the natural gas sector, including regulatory capacity building and research and development activities.
- *Under the North American Energy Working Group*, a trilateral consultative mechanism with Canada and Mexico, there is a Natural Gas Experts Group exploring ways to enhance gas development, trade, and interconnections. Bilateral informal gas talks are ongoing with Canada.  
There is a U.S.-Mexico Cross-Border Working Group to promote trade, interconnections, and expanded development and utilization of natural gas in Mexico. With DOE support, this group is planning several technical and regulatory workshops that will include United States and Mexican Government counterparts from government and industry.
- *With Russia*, on May 24, 2002, Presidents Bush and Putin issued a Joint Statement on the New U.S.-Russian Energy Dialogue. This Joint Statement gave the responsibility for implementing this Dialogue to the Department of Energy and specifically to the Russian-American Working Group on Energy Cooperation. Secretary Abraham had laid the foundation for the Working Group in November 2001, during his meeting with Russian Energy Minister Igor Yusufov. The Working Group will deal with a number of energy issues including, global oil markets; investment; technology; and information exchange. In the technology area, discussions are under way on how to deal with the serious Russian problem of gas flaring associated with the production of oil. Current ideas include use of the gas-to-liquid technology to transform the gas into a liquid that can be used either on site or put into oil pipelines for shipment to markets.
- *With Kazakhstan*, in December 2001, the United States and Russia signed an Energy Partnership Declaration. Under this Energy Partnership, there have been extensive discussions on the appropriate utilization of Kazakhstan's extensive natural gas resources. The U.S. Trade Development Agency has provided

funding for feasibility studies to study the issue. It remains an area of active discussion and study.

- *With China*, the U.S. Government has encouraged China in its plans to increase natural gas use. A U.S.-China Oil and Gas Industry Forum was established in 1998 to foster bilateral cooperation and discussion on oil and gas development. The Forum has had four successful sessions, most recently in July 2002, in Houston. An exchange of natural gas experts between the United States and China was also sponsored under this Forum. In addition to DOE activities, the Environmental Protection Agency (EPA) sponsored, in cooperation with China's State Development Planning Commission, a two-year study on expanding natural gas use in China. The study was completed in April 2002. DOE is also participating in a major assessment of China's energy prospects, infrastructure, potential and policies being conducted by the IEA in Paris. The study identifies policies and investment frameworks needed to encourage greater use of natural gas in China.

#### CONCLUSION

Our ability to create new knowledge and technological innovation will directly impact our national prosperity, security and global influence. American technological leadership is anything but assured in today's global economy. We face more challenges to our innovative capacity and long-term competitiveness than ever before.

By continuing our ongoing interagency efforts, our international outreach effort, and government-industry partnerships, we can continue to meet the competitive challenges in the evolving world energy market. In these partnerships, industry can get better access to new knowledge and leverage it more effectively. Realizing this win-win through effective technology partnerships may prove to be the key to America's continued leadership in the 21st century.

This completes my prepared statement. I will be pleased to answer any questions the Committee Members may have.

The CHAIRMAN. Thank you very much. This Clean Energy Initiative that I gather was announced by our own State Department that you referred to at the Johannesburg meeting, what are the concrete actions that are currently underway within the Department of Energy or elsewhere in the administration to implement that?

Mr. SMITH. If I could, Mr. Chairman, with the chair's permission, I was not at the Johannesburg summit. Other officials from DOE were, but I would ask Mr. Bob Dixon, who is our senior advisor in our Office of Energy Efficiency and Renewable Energy, if he could address the chair.

The CHAIRMAN. Sure. Have a chair there.

Mr. DIXON. Good morning, Mr. Chairman. Robert Dixon, Office of Energy Efficiency and Renewable Energy for the record. Thank you for your question. Since returning from the World Summit on Sustainable Development in Johannesburg, there have been a series of planning meetings, among the participating agencies, the Department of Energy, EPA, AID, State and others, to develop an implementation plan, an action plan for the three elements of the President's announcement.

The plans are in draft form. We are consulting among the technical agencies with the State Department, we are also working with our private sector and non-government organization partners to vet these plans, and we expect the plans will continue to be refined and polished.

The CHAIRMAN. If you would tell me the three elements of this initiative again.

Mr. DIXON. Yes. There are three pieces. The first piece deals with the development of renewable energy resources. That effort is led by the Agency for International Development. The second piece—

The CHAIRMAN. And this is to assist underdeveloped countries in developing renewable energy resources, is that an accurate description?

Mr. DIXON. Yes, Mr. Chairman.

The second piece is a piece that deals with energy efficiency improvement in developing countries around the world, and that piece of work is led by the Department of Energy, and then the third piece again deals with transportation systems and communities and that work is led by the Environmental Protection Agency.

The CHAIRMAN. I would gather that anything we might do in the way of assisting some of the countries that have this practice of gas flaring going on, that would be under the second of these, increasing the efficiency of energy use, is that right? If it is covered under this initiative, it would be covered under that section?

Mr. DIXON. Yes.

The CHAIRMAN. Is it going to be covered as a part of this initiative, or is it not?

Mr. DIXON. The intent is to coordinate all the pieces in our international portfolio, and I need to turn to Mr. Person or Mr. Gale behind me to go into any further detail.

The CHAIRMAN. Okay, anyone who has got detail, I would just be interested in knowing if we are actually going to do anything on this subject. I cannot determine that we have as yet, and I wondered if there is any plan for us to do anything on this subject.

Mr. SMITH. Mr. Chairman, this is Mr. George Person, who is from our Policy and International shop. He is the Director of American and African Affairs in our Policy and International Office.

Mr. PERSON. Good morning, Mr. Chairman. As Mr. Dixon noted earlier, we are in the process of developing followup activities from the summit, and talking with some of the colleagues that were there. It was emphasized that natural gas flaring reduction clearly would be one of the energy efficiency elements that we would seek to coordinate, and so I will be coordinating more closely with some of those colleagues next week to see how we can weave in elements of our natural gas development strategy, including whatever role we play in the World Bank initiative, and to the broader WSSD followup activity.

The CHAIRMAN. I know I did get this letter from Secretary Abraham when I inquired about why we were not participating in the World Bank effort, and I gather from Mr. Smith's testimony this morning that we are still looking at that. Where will the decision be made in the administration on the extent of our involvement in that World Bank effort? Is it the Department of Energy? Is it the Department of State? Is it the White House? Where is that decision made?

Mr. SMITH. Mr. Chairman, it is my understanding it will be a joint decision, that we are monitoring those activities that are now—in fact, there is a meeting today, I understand, and we are closely looking at that and developing our policy, and we will coordinate with those other agencies, but it is an area of interest, of course.

The CHAIRMAN. But it will be a joint decision made by this inter-agency task force that is working on this initiative, is that what I am to understand?



Mr. SMITH. I do not know, Mr. Chairman, specifically, but I would be happy to determine that and report promptly back to the committee.

The CHAIRMAN. If you could let us know as to exactly how this decision is going to be made, and who will make it, that would be very useful. I am encouraged that there is more coordination, but obviously, if there is nobody actually feeling it is their responsibility to do anything, you can coordinate a long time.

Mr. SMITH. Certainly I will be happy, Mr. Chairman, to fully report to the committee on that.

[The information referred to follows:]

Regarding the World Bank's Gas Flaring Initiative, Chairman Bingaman requests that Mr. Smith report back to him on how and by whom a decision will be made on whether or not the U.S. will participate in the World Bank's Gas Flaring Initiative.

The Department of Energy (DOE) is the lead agency and is in discussions with other U.S. Government entities, including White House offices and the Department of State, regarding the nature and scope of U.S. participation. We will keep you apprised of our progress.

The CHAIRMAN. Thank you.

The Energy Information Administration database on domestic gas-flaring is based on voluntary submissions from the various States and from the Department of the Interior. I understand there have been some problems in collecting data. There have been major and fairly frequent revisions of that data once it is collected. Have you looked at this? Do you know, are there actions we need to take in order to improve the quality of this data? How do we ensure that we are collecting decent data for ourselves, and then secondly, I guess, how could we assist with the collection of better data internationally?

Mr. SMITH. Mr. Chairman, that, of course, has been a problem to get accurate numbers, and there are several sources for numbers, and the Energy Information Administration does track that worldwide. I do have Mr. Bill Trapmann from EIA, who I think can answer the chairman's question a little bit more specifically.

The CHAIRMAN. Very good.

Mr. TRAPMANN. At EIA we have been in the short term recently working with the States on data quality issues that we have become aware of. We have tried to coordinate with them on improvements in their data collection and reporting.

Longer term, we are looking at the possibility of collecting production data directly from major producers in an attempt to get this information more directly from the source. We hope that that would improve the timeliness and quality of this information.

The CHAIRMAN. It would seem that that would make a lot of sense. As you see it, is there legislation required in order for you to change that mode of collection, or is it just a decision you need to make and advise producers that you want that information? How does that work?

Mr. TRAPMANN. I do not believe there is legislation required for that collection authority. It is a decision we would have to make based on the expected benefits versus the cost of the program.

The CHAIRMAN. Do you have any time frame for making that decision?

Mr. TRAPMANN. I am not aware of a set time frame. We are expecting to have our review of the possible or potential project by sometime next summer.

The CHAIRMAN. So next summer, you would have again—tell me, what would you have by next summer?

Mr. TRAPMANN. We would have looked at the possibility of conducting a new survey with direct collection of these data items from the companies themselves.

The CHAIRMAN. Would you be ready next summer to decide whether to begin obtaining information directly from the producers?

Mr. TRAPMANN. I think we would have to get back to you on that. I am not aware of how the decision process would be structured for this.

The CHAIRMAN. Do you know, can you advise, are any of the folks who are here from the Department of Energy advised about what is the current state of collection of data internationally, or do we have any knowledge of that, or have we paid any attention to that?

Mr. TRAPMANN. We do pay attention to the international sphere. The EIA does not have collection authority for international data. We rely on secondary sources, the World Bank, for example, as a provider of these data items.

The CHAIRMAN. So if they do not have the information, you would not have access to it, either?

Mr. TRAPMANN. I do not believe so.

The CHAIRMAN. All right. Well, I do think if you could perhaps get back to us as to how some of these decisions are being made in the Department, how they are expected to be made, not just the Department but in the Government generally, I think that would be useful.

Frankly, I have had difficulty understanding why—as the world leader in technology development and oil and gas production generally, it seems unusual to me that we are not providing some level of leadership in this World Bank effort, unless we disagree with it, and I have not found anyone in the administration who has told me a reason why we would disagree with what they are doing. It would seem to be a fairly logical and straightforward way in which we could assist much of the underdeveloped world and ourselves at the same time.

[The information follows:]

The following is the Energy Information Administration's (EIA) response to Chairman Bingaman's request for information regarding EIA's decision-making process for a new survey on gas flaring data:

The project described by Mr. Trapmann is a multi-year project to improve basic natural gas production data. The exploration of data collection options and related work is scheduled to end in June 2003. According to this plan, the assessment and testing of selected data collection options would occur during the remainder of calendar year 2003. A decision to proceed with any option, to be made by the EIA Administrator, will depend on its relative merits and available resources. Public input will be a key aspect of any decision to change EIA data collection operations. Prior to any new data collection survey, EIA would invite public comment on the proposal through a Federal Register notice. The decision is expected to be made in December 2003 and would be followed in 2004 by a request for Office of Management and Budget (OMB) approval of data collection authority and reporting burden. System design and implementation would be conducted in the latter half of 2004. Data collection would start early in 2005. Only the initial feasibility study is funded at present. Subsequent project work requires multi-year funds.

The primary intent of the current phase of this EIA project was the examination of options for the collection of improved production data. However, the recent indication of greater interest in venting and flaring data can be accommodated by a shift in the work plan. The expanded scope and possible acceleration of project schedule would increase the associated costs.

Well, I appreciate very much the testimony, and we will probably have other follow-up questions in the future.

Mr. SMITH. Thank you again, Mr. Chairman.

The CHAIRMAN. Thank you very much. Why don't we go to our second panel, Mr. Daniel Schochet, who is with ORMAT International, Sylvia Baca, who is vice president of health, safety, and environment with British Petroleum, and Jeffrey Logan, who is the senior research scientist with Pacific Northwest National Laboratory. Thank you all very much for being here. I appreciate it very much.

If you will each take 6 or 8 minutes, however much time you need to make the main points in your testimony, the main points you believe we should focus on, and we will include your entire statement in the record.

Mr. Schochet, if you would start.

**STATEMENT OF DANIEL N. SCHOCHET, VICE PRESIDENT,  
ORMAT TECHNOLOGIES, INC., SPARKS, NV**

Mr. SCHOCHET. Yes, thanks, Mr. Chairman.

The CHAIRMAN. I hope that is the right pronunciation.

Mr. SCHOCHET. That is absolutely correct. I appreciate that, Mr. Chairman. I want to thank you for this opportunity to testify. I am vice president of ORMAT Technologies of Sparks, Nevada. My testimony is based on ORMAT's experience in the development of geothermal projects in the United States and in 16 countries worldwide. We have been successful in international competition in the transfer of geothermal technology. However, we are currently facing barriers which increasingly hamper if not preclude future investment in international projects.

What we find is that lenders are reluctant to make long-term loans for renewable energy projects in areas such as Eastern Africa, where there are high country risks, and this despite the fact that Kenya and Uganda, with their combined population of 50 million, could be 100-percent geothermal powered.

Just by way of introduction, ORMAT employs 600 technical staff worldwide. We are a technology based company, with annual sales somewhat over \$100 million primarily from geothermal projects, including 700 megawatts in 17 countries, of which 200 megawatts are in the United States, and these plants range from 200 kilowatt village power units to 130 megawatt central station power units. We also have a number of projects which use our technology to generate electricity from recovered industrial waste heaps.

I would like to address the issues identified by the committee in the following manner. First, U.S. agency programs have been effective in supporting international private investments, but we find that such support has weakened in past years.

An example of the support, in 1985, with a U.S. Department of Energy \$50 million loan guarantee, ORMAT developed in California the first large scale commercial binary power project. This project was successful, and it repaid its guaranteed loan with a pri-

vate refinancing 1 year after plant startup. Though we were awarded projects in developed countries based on competitiveness, and by developed countries I am speaking of New Zealand and the Azores and others, in developing countries the competition from foreign countries supported by their aid agencies was often impossible to overcome.

Our breakthrough came in the Philippines in 1991, where we won two small geothermal projects using a mixed credit loan from Ex-Im Bank and USAID. Subsequently, two larger projects totaling \$250 million in value were awarded to us, and this was by 1995, both with the support of the Ex-Im Bank, and these loans have since been 50 percent repaid, so this was a successful example of U.S. agency activities.

Second, U.S. energy firms are competitive in the world market, but we do need some additional support in overcoming barriers to effective technology transfer and private investment. As I said, though, we have won international projects on the basis of performance and costs. We are meeting increasing barriers to financing, and these include country risk, the creditworthiness of the power purchaser, financing barriers, including difficult access to multilateral agency funds, and institutional barriers.

As examples, in Guatemala, with the IFC leading a group of institutions, a complicated review process delayed the financing of a 27 megawatt geothermal project for 3 years and resulted in unnecessarily increased cost. In this case, we were only able to execute the project by taking the construction risk ourselves.

We are currently developing the Olkaria III geothermal project in Kenya, where a \$50 million investment by ORMAT in drilling and construction has removed all the technical risks. However, the private lenders and investors, as well as the multilateral agencies, are reluctant to provide long term financing due to the risks inherent to Eastern Africa.

Mr. Chairman, in considering my suggestions for improvement, I want to note, and I agree, that the implementation of viable renewable energy projects in developing countries could create a pattern for their sustainable economic development. In that case, public-private partnerships will provide the only solution for financing such projects. We feel a USAID and U.S. Ex-Im should again team up to support the competitiveness of U.S. firms by providing specifically credit support and enhancements, front end contingent grants and loans, and long term debt and equity. This would mitigate country risks and attract private investments, and I want to say that we are believers in contingent grants, rather than pure grants. This would mean that if a project is successful, the project revenues would repay the grant in full.

In addition, since a healthy domestic renewable energy industry is essential for export market, Congress should support the use of renewable energy by the passage of the H.R. 4 energy bill, including the renewable portfolio standard, and the extension of the production tax credit for all renewable technologies, including, we hope, the recovered industrial waste heat.

It is important to add, Mr. Chairman, that industry is also working on the challenges this hearing is exploring. Next April in Kenya we will participate in a conference hosted by the Business

Council for Sustainable Energy. This conference will have its objective to determine how to overcome the barriers to geothermal development in East Africa.

I understand, Mr. Chairman, you were recently in Kenya and undoubtedly heard a great deal about the geothermal potential in that country. Well, ORMAT's Olkaria III geothermal project, as the first private power project in Kenya, has opened a new development chapter. This can be the success story which unlocks the vast geothermal potential in Eastern Africa. We think Olkaria III is the ideal case for another interagency teaming success story, hopefully with the support and guidance of this committee.

Thank you, and I would be happy to answer any questions.

[The prepared statement of Mr. Schochet follows:]

PREPARED STATEMENT OF DANIEL N. SCHOCHET, VICE PRESIDENT, ORMAT TECHNOLOGIES, INC., SPARKS, NV

Mr. Chairman, distinguished members of the committee, ladies and gentlemen, thank you for the opportunity to appear before you. My name is Dan Schochet, I am Vice President of ORMAT Technologies, Inc. of Sparks Nevada. ORMAT Technologies was initially based in Hopkinton, Massachusetts from 1972 to 1984 when we moved our U.S. headquarters to Sparks, Nevada, where our geothermal activities have since been centered.

My testimony today is based on the direct experience of ORMAT in the development, investment and operation of renewable geothermal energy projects in the USA and 16 other countries. In particular we have invested our corporate funds in the ownership of geothermal power projects in the Philippines, Guatemala, Nicaragua, and Kenya as well as in the USA.

We have been successful in international geothermal competition and have participated in the transfer of geothermal technology. We also enjoy excellent relationships with our international colleagues. However we are currently facing barriers, which increasingly hamper, if not preclude, future investment in such international renewable energy projects.

Renewable energy projects are capital intensive since the initial cost includes the lifetime supply of fuel energy. They are typically less than 100 MW and considered as small. This creates a natural reluctance on the part of lenders to make long-term loans for such projects. This is particularly true in Eastern Africa, where the potential for geothermal development is enormous. For example both Kenya and Uganda, with a combined population of 50 Million, could be 100% geothermal powered. With this tremendous geothermal potential, power sectors, which are beginning to undergo reform, should capitalize on this underutilized resource.

Kenya already has a geothermal success with the operation of the multilateral funded Olkaria I geothermal project. ORMAT's Olkaria III geothermal project, as the first private power project in Kenya, has opened a new development chapter. However to turn this project into a U.S. success story in Kenya, which can unlock the vast geothermal potential in Eastern Africa, we need to first make Olkaria III into a U.S. interagency teaming success story.

ORMAT PROFILE

By way of introduction, The ORMAT Group of Companies, founded in 1965, employs some 600 engineers, technical specialists, and staff world wide, with annual sales of over US\$ 100 million, primarily related to renewable energy. As a value-added and technology-based company we develop and manufacture renewable and sustainable power generation systems and projects, fuelled from locally available energy sources. These include:

- Over 700 MW of geothermal power plants in 17 countries, including 200 MW in the USA. These plants range in size from 200 kW village power units in Thailand and Austria to a 130 MW central station power plant in the Philippines. Some 150 MW of these geothermal power plants are currently owned and/or operated by ORMAT in the USA, Kenya, Guatemala, Nicaragua and the Philippines,
- ORMAT also built successful demonstration projects generating electricity from otherwise unused industrial waste heat in a cement plant, on a pipeline compressor station and on a refuse derived fuel installation.

## ISSUES

To address the issues identified by this Committee, I would like to note the following:

*1. Effectiveness of U.S. Agency Programs in Supporting International Private Investment*

Our company has enjoyed the benefits of U.S. agency programs and leveraged the assistance from various agencies to support both domestic and overseas projects, with significant U.S. industrial value added and technology transfer components. Some examples are:

- In 1985 we acquired the East Mesa, California geothermal project, which was eligible for a U.S. DOE \$50M loan guarantee. With the guaranteed loan we developed the first commercial scale binary geothermal power plant. This successful project repaid the guaranteed loan, with a private re-financing one year after plant startup; and jump-started private sector investment in the U.S. geothermal industry.
- Internationally, in developed countries such as New Zealand, Iceland and Portugal, ORMAT was awarded projects based on our experience and competitiveness. But in developing countries, the competition of Japanese, French and Italian companies supported by their Aid Agencies was impossible to overcome. Our breakthrough came in the Philippines where, with U.S. government advocacy, ORMAT won two 16 MW projects on a Build-Transfer-Operate (BTO) basis in 1991, using mixed credit loans from Ex-Im Bank and USAID. This successfully introduced ORMAT's clean sustainable technology into the Philippines.
- We subsequently won a project in the Philippines, for a 130 MW plant, in which we incorporated 85% U.S. content and used specially modified GE steam turbines. CalEnergy Company made the equity investment as the project owner and ORMAT executed the Engineering Procurement and Construction (or EPC) turnkey construction contract. 50% of the Ex-Im loan to CalEnergy has now been repaid. ORMAT was subsequently awarded a U.S. Department of Commerce E award: the only U.S. geothermal company so honored.
- We also received a 50 MW, competitive award in the Philippines, for optimizing existing geothermal plants without drilling new wells. This project, in which ORMAT invested \$15M of corporate funds as an equity owner, was constructed with a term loan of \$45M from the U.S. Ex-Im Bank, fast tracked from application to closing in 6 months as their first project financing for Small Business. Approximately 43% of this loan has been repaid to date.

*2. Consistency of U.S. Policies Addressing Technology Transfer and Private Investment*

ORMAT's overseas projects operate with locally hired and trained engineers and technicians. There are no expatriates employed at any of our facilities, and our factory engineers provide support, often by real time linked computers, along with periodic visits to provide refresher-training courses.

- During the 1995-2002 period we constructed a number of power plants for our account as well as for other owners overseas, where we were able to take advantage of our U.S. geothermal technology transfer by utilizing our engineers from ORMAT's Philippine operations staff to assist in the construction and training in several other countries.
- Despite ORMAT's ongoing investment in international geothermal projects, with their concomitant technology transfer, the support from U.S. agencies has waned in past years. Though small grants for studies and conferences have been forthcoming, these have not as yet addressed the real problems of supporting private investment in technically sound renewable projects, and overcoming market and institutional barriers in developing countries.

*3. Relative Competitive Position of U.S. Energy Firms in the World Market*

From a competitive standpoint ORMAT has been able to win projects internationally on the basis of its track record, its technical superiority and the cost effectiveness of its equipment and services. However there have been increasing competitive barriers, particularly in the areas of project financing, where we are often faced with strong Japanese and European competitors.

- Our development in Guatemala was executed, with the IFC leading a group of institutions financing the 25MW Zunil project. However, here we encountered a complicated structure and review process, which a small project cannot support, and which delayed the financing for 3 years and resulted in unnecessarily,

increased costs. Completion of this project was only possible because ORMAT took the risk of the construction financing.

- We are currently developing the Olkaria III geothermal project in Kenya, where a \$50M investment by ORMAT in the drilling of wells and in construction of the first phase power plant, has removed all technical project risk. We are in the process of pursuing the long-term loan for the project, however the private sector lenders and investors, as well as the multilateral agencies, who are normally involved in such energy projects, have displayed a reluctance to provide financing due to the Eastern African country risks.

#### 4. *Barriers to Effective Technology Transfer and Investment*

Financing of renewable energy projects in international markets and the entry into these markets in general are hampered by various barriers, consisting primarily of:

- *Country Risk Barriers:* Most Renewable Energy projects in developing countries face country risks that private sector investors and lenders will not accept. Currently with even U.S. Investor Owned Utilities undergoing credit downgrading, the utilities in areas like Eastern Africa are simply not considered as commercially creditworthy.
- *Market Barriers:* Renewable Energy projects are relatively small and the cost of the review process may be prohibitive.
- *Institutional Barriers:* The playing field is not level for Renewable Energy projects, which often require specific regulatory framework, when compared with larger conventional energy projects, which are more attractive to the host country and the agency involved.
- *Financial Barriers:* These include barriers resulting from
  - Competition from Japanese, French and Italian companies in projects supported by their export agencies, and
  - Difficult and lengthy access to multilateral financial institution funds.

#### 5. *Suggestions for Improvements*

Mr. Chairman and members of the Committee, I would like to make several suggestions for improving this situation. Since energy is vital to poverty alleviation and economic growth in developing countries; enabling implementation of viable renewable energy projects would create a pattern of sustainable and environmentally sound development. Due to the country risks and barriers, we believe that Public-Private Partnerships provide the most effective and often the only solution for financing such projects, as follows:

- U.S. agencies, such as U.S. AID and U.S. Ex-Im, should again team up to support the competitiveness of U.S. energy firms by providing either credit support or other enhancements to attract both investment and long-term project loans. Such a joint approach can overcome barriers to meet the financing needs of projects in Developing Countries, where U.S. interests are of concern, and creditworthiness support is required.
- Examples of governmental inter-agency cooperation includes the support which helped U.S. exporters penetrate the Philippine geothermal market, where ORMAT obtained two project finance loans from Ex-Im Bank for over \$200MM, and successfully competed against credits from other countries. Here U.S. Government funding was 1/3 grant and 2/3 loan.
- Front-end contingent grants or soft loans, to defray a portion of initial capital expenditures can be leveraged to share and mitigate country and market risks;
- Long-term senior and/or subordinated debt, and equity participation by U.S. agencies can provide a platform for private sector investment and technology transfer, and
- Finally, we realize that a healthy domestic renewable energy industry is essential to support a successful export market. We therefore respectfully request that the support of the U.S. Senate and Congress for the use of renewable energy in the USA and abroad be demonstrated by the passage of the Energy Bill. This should include the Renewable Portfolio Standard (for Geothermal, Wind, Solar, Biomass and Recovered Waste Heat) as well as the extension of the Production Tax Credit to all renewable energy technologies. This will accelerate the market introduction of new technology and give U.S. firms a jump start in export markets.

EAST AFRICA—WHERE THE PHILIPPINES WAS 12 YEARS AGO

I want to close my testimony by noting that at the World Summit on Sustainable Development the U.S. and other nations committed themselves to supporting the

New Partnership for Africa's Development (NEPAD). The partnership's goal is to secure energy access for at least 35 per cent of the African population within 20 years.

Our Case In Point here, is the potential for geothermal development in Eastern Africa, a U.S. interest area, with enormous resources in every country along the Rift Valley. For example both Kenya and Uganda, with a combined population of 50 Million, could be 100% geothermal powered.

- With this enormous geothermal potential, and with power sectors beginning to undergo reform, East Africa may be able capitalize on this as yet underutilized resource;
- Recognition of this large potential within the area, and of the need for Public Private Partnerships is evidenced by the support given to the East African Geothermal Energy Development Initiative announced at the World Summit for Sustainable Development in Johannesburg by the U.S. Business Council for Sustainable Energy (one of the lead partners along with UNEP). Supporting U.S. agencies for this initiative included USAID, USTDA, U.S. Geological Survey, and others.
- Kenya is already a genuine geothermal success story with technology transfer in the Olkaria I geothermal project from many countries, including Iceland and New Zealand.
- Olkaria III, in Kenya, as the first private power project in Kenya has opened a new development chapter; and this geothermal success story in Kenya can unlock the vast geothermal potential in East Africa. Olkaria III is the ideal case for another interagency teaming success story.

The CHAIRMAN. Thank you very much. Before I ask any questions, let us hear from the other two witnesses. Sylvia Baca, we are very glad to have you here, representing BP.

**STATEMENT OF SYLVIA BACA, VICE PRESIDENT, HEALTH,  
SAFETY AND ENVIRONMENT, BP AMERICA, INC.**

Ms. BACA. Thank you, Mr. Chairman. It is good to be back. It has been 3 years today that I was before this committee for my confirmation hearing, so it seems fit that I am back once again.

The CHAIRMAN. Well, we miss you in that old job.

Ms. BACA. Thank you, Mr. Chairman.

Again, thank you for the opportunity to participate in today's discussion. As you know, BP is a major energy company with 110,000 employees, operating in about 100 countries around the world. We are involved in the exploration, production, and transportation of crude oil and natural gas, also in refining, marketing of fuels, manufacturing of petrochemicals, as well as in the production of solar and gas-fired power generation.

BP is the largest oil and gas producer in the United States, and nearly half of our assets and our people are here in this country, Mr. Chairman. At BP, Mr. Chairman, we believe that energy and environmental policy can go hand in hand. We are committed to achieving an appropriate balance between the two, and to finding new ways to deliver clean products while minimizing our impact on the environment.

Mr. Chairman, through this hearing today, the committee is evaluating barriers to effective technology transfer and investment in clean energy, as well as looking at the importance of public-private partnerships to reducing gas flaring and venting.

Mr. Chairman, you are to be commended for your interest and attention to this important international issue, and it is going to require the participation of all stakeholders, and that is government, industry, nongovernmental agencies, in order for any sort of real material results to be achieved.



The World Bank gas-flaring study we believe was a first important step in highlighting the issues that are associated with flaring and venting. This study aims to support the petroleum industry and national governments in efforts to reduce flaring and venting of gas associated with the extraction of crude oil. We participated in this study. We support many of the findings of the study, and we have recently reiterated our support for the initiative at the World Summit for Sustainable Development in Johannesburg earlier this month. We did have a contingent from BP who participated in Johannesburg.

I would first like to say that BP's flaring and venting reduction activities are aligned with our overall health, safety, and environment corporate policies, and that is to minimize and do no harm to the environment. Our policy is to eliminate continuous hydrocarbon gas disposal by flaring and venting. Our business units have aggressive improvement plans in place to achieve this policy, and until elimination is totally achieved we are using the best available technology to deliver reduction results.

It is increasingly recognized that international flaring and venting not only are wasting valuable natural resources, but they also contribute significant greenhouse gas emissions to the atmosphere. The ratio of gas vented to gas flared is very crucial, because the impact of methane on the environment is about 21 times greater than that of CO<sub>2</sub>, so the significance of these reductions is very clear.

Despite commitments by governments and companies, global flaring levels have remained virtually constant since 1983, and as we know, much of the incremental growth in global oil production will come from countries and regions that currently have large flaring problems. Therefore, companies and countries will face a major challenge in finding outlets for this gas that would otherwise be flared.

From BP's perspective, Mr. Chairman, the single most important step that can be taken to address gas flaring on an international scale is the further development of international and domestic natural gas markets. If these markets develop, incentives will be in place to encourage local governments to monetize their natural gas resources, rather than them being left to be vented.

Further development of international markets will also create a positive social and economic benefit, including the reduction and lowering of greenhouse gas emissions, as well as improving poverty and also providing a means of cost-effective, reliable, clean fuels for these economies that otherwise would not have access to them.

Mr. Chairman, one of the potential solutions to global gas flaring exists in the form of North American natural gas, where the demand is expected to grow substantially in the coming decade to about 30 TCF per year. It is generally agreed that traditional suppliers of North American supply will be insufficient, and therefore other sources will have to be tapped in order to meet the growing demand.

Supply sources include Canadian as well as Alaskan natural gas, and LNG from Trinidad and West Africa. We believe that these LNG supply sources can compete in the U.S. market, and will play a role in meeting that demand. However, post September safety

and security issues have complicated the debate around LNG, and have forced governments and others to reexamine policies related to the siting and the expansion of LNG facilities.

Natural gas reinjection is another means of reducing flaring. Gas reinjection is used in many areas throughout the world to increase pressure in oil reservoirs and thereby enhance oil recovery. Much of this is being done on the North Slope in Alaska. Other options include reinjecting gas into reservoirs for later use when markets can be further developed.

All of these options will be enhanced through government policies that encourage participation. These can be achieved through sound fiscal and regulatory frameworks that provide incentives for investment. Simply stated, Mr. Chairman, BP views gas flaring and the associated hydrocarbon losses as not only an economic but an environmental issue. Such losses, we believe, are a distinct area, through the performance management and good business practices, significant operational and environmental improvement can be achieved.

I would like to share with you just a couple of examples where we are reducing our flaring and venting. In Egypt, Mr. Chairman in recent years gas was just an unwanted byproduct and even considered a nuisance at our operations. In fact, most of it had been just directly vented into the atmosphere.

Since those days, much has been done to capture the gas and to reduce our emissions. Many of the fields have had pressure support through gas reinjection and a system of pipelines has been put in place, and we have now been able to provide energy to the local economy. Gas that would have otherwise been flared and wasted has now been captured and is being used in the Egypt fuel economy, is being used to support natural gas vehicles, as well as fuel butane for the local economy. This has proven to be not only good for the Egyptian economy and the environment, but has also been a good business option for us as well.

In the United States, Mr. Chairman, in an area you are familiar with, the Western United States, specifically the San Juan Basin, we have replaced approximately 2,500 valves that separate our fluids from gas at the wellhead and, as a result, we are now capturing about 2.9 million cubic feet of gas per day that would otherwise have been emitted into the air. That gas we are selling on the open market.

Best practices, Mr. Chairman, 4 years ago BP set up an internal network to facilitate the exchange of ideas and technology for the improvement of our environmental performance. This network of employees facilitates the best practice sharing and problem-solving through an interactive means. This is how we transport our technology across our 110 business units across the world.

Also, as you know, Mr. Chairman, we are engaged in the development and marketing of renewable energy as well. We are one of the largest solar provider companies in the world, and we have an aggressive program in place to aggressively grow our solar market here in the United States as well and worldwide.

Also, we have recently engaged in a contract with Chevron-Texaco in Norway to conduct a wind project, and so we are taking steps forward in wind energy as well.

So Mr. Chairman, with that, I would be happy to answer any questions you might have.

[The prepared statement of Ms. Baca follows:]

PREPARED STATEMENT OF SYLVIA BACA, VICE PRESIDENT, HEALTH, SAFETY AND ENVIRONMENT, BP AMERICA, INC.

Mr. Chairman and Members of the Committee, I am Sylvia Baca, Vice President of Health, Safety and Environment for BP America, Inc. Thank you for the opportunity to participate in this discussion today about technology transfer and natural gas flaring.

BP is a major energy company with 110,000 employees operating in over a 100 countries around the world. We are involved in the exploration, production and transportation of crude oil and natural gas; refining and marketing of fuels; manufacturing and marketing of petrochemicals, and solar and gas-fired power generation. BP is the largest oil and gas producer in the US and has nearly half of its assets, resources and people (45,000 employees) in this country.

At BP we believe energy and environmental policy go hand-in-hand. We are committed to achieving an appropriate balance between the two and to finding new ways of delivering clean products while minimizing impacts to the environment.

While the science is still provisional, in recent years evidence of global warming has accumulated, suggesting that human activities are having an impact on the climate. BP believes that the debate is too important to ignore and therefore, our company has made public commitments to reduce our emissions globally. Since making those commitments, tremendous advances have been made across our company to translate them into real results. In many instances, our experience has demonstrated that it is possible to improve both environmental and business performance.

Through this hearing, the Committee is evaluating barriers to effective technology transfer and investment in the energy industry as well as the importance of public-private partnerships to reduce gas flaring.

The Committee is to be commended for its attention to this important international issue that will require participation of all stakeholders—government, industry and non-governmental organizations—to achieve material results.

The World Bank gas flaring study was an important first step in highlighting the issues associated with gas flaring. The study aims to support the petroleum industry and national governments in efforts to reduce flaring and venting of gas associated with the extraction of crude oil. We participated in the study, support many of the findings and reiterated our support for the initiative at the World Symposium for Sustainable Development in Johannesburg earlier this month.

I would first like to say that BP's flaring and venting reduction activities are aligned with our overall health, safety and environmental policy goals—to do no harm to the environment.

Our policy is to eliminate continuous hydrocarbon gas disposal by flaring and venting. Our business units have improvement plans in place to achieve this policy and until elimination is achieved, best available technology will be used to deliver reductions.

It is increasingly recognized that international flaring and venting not only waste valuable natural resources but also contribute significant sources of GHG emissions. The ratio of gas vented to gas flared is crucial because the impact of methane on the environment is about 21 times greater than that of CO<sub>2</sub> so, the significance of these reductions is quite clear.

It is estimated that global flaring and venting totals almost 10 bcf/d. Of this, 50% occurs in Africa and countries of the Former Soviet Union; with Nigeria being the single largest contributor at about 20% of world total. (There are efforts underway in Nigeria to bring down the level of flaring over the next several years however, the challenge will be to do so while production is increasing.)

Despite commitments by governments and companies, global flaring levels have remained virtually constant since 1983. As we know, much of the incremental growth in global oil production will come from countries and regions that currently have large flaring problems. Therefore, companies and countries face a major challenge in finding outlets for this gas that would otherwise be flared. According to the World Bank Global Gas Flaring Reduction report, global oil production capacity is forecast to increase by 60 percent from 2000 to 2020, and a similar trend can be expected for associated gas production. If existing regional ratios of gas flared to oil produced are maintained, forecasts for incremental oil production imply increased levels of flaring will also increase by similar amounts during the same period.

However, substantial reductions in flaring during the next 20 years may be possible if current national and corporate policies and strategies designed to reduce flaring continue. These reductions can be achieved by greater gas utilization in international and domestic markets, site use and re-injection. The key challenge is developing markets for this resource.

From BP's perspective, the single most important step that can be taken to address gas flaring on an international scale is the further development of international and domestic natural gas markets. If these markets develop, incentives will be in place to encourage local governments to monetize their natural gas resources, rather than allowing them to be vented. Further development of international gas markets will create positive social and economic benefits including lower GHG emission, poverty reduction and cost-effective, reliable, clean fuels through greater energy supply diversity.

One potential solution to global gas flaring exists in the form of the North American natural gas market where demand is expected to grow substantially in the coming decade (to @30 TCF/YR). It is generally agreed that traditional supply sources in North America will be insufficient and therefore, other supply sources will have to be tapped in order to meet growing demand. Supply sources include Canadian and Alaskan natural gas and LNG from Trinidad and West Africa. We believe that these LNG supply sources can compete in the US market and will play a role in meeting demand. However, post-September 11 safety and security issues have complicated the LNG debate and have forced governments to re-examine policies related to siting and expansion of LNG facilities.

Natural gas re-injection is another means of reducing flaring. Gas re-injection is used in many areas throughout the world to increase pressure in oil reservoirs and thereby enhance oil production. Other options include re-injecting gas into reservoirs for later use when markets are further developed.

All of these options will be enhanced through government policies that encourage participation. This can be achieved through sound fiscal and regulatory frameworks that provide incentives for investment.

By focusing on gas flaring and greenhouse gas emission reductions at BP, we have added hundreds of millions of dollars of value to the company. Much of this has been delivered through improvements in energy management and energy efficiency. For example, we can now track reductions to specific projects where technologies have been implemented to reduce emissions. And, as an added benefit, we are able to share these practices across the company.

Simply stated, BP views gas flaring and the associated hydrocarbon losses as an economic and environmental issue. Such losses are a distinct area where, through performance management and good business practice, significant operational, economic and environmental improvements can be achieved.

Now I would like to share a few of our gas venting/flaring and GHG reduction success stories.

**Egypt**—In the early years, gas was an unwanted by-product, even a nuisance. In fact most of it was vented directly to atmosphere. Since those days much has been done to capture the gas and reduce emissions. Many of the fields have had pressure support through gas re-injection, and a pipeline network now supplies an onshore gas plant. Gas that would have otherwise been wasted is now captured and used as fuel in Egypt; to power vehicles and butane is available for heating and cooking. This has proven to be not only good for the Egyptian economy and the environment but also extremely good business.

**San Juan Basin**—Sometimes the solutions are quite simple. For example, in our lower-48 gas business unit, we replaced approximately 2500 valves that separated fluids from gas at the wellhead. As a result, we are now capturing approximately 2.9 million cubic feet of gas per day instead of emitting it into the atmosphere.

**Texas**—We have taken a holistic approach to energy management at our Texas City refinery. We have implemented a range of process changes to drive down energy cost—this has enabled us to reduce greenhouse gas emissions by 300,000 equivalent CO<sub>2</sub> tones.

**West Trinidad**—A new flaring strategy, combined with improved operational control have delivered an approximately 18% reduction in the amount of gas flared. These reductions have helped to counteract other flaring increases in the region and the ongoing program to address emissions in Trinidad will provide the further reductions over the next few years. By the end of 2004 we will have eliminated routine gas disposal.

**North Sea**—We have had substantial voluntary reductions in the North Sea which enabled BP to actively engage in the United Kingdom Emissions Trading Scheme. This is an example of a market mechanism that is providing an actual incentive for further reductions.

Technology Transfer in BP—Four years ago, BP set up an internal network to facilitate the exchange of ideas in technology and to improve environmental performance. This network of employees facilitates best-practice sharing and problem solving through interactive means. The network allows for instant access to corporate-wide knowledge and allows for sharing of best practices across the company.

As an energy company, BP is also engaged in the development and marketing of renewable energy solutions; solar and wind, in particular. With nearly 20% of the global market, BP is one of the world's leading solar companies. In 2001, BP Solar produced over 57 Megawatts of solar cells with \$200 million in sales. Our intention is to increase annual sales to 300MW by 2007 and to use solar to provide access to energy to 5 million people. We can imagine a future where the windows, walls and roofs of buildings power entire homes and businesses. Recently, we announced plans with Chevron-Texaco to build a 22.5 MW wind farm at our jointly owned Nerefco refinery near Rotterdam. The aim is to generate electricity equivalent to the consumption of 20,000 households, thereby displacing some 20,000 tones of CO<sub>2</sub> annually.

The fact is, there are barriers to widespread use of these products. This is due largely to costs structures and design limitations. However, we do envision a future where substantial markets will emerge for these products. In our view, governments around the world are engaged in a constructive fashion to encourage the use of these products, largely through tax and regulatory policy.

Mr. Chairman and members of the committee, I want to thank you again for the opportunity to be here today. I would again like to commend you for your focus and leadership on this important global issue. I would be happy to answer any questions.

The CHAIRMAN. Thank you very much for your testimony.  
Why don't we go ahead with your testimony, Mr. Logan.

**STATEMENT OF JEFFREY LOGAN, SENIOR RESEARCH SCIENTIST, ADVANCED INTERNATIONAL STUDIES UNIT, PACIFIC NORTHWEST NATIONAL LABORATORY**

Mr. LOGAN. Thanks, Mr. Chairman. I appreciate the opportunity to testify here today on U.S. technology transfer programs.

Engaging, developing, and transitioning economies in energy and environmental issues matters profoundly to the United States. When the "Iron Curtain" fell, Congress supported programs that successfully engaged the former Soviet Union, using minimal resources but leveraging profound change. Relatively secure programs helped secure weapons of mass destruction and prompt energy and environmental policy reform, and to organize investments that made major improvements in people's lives. U.S. programs have helped change the fundamental relationship between America and its former enemies, and made America more secure.

America benefits from the transfer of efficient and clean energy technology to developing and transitioning economies in three ways. First, it creates jobs at home and improves our trade balance, second, it reduces global environmental impacts by cutting carbon dioxide, methane, and sulfur dioxide emissions from energy conversions, and third, it generates security benefits by helping less stable countries and regions to develop their economies.

This contribution to international development gives people a stake in peace and stability by helping them achieve their own aspirations. We see this outcome in better relations with Russia and China as a result of cooperation in trade.

Much of the world's energy future will be set in concrete over the next few decades. The largest investments in energy supply and conversion systems will occur in developing and reforming countries, and these will soon lock in technologies for decades to come. The long lead time required to move technologies through the inno-

vation pipeline means that efforts to deploy technology in the second quarter of this century need to be started today.

The Advanced International Studies Unit at Pacific Northwest National Lab with support from the EPA, the Department of Energy, the Agency for International Development, the World Wildlife Fund, and several private foundations, has built nongovernmental not-for-profit organizations in Russia, the Ukraine, Bulgaria, Poland, and the Czech Republic. These organizations have developed world class expertise, each with staffs of 15 to 50 people. Each center is now self-sustaining and fully independent.

Together with the centers, we have helped organize over \$1 billion in energy efficiency investment projects in transition economies over the past 5 years. Similar efforts in China have contributed to greater transparency and market reform in that large country. China offers a case study in the role of energy sector cooperation, with special relevance for large countries like India and Pakistan.

China has long suffered severe economic constraints and environmental problems due to distorted markets, outdated technologies, and inefficient management. Ongoing Sino-U.S. collaboration on energy efficiency and fuel-switching helps to catalyze additional measures to improve energy efficiency, reduce pollution, and boost U.S. exports in energy technologies.

Successful cooperation relies heavily on local experts in partner countries. In some foreign assistance efforts, donor personnel provide all the leadership and utilize most of the resources, and when the aid money is exhausted, they return home with little to show for their efforts in the target country.

By contrast, American efforts to build energy efficiency centers in transition economies have anchored long-term substantive engagement between American experts and local energy specialists. This approach acknowledges and invests in existing human resources, engaging both public and private sectors in each country.

Our partnerships with transition and developing countries have relied on three technology transfer mechanisms, policy reform, financing, and capacity building. Policy reform, which means getting prices right and making prices matter, can support development and cut pollution by reducing distortions and subsidies that encourage energy waste. Programs to develop financing multiply the effectiveness of Government funds by helping to provide conditions necessary to attract investors.

Lack of credit, collateral, or funds to prepare business plans are the biggest barriers to energy efficiency and fuel switching in many economies. Some of the most practical work U.S. agencies have done to address these problems have been in capacity building. This approach is illustrated by our effort to create centers of local expertise and to promote reform and innovation for the deployment of energy efficiency and selected supplyside technologies. Our experience in the former Soviet Union, Eastern Europe, and China has proven the value of capacity building and project finance as a means of accelerating the transition to a democratic market economy.

The Central European nations of Poland, Hungary, and the Czech Republic are prime examples of the value of this develop-

ment path, and U.S. programs in these three have contributed measurably. These countries have eliminated much of the energy waste that stem from the legacy of central planning by implementing hard budget constraints, meaningful energy prices, institutional reform, and economic restructuring. Nations failing to implement those measures elsewhere have robbed citizens of economic and social well-being, creating conditions that increase the risk of proliferation of weapons of mass destruction.

Building the foundations of energy sector innovation means enhancing management and technical capacity, reforming the energy sector, and organizing finance for innovative investment. Mr. Chairman, U.S. self-interest would be served by increasing international energy cooperation, particularly with the transition and developing economies, where most energy demand growth will occur this century.

U.S. economic, environmental, and national security interests are tightly linked to global energy use. Energy technology innovation improves our security, helps the United States avoid inflation and recession, expands our market share in multibillion, multihundred billion dollar per year global energy technology markets, and mitigates atmospheric emissions in the fastest growing energy demand markets.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Logan follows:]

PREPARED STATEMENT OF JEFFREY LOGAN, SENIOR RESEARCH SCIENTIST, ADVANCED INTERNATIONAL STUDIES UNIT, PACIFIC NORTHWEST NATIONAL LAB

Engagement in energy and environmental problems in developing and transition countries matters profoundly to the United States. When the Iron Curtain fell, Congress supported programs that successfully engaged the Former Soviet Union using minimal resources but leveraging profound change. Relatively small programs helped secure weapons of mass destruction and prompt energy and environmental policy reform and to organize investments that made major improvements in people's lives. U.S. programs have helped change the fundamental relationship between America and its former enemies, and made America more secure.

International engagement through support of policy reform and technology transfer especially by leveraging private sector investment brings security, environmental, and trade benefits to Americans. (See Box 1.) Unfortunately, distractions and competing demands may cause us to miss historic opportunities to correct problems in unstable and underdeveloped regions.

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Box 1.—The U.S. Stake in Global Energy Markets

<b>Economic</b>	Supply- and demand-side technology
Development	
Energy technology exports	
<b>Environmental Mitigation</b>	<b>International Security</b>
Local air quality	More secure supplies of foreign oil
Regional acid rain	Nuclear non-proliferation
Global warming	Political stability in developing countries
<b>U.S. Leadership</b>	<b>U.S. Values</b>
Energy Science	Human rights
	Civil society
	Equity, self-determination, stewardship

U.S. President's Committee on Advisors on Science and Technology, *Powerful Partnership: The Federal Role in International Cooperation on Energy Innovation* (Washington, D.C.: The White House Office of Science and Technology Policy, June 1999). available at <http://www.ostp.gov/html/P2E.pdf>.

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The transfer of efficient and clean technology from the United States to developing and transition economies helps the United States in three main ways. First, most directly, it creates jobs at home and improves our trade balance. Second, it reduces global environmental impacts by reducing carbon dioxide, methane, and sulfur dioxide emissions from energy conversion. And third an often overlooked but extremely important contribution it generates security benefits by helping unstable countries and regions to develop their economies. This contribution to international development gives people a stake in peace and stability by helping them achieve their own aspirations. We see this outcome in better relations with Russia and China as a result of cooperation and trade.

Energy matters greatly for global environment, for regional security in key parts of the world, and for the future of some of the world's poorest people. U.S. assistance in South and Central Asia can help create partnerships in these areas by developing financing for energy productivity investment projects, especially in demand-side efficiency and natural gas development and transportation.

Development is constrained in many areas because energy utilization infrastructure is inadequate to provide for basic human needs, economic development, and environmental protection. In India and Pakistan, per capita energy use is only one-tenth that of the United States and frequent power shortages interfere with production and constrain delivery of basic services. We have an opportunity to help develop cleaner, low-risk energy alternatives than these nations might adopt otherwise. And it should not be forgotten that developing country carbon emissions will likely surpass those from developed countries within the first half of this century, highlighting the need for developing country participation in an international effort to reduce the risk of climate change.

#### WHAT WORKS

The greatest leverage for energy and environmental engagement comes with supporting market-based policy reform and in developing financing to implement emissions-reducing projects. Economic reform getting prices right and making prices matter can support development and reduce pollution in countries including India, China, Russia, and Brazil by reducing distortions and subsidies that encourage energy waste. Programs to develop financing multiply the effectiveness of government funds by helping to provide conditions necessary to attract investors. Lack of credit, collateral, or funds to prepare business plans are the biggest barriers to energy efficiency and fuel switching in many economies.

The experience of Central Europe proves that general economic reform works to improve the energy and environmental balance. It is well known that the formerly planned economies ranked as the most energy wasteful in the world. Energy intensity (energy per unit of real output) serves as an index of reform, as an indicator of successful and unsuccessful policies. Our latest data show that not only has Central Europe cut energy intensity by one third over the last decade, but that Russia and Ukraine have finally begun to follow suit. Reducing energy intensity has had major benefits for the economies and environment of the formerly planned economies. (See Figure 1.)\* The region has achieved this success by implementing hard budget constraints, meaningful energy prices, institutional reform, and economic restructuring. Russia and Ukraine, for example, have recently more than doubled their rates of collection of utility payments to over 90 percent.

Some of the most practical work U.S. agencies have done to address these problems has been in what we call "capacity building." (See Box 2.) This approach is illustrated by our effort to create centers of local expertise to promote reform and innovation for the deployment of energy-efficiency and selected supply-side technologies. Our experience in the Former Soviet Union, Eastern Europe, and China has proven the value of capacity building and project finance as a means of accelerating the transition to a democratic market economy. Countries that have adopted energy sector reforms have more rapidly achieved civil society combined with economic recovery, which in turn have helped foster peace and security. The Central European Nations of Poland, Hungary, and the Czech Republic are prime examples of the value of this development path, and U.S. programs in these three have contributed measurably. These countries have eliminated much of the energy waste that stemmed from the legacy of central planning by implementing hard budget constraints, meaningful energy prices, institutional reform, and economic restructuring. Nations failing to implement those measures elsewhere have robbed citizens of economic and social well-being, creating conditions that increase the risk of proliferation of weapons of mass destruction. Building the foundations of energy-sector inno-

\* Figures 1-3 have been retained in committee files.



vation means enhancing management and technical capacity, reforming the energy-sector, and organizing finance for innovative investment.

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Box 2.—Elements of Technology Transfer

Building human skills  
Reforming Energy policy

Leveraging private investment

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Successful cooperation relies heavily on local experts in the partner countries. In some foreign assistance efforts, donor personnel provide all the leadership and utilize most of the money and, when the aid money is exhausted, return home with little to show for their efforts in the target country. By contrast, American efforts to build energy efficiency centers in the former Soviet Union have anchored long-term substantive engagement between American experts and local energy specialists in the transition economies. This approach acknowledges and invests in existing human resources, engaging both public and private sectors in each country.

The Advanced International Studies Unit, with support from the Environmental Protection Agency, the Department of Energy, the Agency for International Development, the World Wildlife Fund, and private foundations, has built non-governmental, not-for-profit organizations in Russia, Ukraine, Bulgaria, Poland, and the Czech Republic. These organizations have developed world-class expertise each with staffs of 15-50 people. Each center is now self-sustaining and fully independent. Together with the centers, we have helped organize over \$1 billion of energy-efficiency investment projects in transition economies over the past five years. (See one example in Figure 2.)

Similar efforts in China have contributed to greater transparency and market reform in that large country. China offers a case study in the strategic role of energy sector cooperation, with special relevance for large countries like India and Pakistan. China has long suffered severe economic constraints and environmental problems due to distorted markets, outdated technologies, and inefficient management. The World Bank estimates that approximately eight percent of the country's gross domestic product is lost each year due to pollution that damages human health, natural ecosystems, and physical infrastructure. Fortunately, China has made progress with energy efficiency having reduced the energy required to produce its GDP by one-third or more. China's post-reform economy has grown faster than energy use for more than two decades. Ongoing Sino-U.S. collaboration on energy efficiency helps to catalyze additional measures to improve energy efficiency, reduce pollution, and boost exports of U.S. technology.

*Policy Development*

Assistance objectives can be linked to assistance mechanisms including policy assessment, investment project development, and technology information provision. Examples of productive activities can be drawn from the experience of the existing centers created with U.S. support. For example, the Polish energy efficiency center, FEWE, helped draft Poland's Energy Law that provides for utility investments in energy efficiency. FEWE specialists served on the steering committee that developed regulations for implementing this law. The center in the Czech Republic, SEVEEn, has bolstered local efforts to improve efficiency by drafting energy strategies that have been implemented in Prague, Plzen, Tabor, Bechyne, Mimon, Nymburk, and Cesky Krumlov. Each plan was tailored to the needs of the specific locality and included methods for cutting costs by implementing energy efficiency projects. The Russian Center CENEf developed energy conservation laws that have been enacted in Chelyabinsk, Tula, Nizhnii Novgorod, Sakhalin, Kostroma, Ryazan, and Yaroslavl. The U.S. Department of Energy continues to provide support for similar programs, but unfortunately the sums available for such efforts are extremely limited.

Another example comes from work in Bulgaria with EnEffect, the center in Sofia, which has worked with the Global Environment Facility to support municipalities in developing their own energy efficiency offices and infrastructure. This effort has recently been supported by the Agency for International Development through its Municipal Energy Efficiency Network. But, again, the resources available for this and similar efforts are quite small.

The Chinese center, BECon, helped develop the energy conservation law approved by the Chinese National People's Congress in 1997, and has since assisted provincial-level ministries in developing the regulations, standards, and monitoring and enforcement measures needed to implement the law. Significantly, BECon has

worked with the World Bank to create and develop the first-ever energy-conservation service companies in China.

#### *Business Partnerships*

The centers can assist companies to do business in their countries by providing the most successful avenue for technology transfer foreign investment. The existing centers have been successful at helping private companies analyze existing and potential new markets for their products, identify barriers and ways to overcome them, and access information on privatization, tax, property, and other laws that affect the company through the following:

- Filling information needs for industry through interaction with firms and regional industry experts.
- Gathering information on financial and technical resources and conducting market surveys for companies and their products.
- Preparing business plans and feasibility studies.
- Working with energy efficiency experts and in-country authorities to develop innovative ways to finance energy efficiency investments.

Similar efforts could follow the model of the business development work of the existing six transition economy centers. A sampling of their experience follows. ARENA-ECO was instrumental in securing \$50 million in investment for energy efficiency improvements in 15 industrial facilities and initiating a \$30 million program to upgrade the efficiency of schools and hospitals in Kiev; BECon worked with Armstrong International to help establish the U.S.-Chinese joint venture Kangsen-Armstrong Company, Ltd. to produce high-efficiency steam traps in China. The plant began production in 1995 and the annual production capacity of 100,000 steam traps per year will likely be expanded; SEVEN in 1995 helped establish the first energy service company (ESCO) in the Czech Republic, and it continues to do business with industry, schools, and hospitals in that country.

Local centers of expertise can be designed to help introduce market-based approaches for the utilization of new technologies in developing countries. To fulfill this objective, local experts could conduct major efforts to develop policies, create partnerships among local and American businesses, demonstrate and train specialists in new energy systems, and to educate the public.

Such centers can be not-for-profit, non-governmental independent entities. The centers help forge partnerships between suppliers of modern energy-efficient equipment and services and in-country partners. For these business efforts to succeed, the centers encourage legal reform to develop incentives for energy conservation. In the centers we established more than a decade ago, the effort has yielded a large body of collaborative research. In addition, new domestic laws and international agreements have been enacted to support energy efficiency. Independent evaluations of the transition economy centers' have been very positive, and the program has won a number of prestigious international prizes, including three Global Technology Leadership Awards (International Energy Agency) and two International Energy Project of the Year Awards (Association of Energy Engineers).

These examples illustrate the types of accomplishments that continued and expanded engagement can be expected to achieve, with specific accomplishments appropriately tied to priority objectives and activities. The key is selecting the people with the qualifications and motivation to do the job, and providing them with the necessary equipment and technical resources through the core period. (To learn more, the interested reader is encouraged to visit [www.pnl.gov/aisu](http://www.pnl.gov/aisu).)

#### THE NEED FOR RENEWED ENGAGEMENT

Energy cooperation in Central Europe and China has accelerated development and ameliorated environmental conditions, even while cutting the costs of providing basic energy services. It would be reasonable to take the best elements of those successes and apply them to reduce the risk of proliferation in the South Asia, the Middle East, and Central Asia. This effort could build good will and more open market-based systems by investing in people, leveraging indigenous scientific capabilities, and supporting local experts. Our experience has shown that tackling fundamental problems can help minimize future conflict.

For example, the U.S. government could support new centers of regional energy cooperation. These centers might have as their goals development of local capacity and working together to solve regional development problems stemming from energy investment constraints. This effort should be focused on clean systems like natural gas and energy efficiency technologies to ensure cleaner, more-affordable investment without causing new environmental or security-related concerns. A key focus could be to develop project-based financing on a regional basis. This effort will address

a major failure of international energy development in the targeted countries, which is the lack of investment in infrastructure and productive capacity necessary for creating jobs. Countries like Pakistan and India do not lack technical skills to utilize energy for productive purposes. However, many such developing economies still require the entrepreneurial and financial planning skills necessary to develop, implement, and manage fungible projects. The purpose of this proposed effort would be to provide training in business plan preparation to fill the need for entrepreneurial skills, and to use the training as an opportunity to develop and finance serious, job-creating investments. U.S. experts have extensive experience in such efforts, having led in numerous successful projects of this type in countries around the world.

Another key component of an international energy strategy led by the U.S. would be establishing a natural gas network connecting the Caspian Region and South Asia and another connecting Russia and China. Helping China develop its own natural gas resources would bring major benefits for the United States by reducing China's level of carbon dioxide and methane emissions, and with them the risk of global warming. It should be noted that China's gas resources have been overlooked and understated. (See Figure 3.)

By creating the skills to meet the needs for regional security, investment, regulatory reform, and infrastructure development, U.S. government and industry could work together to accelerate development and promote stability through interdependence. Such efforts would require strengthening regional cooperation and communication, and improving the relationships that are necessary for U.S. companies to operate in these markets. Greater use of natural gas in South Asia can address chronic air pollution problems, improve economic efficiency, reduce greenhouse gas emissions, and expand business opportunities for U.S. oil and gas companies.

South Asia and China have shown encouraging signs of accelerating development of the natural gas sector, but important hurdles remain. Comprehensive policy frameworks have yet to emerge to help guide investment, allocate scarce resources, and minimize risk. Local companies are often hindered by outdated technologies and management practices, resulting in inefficiency and high cost. Natural gas projects especially among end-users are slow to develop due to conflicting authority, lack of incentives, and entrenched coal interests. Personnel in these countries' gas sectors are not fully prepared to function in the increasingly market oriented economies and need training in finance, regulation, policy, safety, planning, and management. Expanded use of natural gas can help Asian economies improve air quality, increase economic efficiency, and reduce growth in greenhouse gas emissions. Despite these advantages, Asia's natural gas sector has been relatively slow to develop.

To adequately address the opportunities for U.S. engagement in the energy markets of transition and developing countries around the world, an expert review panel in 1999 called for a doubling of U.S. government support for international activities described in this testimony. In the much more challenging international environment of today, this funding could be considered an investment in global security. Legislation already adopted by the Senate wisely adopts that approach and deserves the support of the American people.

#### CONCLUSION

Much of the world's energy future will be set in concrete over the next two decades. The largest investments in energy supply and conversion systems will occur in developing and reforming countries, and these will soon "lock in" technologies for decades to come. The long lead-time required to move new technologies through the innovation pipeline let alone penetrate markets means that efforts to deploy technology in the second quarter of this century need to be started today.

Great leverage for greenhouse gas emissions reductions comes with supporting market-based policy reform and in organizing financing to implement energy technology transfer in developing and transition economies. Economic reform getting prices right and making prices matter can help reduce emissions in countries as diverse as Brazil, China India, Pakistan, Russia, Saudi Arabia, and Ukraine by reducing distortions and subsidies that encourage energy waste. Efforts to organize investment financing for energy innovation can multiply the effectiveness of government funds.

U.S. self interest would be served by increasing international energy cooperation, particularly with the transition and developing economies where most energy demand growth will occur this century. U.S. economic, environmental, and national security interests are tightly linked to global energy use. Energy technology innovation improves our security, helps the United States avoid inflation and recession, expands our market share in multi-hundred-billion dollar per year global energy-

technology markets, and mitigates atmospheric emissions in the fastest-growing energy demand markets.

The CHAIRMAN. Thank you very much for your testimony. Let me just ask a few questions.

Mr. Schochet, let me ask you first, your testimony indicates that you believe there has been a decline in the level of support from the Ex-Im Bank and from USAID for U.S. companies such as your own that are trying to engage in projects in some of these countries. Is that an accurate paraphrase of what you said?

Mr. SCHOCHET. Yes and no. There has been a decline in support, but I do not believe that I want this to be a criticism of Ex-Im. I think this is more a criticism of the constraints placed on Ex-Im with regard to where they finance and how they finance Ex-Im is a bank, and as a bank, for example, they are currently cooperating with us and looking at our project in Kenya, and because it is in the process of undergoing financing I cannot really speak about it, but I can say this.

They are looking at it as a bank would, whereas I believe that U.S. Government policy in an area of concern should allow them a greater latitude in dealing with issues, for example, in Eastern Africa, so that a private sector bank simply will not make a loan in Eastern Africa because they will not take the country risk, or they say the utility in Kenya is not creditworthy, and in fact the World Bank private sector financing and the IFC has said the same thing.

We really do not want Ex-Im to come to the same conclusion. They are almost our last and best hope, and we feel that what Ex-Im should be looking at is a bank, but a bank that is implementing U.S. policy, so we feel to that extent the support of Ex-Im and USAID is weakening, and I think it is weakening primarily because the policy perhaps constrains them from taking more aggressive action in providing credit support and loans.

The CHAIRMAN. And which policy is it that you are saying constrains Ex-Im Bank that was not in place before? Mr. SCHOCHET. I think the policy they have—and again, I am circumspect because I do not want to be placed in a position of criticizing an excellent agency. I think perhaps they are acting too much like a bank, and not enough like an extension of U.S. export policy.

The CHAIRMAN. All right. Let me ask Sylvia Baca about her testimony here. You indicated that BP is cooperating, as I understand it, with the World Bank initiative to reduce the flaring and venting of natural gas, and is doing that as a corporate entity irrespective of the policy of the U.S. Government in this area. Is that an accurate description of what your company's policy is?

Ms. BACA. Mr. Chairman, the World Bank initiative went out and asked for various partners to come to the table to discuss what the practices are out there, and BP was very happy to cooperate on that.

The CHAIRMAN. Separate from the World Bank effort, or in coordination with the World Bank effort, is there a move, on the part of oil and gas producers, to adopt a set of best practices, or acknowledge what the best practices are related to this issue, in order to come to a more uniform agreement on that?

Ms. BACA. I cannot really speak for any of the other industries, but I can tell you from our perspective that as I said in my testimony, we look at flaring and venting as not only an environmental problem for us, but it is an economic problem as well. As long as the resource is being flared or vented, it is being wasted, so we look at it on two fronts. We are looking at it from an economic lens as well as an environmental lens.

We do share lots of operations with partners, other companies, and I think we have taken an aggressive stand in terms of our deep desire to reduce the emissions and so we are actively working with our partners where we have the joint venture situation to aggressively implement reductions, whether they be on the flaring or venting side.

The CHAIRMAN. The example you have in your testimony about the replacement of 2,500 valves in the San Juan Basin, when did that happen?

Ms. BACA. Mr. Chairman, this was very recently. This was in the last couple of years. As you know, Lord Brown made a commitment that BP would reduce its greenhouse gas emissions by 10 percent, to the 1990 Kyoto baseline, so we went around the company looking for various places where we could make those reductions. This was an area where we gained a significant amount of reductions in the United States.

As you know, that whole San Juan Basin, Wyoming Basin, there is a lot of methane production going on there, and by just a simple change-out of our wellheads there we were able to significantly reduce our greenhouse gas emissions. That methane was being vented into the atmosphere. We have been able to capture it, turn it around, and sell it. We are making money on it.

The CHAIRMAN. And I gather that none of this was required by any regulatory agency?

Ms. BACA. No, Mr. Chairman. This was not required.

The CHAIRMAN. So other producers that are operating in that basin may be continuing to vent, not having done the changeover of valves that you are talking about?

Ms. BACA. That is quite likely, Mr. Chairman.

The CHAIRMAN. Now, is that peculiar to the San Juan Basin that there is no regulation of such venting, or is that common throughout the continental United States?

Ms. BACA. Mr. Chairman, I do not know the answer to that question, but I can get back to you on that.

The CHAIRMAN. I would appreciate that.

Mr. Logan, let me ask you, your laboratory has focused on a lot of these issues of how to improve energy efficiency and reduce environmental impacts of energy production. Have you done anything to try to rank, order, or prioritize which are the problems that are most in need of attention, which are the areas where the greatest progress can be made, the easiest, those kinds of questions?

Mr. LOGAN. Yes, Mr. Chairman. That is actually a very region-specific question. Most of our work has occurred in the transition economies such as the former Soviet Union, where the legacy of central planning and very, very low energy prices made energy waste endemic throughout the economy, and some very simple measures could make tremendous impact in those countries.

The CHAIRMAN. And what have you identified as the most attractive targets to deal with first, to really make progress there in the former Soviet Union countries, if you have done that?

Mr. LOGAN. Well, in the industrial sector, helping to implement reforms so that energy prices do matter, helping to train entrepreneurs in how to prepare a business plan so that they can get financing, and helping to train people in the Government to develop regulations and legal reforms, things like that, are probably the most useful in those sets of countries.

The CHAIRMAN. Okay. I have had concerns in trying to think about what policies we ought to spend our time working on. I have had difficulty trying to compare a policy to reduce venting and flaring of gas, for example, against a policy to reduce industrial emissions, and to see which of those would have the largest benefit. Have you done any analysis of that sort of thing?

Mr. LOGAN. Well, as Ms. Baca mentioned, the greenhouse impact of methane emissions, which is basically what vented or flared gas is, are 21 times more powerful than standard carbon dioxide emissions, but you would have to look at each country individually.

Nigeria, for example, probably the most powerful impact would come from preventing or capturing the methane emissions that occur there, and as you probably know, from a business point of view making practical use of natural gas that would otherwise be flared requires a full chain of upstream, midstream, and downstream uses, so not only do you need to capture the gas and have pipelines to send it to markets, but you also have to make sure that there are end users in each of those markets to make use of the gas, and that would require, again, the same types of issues that we are talking about here, making sure that economies are transparent, making sure that there are regulations and rules in place, making sure that people are trained in how to get financing for their projects.

The CHAIRMAN. These organizations you have helped establish, these not-for-profit organizations in Russia, Ukraine, Bulgaria, Poland, the Czech Republic, you say these organizations have developed world class expertise. What are they expert on? What information are they able to provide that we do not otherwise have, or that the policymakers in those countries do not otherwise have?

Mr. LOGAN. For example, in China, the Beijing Energy Efficiency Center is assisting the World Bank in creating energy service companies, and this is a first-time activity for that type of business in China, and they are advising the World Bank and working with the Chinese government to make sure that the environment is satisfactory for energy service companies to operate in China. That is one type of expertise that these energy efficiency centers have.

I do not work directly with the efficiency centers in most of the former Soviet Union countries, so I am probably not good at answering that question, but I can ask William Chandler to respond to that as soon as he returns from overseas travel.

The CHAIRMAN. You also say the centers, each of these centers, are now self-sustaining. How can they be self-sustaining? Who gives them money?

Mr. LOGAN. The centers were initially set up with what we call core funding, and the U.S. Environmental Protection Agency and

the Department of Energy provided 3 years of guaranteed funding for each of the centers, and they were generally amounts ranging from \$200,000 to \$400,000 for the establishment of each center. Now, each center has——

The CHAIRMAN. \$200,000 to \$400,000 per year?

Mr. LOGAN. It depends upon the country, but I think it was in total.

The CHAIRMAN. So \$200,000 to \$400,000 spread over a 3-year period?

Mr. LOGAN. Yes, Mr. Chairman. Now, each of these centers is doing business with private sector companies, with their own Governments, with multilateral lending agencies, and a variety of foundations, and that is where they get their support now.

The CHAIRMAN. All right. Well, there are a great many issues embedded in this general subject of technology transfer and how we should be assisting the rest of the world in the efficient use of their energy resources and environmentally responsible use of their energy resources. I do not think we really can begin to scratch the surface of it here, but this is useful testimony to sort of lay a groundwork for further investigation of the issue. I appreciate you all testifying, and we will undoubtedly follow up on this in some future hearings.

Thank you all very much.

[Whereupon, at 10:40 a.m., the hearing was adjourned.]

[Subsequent to the hearing, the following statement was received for the record:]

PREPARED STATEMENT OF DAN RENBERG, MEMBER OF THE BOARD OF DIRECTORS,  
EXPORT-IMPORT BANK OF THE UNITED STATES

Thank you for the opportunity to provide the Committee with information on the important role the Export-Import Bank of the United States (Ex-Im Bank) is playing in technology transfer by offering companies the financing packages they need to win global competitive bids. While Ex-Im Bank is predominately oriented to support capital goods exports, we are also supporting services, services such as the training of local workers needed to maintain and use high-tech systems equipment used in plants.

As the U.S. government's export credit agency, Ex-Im Bank has financed over \$400 billion in U.S. goods and services exports since its inception in 1934. Ex-Im Bank's primary role is to finance and facilitate U.S. exports by filling commercial financing gaps and to level the playing field for U.S. exporters. In fiscal year 2001, Ex-Im Bank supported \$12.5 billion in U.S. exports under our loan, guarantee and insurance programs. This financing assisted 2,358 export sales. Sales that helped sustain thousands of U.S. jobs. Last year, 90 percent of the transactions authorized by Ex-Im Bank supported small business exports. The transactions provided short (up to one year), medium (one to seven years) and long-term (over seven years) financing to creditworthy international customers, both public and private-sector working capital Guarantees to U.S. exporters.

Ex-Im Bank's financing is in accordance with the Organization for Economic Cooperation and Development (OECD) arrangement, which established the financing parameters for most national export credit agencies. Under the arrangement, Ex-Im Bank provides the maximum allowable loan/guarantee repayment terms, allows support of up to 85 percent of U.S. content, and sets guidelines for interest rates at the Commercial Indicative Reference Rate (CIRR) or market prevailing rate.

Currently, Ex-Im Bank has special initiatives for environmental exports, small business, and lending directly to municipalities in certain countries. As a result of Ex-Im Bank's Environmental Exports Programs, which consists of pro-active business development and enhancements to our programs, transactions approved under the program have grown from 13 in 1994, to 71 in 2001, totaling over \$1.5 billion or a 446.2 percent increase. Under this program, renewable energy exports have been a major focus. From 1980-2001, Ex-Im Bank supported over 58 projects worth

over \$2 billion in renewable energy goods and services exports. To increase Ex-Im Bank's support of these exports, Ex-Im Bank is working in close partnerships with the Department of Commerce, Energy, Environmental Protection Agency, and renewable energy, energy efficiency trade associations.

Renewable energy includes solar, wind geothermal, hydro-power, biomass, and possibly new technologies such as fuel cells. The growth potential in this market is enormous with the value of the world's power generated from renewable energy estimated at \$7 billion up from a billion dollars in 1990, and projected to reach \$82 billion by 2010. In this area, Ex-Im Bank has supported \$653.4 million in exports since 1992, which consisted of \$442.2 million geothermal, \$11.7 solar, \$13 million wind, \$160.9 million hydro and \$25.7 million biomass exports.

Wind energy has been the fastest growing new source of electricity since 1998, with a 30 percent average per year growth and a total market value at \$4 billion. In the U.S., there are 10,000 MW, with 6,000 to 7,000 under construction. This is three times what they were in the early 90's. Currently, Danish turbines account for 60 percent of U.S. capacity, and U.S. firms have 30 percent of the wind market share.

Another growing area is solar photovoltaics, which increased 37 percent in 2000 to a total market of \$2.5 billion. Solar power costs have fallen 65 percent from 1990 to 2000, to 40 cents/kw and is estimated to fall to 10 cents/kw by 2010. In 1996, the U.S. was the world's leader in photovoltaics with a 40 percent market share; however, Japan is the current world leader (what is their market share).

Ex-Im Bank's financing has been a key component of these renewable energy companies export success. In 1995, Ex-Im Bank provided a medium-term guarantee for a three-year loan for one \$440,000 wind turbine from Zond Energy Systems, Inc. (Zond Energy), Tehachapi, California, to a cement maker in Mexico. Zond Energy also received a \$12.5 million tied aid direct loan in 1996 to finance three wind energy projects in China to match Danish "soft loan" terms. In 1996, a \$49.7 million direct loan was provided to build, own, and operate four geothermal 530 KM power in Manila to Onnat Leyte Co. Ltd., which included the training of local workers in maintaining the geothermal plant system. More recently, in 2001 Ex-Im Bank provided a six-year extended loan to support a \$700,000 sale of solar panels by BP Solar International, a small company in Linthicum, Maryland, to a utility in Argentina. In addition, AstroPower, Inc., a small company in Newark, Delaware, purchased short-term insurance, which enabled the company to offer four separate open account credit lines to solar energy dealers worldwide, including a \$9,000 credit line to a dealer in South Africa.

While Ex-Im Bank support in this area has increased, much more needs to be done to increase U.S. market share of renewable energy exports. Therefore, Ex-Im Bank is increasing our international business development efforts to major public, private buyers to stimulate demand-pull for U.S. exports. We are also conducting joint initiatives with the Department of Energy and the Department of Commerce in Brazil, Mexico, India, China, and other target markets to identify and pursue procurement opportunities. In addition, we are increasing domestic business development efforts that focus on closer collaboration with leading exporters, outreach efforts to small business exporters, and our Public Affairs efforts to highlight our successes. Furthermore, we will raise with Treasury and the interagency group the possibility of having the U.S. propose within the OECD to extend the repayment terms for renewable energy exports to 15 years in order to match those of nuclear energy. However, we will need to consider the potential trade-offs of such a proposal, both within the domestic budget and among other U.S. issues of interest within the OECD, in determining the appropriate strategy. Finally, we have just recently established a Renewable Energy Exports Advisory Committee to assist and advise Ex-Im Bank on ways to increase exports in this area.

But the biggest challenges to increasing U.S. renewable energy exports are market barriers to renewable energy use, lack of awareness of Ex-Im Bank financing among U.S. exporters and key foreign buyers, and tied aid terms offered by other governments. To address these problems, Ex-Im Bank is committed to coordinating with the Department of Energy and the Department of Commerce and to identifying new methods of supporting renewable energy and energy efficiency industries as they pursue opportunities in the global marketplace.





## APPENDIX

### RESPONSES TO ADDITIONAL QUESTIONS

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ORMAT TECHNOLOGY INC.,  
Sparks, NV, October 8, 2002.

*Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.*

Attention: Jonathan Black, SD-312

Subject: Response to Questions by Senators Bingaman and Murkowski

DEAR JONATHAN: I want to personally thank Chairman Bingaman, the Members of the Committee and the Staff for inviting me to appear before the Committee on Energy and Natural Resources on September 18, 2002.

It was an honor to be able to appear and testify on Export Investment and Technology Transfer before this most important committee. I hope that my comments were of interest to the Chairman and that my testimony was useful to the members.

Attached hereto are the answers to the question asked by the Chairman at the hearing and the questions forward from Senator Murkowski subsequent to the hearing.

If any of the members or staff have any additional questions, please do not hesitate to contact me directly, or my colleague John Garrison at the Business Council for Sustainable Energy in Washington, DC.

Again I want to thank you for the courtesy and kind consideration extended to me by the Committee Staff and I remain,

Sincerely yours,

DANIEL SCHOCHET,  
*Vice President.*

#### RESPONSE TO QUESTION FROM SENATOR BINGAMAN

*Question.* What recommendations does ORMAT have with regard to the role of the U.S. Export-Import Bank in financing renewable energy projects in developing countries?

Answer. (a) ORMAT believes that in areas where U.S. interest dictates, the Bank should apply special conditions to stimulate private renewable energy projects. This was very successful in the Philippines in the mid 1990s. In the case of geothermal energy projects, we would recommend that Ex-Im actively seek out projects and work with finance agencies in Central America and Eastern Africa. These areas do not have indigenous fossil fuels and geothermal electrical power generation is cost-effective in real unsubsidized terms, when compared to electricity generated by use of imported fossil fuels.

(b) Ex-Im needs to demonstrate, and increase, its commitment to clean and renewable energy projects. Additional staff and Bank resources should be dedicated to renewable energy projects to allow Ex-Im to maintain uninterrupted focus on such projects. Greater flexibility should also be afforded loan officers to apply innovative methods when financing clean energy exports. For example, the Bank should increase limited or non-recourse financing for renewable energy projects. ORMAT recommends that Ex-Im endorse a voluntary initiative launched at the World Summit on Sustainable Development by the Global Legislators for a Balanced Environment (GLOBE) that calls upon the G8 countries to promote the large-scale transfer of renewable energy technologies to developing countries by devoting 10 percent or more of their energy export finance portfolios to the renewable energy sector by 2010.

(c) A third recommendation is to have a "team" effort to coordinate and leverage the activities of Ex-Im with those of other agencies, such as USAID, OPIC and TDA. We understand that this effort is already underway with the formation of the "Clean Energy Technology Export Initiative" (CETE). However, it is imperative that CETE explicitly includes renewable technologies as a dedicated component. ORMAT

fully supports the creation of CETE and strongly recommends that clean energy companies be given a role in its development.

(d) Since the period granted for nuclear energy projects by the OECD countries is 10 to 15 years, it is recommended that renewable energy projects also be granted the same long-term debt financing repayment terms. It is our understanding that Ex-Im need only notify the OECD that it is making longer-term credit available for renewable energy projects, and that concurrence by the OECD is not required.

#### RESPONSES TO QUESTIONS FROM SENATOR MURKOWSKI

*Question.* What kinds of projects have been most successful in achieving transfer of technology to other countries?

*Answer.* It is difficult to say whether there is a standard "type of project" that clearly stands out as having the greatest success in achieving technology transfers. From ORMAT's perspective, geothermal power projects have been very successful in transferring technology to other countries. These projects are local labor intensive both during construction and the subsequent long-term operation. In addition to requiring the development of a supporting infrastructure, geothermal projects create a long-term industry with high paying technical jobs manned by locally recruited and trained staff. This has been proven in the Philippines, Kenya and elsewhere. Thus geothermal projects create not only a sustainable technology transfer, but also a sustainable industrial development with a trained cadre of indigenous specialists who can participate in additional in-country geothermal related development.

*Question.* Are there different barriers or issues for different kinds of energy technologies (efficiency, renewable, nuclear, fossil)?

*Answer.* Yes there are. In particular renewables face institutional and financing barriers based on the fact that: (a) renewable and energy efficiency projects are often relatively small both in the amount of power they produce and in terms of the amount of financing they need when compared to fossil fuel projects and hence often cannot compete for the attention of government agencies with limited manpower to conduct project reviews; (b) renewable projects are capital intensive since the initial cost includes the construction expenses, including the equipment and a lifetime supply of fuel, and this often results in higher initial costs even when total lifetime costs are competitive; (c) in developing countries fossil fuel is often subsidized and electricity costs appear to be more economical than renewable energy; (d) developing countries often lack the regulatory framework to support private renewable projects; and (e) financing barriers exist due to cumbersome and costly review and approval procedures, more suited for large projects than for smaller renewable projects.

*Question.* To what extent are U.S. energy partnerships with other countries hindered by the U.S. lack of participation in the Kyoto Protocol and its "market-based mechanisms"? Will this be a more significant problem if Kyoto enters into force?

*Answer.* ORMAT has found that many international clean energy projects have been delayed because Lesser Developed Countries (LDCs) have put off energy efficient and/or renewable energy projects until the Clean Development Mechanism (CDM) comes into force for fear that: (a) they may lose the future, and as yet undefined, benefits of the CDM; and (b) the CDM benefit may not apply if a project is unable to prove that it would not have been built were it not for the CDM.

Should the Kyoto Protocol enter into force, without U.S. participation, U.S. clean energy companies will be placed at an even greater disadvantage than they are now with respect to their European counterparts, by being denied access to CDM and not being able to take part in the Kyoto emissions trading scheme (a potential source of income from the sale of emissions allowances or credits). The end result will be a loss of U.S. jobs and with it a decrease in U.S. competitiveness.

*Question.* Are private-sector technology transfer programs more or less successful than similar Federal programs?

*Answer.* Federal programs often train people very well, who then emigrate to the U.S. or other industrial nations for better paying jobs, thus creating a "brain drain." From our perspective, private-sector technology transfers through clean energy power projects are more successful than Federal programs. In the geothermal industry, for example, the long-term operations of the power projects create well paying jobs locally, which promote future use of geothermal technology in country. There are 22 geothermal countries, including the U.S., where such opportunities have been created.

In many cases, such as Kenya and the Philippines, geothermal technology transfer has created sustainable industrial development. In the case of the Philippines, the industrial development was created by the private sector, but in the case of Kenya it was by the public sector (World Bank and UN). The advantage of the private sector is that technology transfer creates long-term sustainable relationships

leading to future exports. The addition of Federal programs to support such private-sector technology transfer can help keep trained people in place and contribute to the economic development of their country both by providing sustainable electrical power from clean indigenous resources and also by creating conditions conducive to increasing exports from the U.S. and high paying long term employment for the local population.

*Question.* What should be the proper balance of resources and activities between the public and private sectors?

*Answer.* In developing countries the standards applied to investment in the U.S. or the OECD are often not applicable. Private industry can and should assume the technology, development, and project performance risks. However the country risks, including credit worthiness, institutional barriers and exploration risks (in the case of geothermal energy), need to be supported by the public sector. This is especially true in countries with fragile economies and mixed economic systems. The balance between private and public sector resources should be applied to balance the risks so as to enable investment by the private sector in those projects, which benefit those countries where long-term U.S. interests are at stake.

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RESPONSES OF JEFFREY LOGAN AND WILLIAM CHANDLER TO QUESTIONS FROM  
SENATOR MURKOWSKI

The text below addresses questions raised by Senator Murkowski following testimony provided on 18 September 2002. In addition to the information here, readers are encouraged to see the attached document on energy efficiency centers\* in transition economies that address many of the questions in more detail. The document is also available on-line at <http://www.pnl.gov/aisu/pubs/center.pdf>.

*Question 1.* What kinds of projects have been most successful in achieving transfer of technology to other countries?

*Answer.* Successful U.S. technology transfer projects help other countries meet their economic development needs without compromising environmental quality. They allow consumers to save money on energy bills, reduce emissions of damaging local pollutants such as sulfur dioxide and particulates, and improve global energy security. These measures also reduce greenhouse gas emissions. While public funding can help lay the groundwork for effective technology transfer projects, in the end, only the private sector has the resources and incentives to address the challenge of climate change on the scale required.

Energy technology gets transferred through the market place and in conjunction with finance and investment. Thus, projects designed to facilitate private sector investment have been most successful. Experience from Battelle's Advanced International Studies Unit indicates that successful projects must address specific barriers and give in-country partners a stake in the outcome. Successful examples of technology transfer projects conducted with Battelle's assistance include "classical" energy efficiency, fuel switching, methane mitigation, district heating, combined heat and power, building codes and appliance standards, and financing facility projects.

*Question 2.* Are there different barriers or issues for different kinds of energy technologies (efficiency, renewable, nuclear, fossil)?

*Answer.* Some of the key barriers involved in technology transfer are similar across the range of energy technology types. Consumers and decision-makers in developing countries lack information on energy technologies, rendering them incapable of evaluating the most economic alternative when all costs are included. These markets often lack transparency and legal foundations so investors perceive higher risk.

Other barriers are distinct and depend on the specific technology in question. Energy efficiency markets, for example, face additional challenges in developing and transition economies. Western energy efficiency markets have evolved over decades, creating along the way the regulatory, legal, and financial infrastructure necessary to do business. This business, being decentralized and distributed in nature, requires much preparation to make it work. Market creation and market conditioning are vital for most energy efficiency technologies.

Renewable energy technologies, on the other hand, face higher barriers because they usually can't compete with traditional fossil fuel options unless full environmental costs are considered. Technological barriers, such as connecting wind turbines to local power grids, are also often specific. Nuclear power plants, which re-

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\*The document has been retained in committee files.

quire very high up-front costs, raise risk premiums and magnify normal market distortions.

*Question 3.* To what extent are U.S. energy partnerships with other countries hindered by the U.S. lack of participation in the Kyoto Protocol and its “market-based mechanisms”? Will this be a more significant problem if Kyoto enters into force?

Answer. It is too early to define how U.S. energy partnerships have been hindered by absence of the U.S. in the Kyoto Protocol, but it is likely there will be a significant impact. European commercial interests in natural gas development are turning away U.S. competition in part based on Kyoto. In Russia, U.S. coal mine methane efforts are being diverted to European interests. Key developing countries like China have already turned to Europe and Japan to collaborate on promoting the development and use of carbon-friendly technologies. U.S. energy suppliers could be cut out of markets for the next decade.

If Kyoto enters into force, the lack of U.S. participation will likely have a significant impact on energy partnerships vital to U.S. interest. (See Box 1). European countries and Japan are developing ties with the research, policy-making, and private sector communities in developing countries associated with the Kyoto Protocol, particularly the Clean Development Mechanism (CDM). In China, for example, both the Dutch and Japanese governments have funded projects that will influence how China participates in CDM and what technologies will be important to focus on. In Russia, the U.S. has set up a coal mine methane center, but it may be most useful to the Europeans now.

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Box 1.—The U.S. Stake in Global Energy Markets

<b>Economic</b> Development Energy technology exports	Supply- and demand-side technology
<b>Environmental Mitigation</b> Local air quality Regional acid rain Global warming	<b>International Security</b> More secure supplies of foreign oil Nuclear non-proliferation Political stability in developing countries
<b>U.S. Leadership</b> Energy Science	<b>U.S. Values</b> Human rights Civil society Equity, self-determination, stewardship

U.S. President's Committee on Advisors on Science and Technology, *Powerful Partnership: The Federal Role in International Cooperation on Energy Innovation* (Washington, D.C.: The White House Office of Science and Technology Policy, June 1999). available at <http://www.ostp.gov/html/P2E.pdf>.

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*Question 4.* Are private-sector technology transfer programs more or less successful than similar Federal programs?

Answer. Public and private sector technology transfer programs are often complementary. In many developing countries, markets may be too distorted for private sector investment to flow, so market transformation programs funded with Federal resources can help lower the investment risk. Federal programs can help condition the market by defining new policy measures such as energy efficiency legislation and regulation, funding feasibility studies or loan guarantee programs, and informing the public on how to evaluate appliance purchases, for example. Federal programs should be limited to helping condition the market so that all technologies can compete on a level playing field; they should not attempt to pick the technology winners.

*Question 5.* What should be the proper balance of resources and activities between the public and private sectors?

Answer. In general, public sector programs should be restricted to ensuring a level playing field and working to correct market failure. Only the private sector has the resources and incentives to address the challenge of climate change on the scale required.

In almost all developing and industrialized countries, both public and private sector participation is essential for greater penetration of carbon-friendly energy technologies. Public sector programs are essential to condition the market and inform stakeholders so that all participants make enlightened decisions. The public sector should focus mainly on leveling the playing field so that the market can pick the best technology, rather than trying to do that task itself. The exact balance between

public and private sectors will depend on specific conditions in a particular market and the speed at which technology transfer is to occur.

In some cases, the distinction between public and private sector activities is not clear. In many countries, private sector non-governmental organizations are playing an active role in addressing market distortions and failures that public bureaucracies are unable or unwilling to address. Most governments now acknowledge the important role served by these foundations and NGOs given the competing demand for resources in today's world.

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BP  
*Los Angeles, CA, October 25, 2002.*

Hon. JEFF BINGAMAN,  
*U.S. Senate, Committee on Energy and Natural Resources, Washington, DC.*

DEAR HONORABLE BINGAMAN: Thank you for the opportunity to testify before the Committee on September 18, 2002. Enclosed are the questions and answers submitted for the record. I hope the answers are satisfactory and acceptable to the Committee.

Please feel free to call me with any questions.

Respectfully yours,

SYLVIA BACA.

[Enclosure].

*Question 1.* Is it peculiar to the San Juan Basin that there is no regulation of the venting, or is that common throughout the continental U.S.?

Answer. The change that BP did on the pneumatically actuated valves of the oil & gas production separators in the San Juan Basin was a BP (Amoco) voluntary initiative as part of its participation in the U.S. EPA Natural Gas Star Program. This was not routine venting, just bleeding of natural gas when the separator valves were actuated by natural gas (mainly methane). BP switched valves and procedures to avoid this emissions seepage.

In general, standard practice used is that natural gas associated with oil production was not carefully metered if the gas had no market value and if it was not part of the production agreement. In recent years companies started to value this gas and capture it for sale. Also, current regulations on emissions from production operations vary throughout the U.S. depending on their Ozone attainment status and the respective State Implementation Plan (SIP) under the Clean Air Act—Local authorities control emissions of Volatile Organic Compounds (VOCs) from which methane is excluded (by definition) and these kind of emissions or venting might not be addressed by existing rules or practices.

*Question 2.* What kind of projects have been most successful in achieving transfer of technology to other countries?

Answer. Most successful projects are those that are done collaboratively with local authorities while engaging local academic institutions to facilitate knowledge transfer. Specifically, national and local authorities need to make the proper commitment and enable the new technologies via their strategic plans. As an example, such an approach was used by BP in its "Clean Cities" program that has brought cleaner fuels to 100 cities around the world, ahead of regulatory mandates.

*Question 3.* Are there different barriers or issues for different kinds of energy technologies (efficiency, renewable, nuclear fossil)?

Answer. The most common barriers are associated with the different level of training required, with nuclear technologies probably requiring the highest proficiency. For other energy sources cost of resources and services as well as licensing requirements could be a barrier to entry if no proper incentives are available within the framework of national strategic energy planning. In addition, issues around political instability and governance slow down the implementation of many large energy and infrastructure projects, which require long lead times and assurances of an enabling environment.

*Question 4.* To what extent are U.S. energy partnerships with other countries hindered by the U.S. lack of participation in the Kyoto Protocol and its "market-based mechanisms?"

Answer. The U.S. is viewed with suspicion and its motives are being questioned since it has withdrawn from the Kyoto Protocol and has not offered yet an alternative action plan. In a move towards sustainable energy many of the emerging global partnerships strive to demonstrate their environmental acceptability by documenting supplementary benefits from such projects. To achieve this goal these energy partnerships would like more certainty in "Carbon Risk" pricing to ensure a

stable market for carbon reduction projects. As an example, over a year ago when the U.S. was still considering the Kyoto Protocol, the GRG trading price was \$ 25/ per ton of Carbon, while now it has declined to 5/per ton, as all the U.S. emissions reductions allocations are being factored out of the emerging trading markets.

*Question 4a.* Will this be a more significant problem if Kyoto enters into force?

Answer. If the Kyoto Protocol enters into force, the U.S. will not have the ability to receive emissions reduction credits for projects it is undertaking in other countries, neither through Joint Implementation projects (with Annex 1 countries) nor through the Clean Development Mechanism (with developing countries). This might impact U.S. companies doing business abroad, since they will have to work through overseas subsidiaries in countries that ratified the Kyoto Protocol. This could result in the transfer of the emission reductions credits, created by these projects, to the emissions allocation budget of other countries.

*Question 5.* Are private sector technology transfer programs more or less successful than similar Federal programs?

Answer. Private sector technology transfer projects are successful when operated by commercial interests through their contacts in host countries and when they are tailored to local needs. Federal programs that reach out only to other national governments, without involving other stakeholders, are less efficient and are not always sustainable. Sectoral industry association can help in facilitating, collaborative activities among members in conjunction with governmental and other interested organizations.

*Question 6.* What should the proper balance of resources and activities be between the public and private sectors?

Answer. The emerging consensus following the World Summit on Sustainable Development is that implementation of projects on the ground are best done in Partnerships, where the political/national objectives are specifically spelled out, targets are clear, a governance framework is in place and all relevant stakeholders are invited to participate. What is needed from the public sector is to create the enabling framework and provide positive market signals to the private sector. The public sector can also be pivotal in funding education, research and development, establish centers of excellence to assist with knowledge transfer and retention, and provide a resource base for implementation.

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DEPARTMENT OF ENERGY,  
CONGRESSIONAL AND INTERGOVERNMENTAL AFFAIRS,  
Washington, DC, October 31, 2002.

Hon. JEFF BINGAMAN,  
*Chairman, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.*

DEAR MR. CHAIRMAN: On October 16, 2002, we sent you the edited transcript of the September 18, 2002, testimony given by Carl Michael Smith, Assistant Secretary for Fossil Energy, regarding the effectiveness and sustainability of U.S. technology transfer programs for energy efficiency, nuclear, fossil and renewable energy.

Enclosed is one of the inserts requested by you. Also, enclosed are the answers to three questions submitted by you for the hearing record.

The remaining insert and the remaining answers to questions from you and Senators Murkowski and Graham are being prepared and will be forwarded you as soon as possible.

If we can be of further assistance, please have your staff contact our Congressional Hearing Coordinator, Lillian Owen, at (202) 586-2031 or Barbara Barnes at (202) 586-6341.

Sincerely,

DAN R. BROUILLETTE,  
*Assistant Secretary.*

[Enclosures].

#### RESPONSES TO QUESTIONS FROM SENATOR BINGAMAN

##### STATEMENT REGARDING EIA'S GATHERING OF GAS FLARING DATA

*Question 4.* Regarding the testimony of Bill Trapmann on the gathering of gas flaring data by EIA from the States and the work that is currently going on as to the survey, is legislation required to implement the long term plan for collecting data (mention of a new survey w/data coming directly from domestic producers)?

Answer. EIA has collection authority under the Federal Energy Administration Act of 1974 to gather energy data, such as the production data under consideration,

from energy firms. Additional legislative authority is not needed to collect data from that source.

#### PROJECTED TIMELINE FOR EIA'S PROJECT

*Question 5.* What is the projected timeline (start and finish date) for the project that was described by Mr. Trapmann? Will DOE be ready by next summer to decide? How is the decision being structured? (I.e., who will decide and when?) In general, how are decisions on this made?

*Answer.* The project described by Mr. Trapmann is a multi-year project to improve basic natural gas production data. The exploration of data collection options and related work is scheduled to end in June 2003. According to this plan, the assessment and testing of selected data collection options would occur during the remainder of calendar year 2003. A decision to proceed with any option, to be made by the EIA Administrator, will depend on its relative merits and available resources. Public input will be a key aspect of any decision to change EIA data collection operations. Prior to any new data collection survey, EIA would invite public comment on the proposal through a Federal Register notice. The decision is expected to be made in December 2003 and would be followed in 2004 by a request for Office of Management and Budget (OMB) approval of data collection authority and reporting burden. System design and implementation would be conducted in the latter half of 2004. Data collection would start early in 2005. Only the initial feasibility study is funded at present. Subsequent project work requires multi-year funds.

The primary intent of the current phase of this EIA project was the examination of options for the collection of improved production data. However, the recent indication of greater interest in venting and flaring data can be accommodated by a shift in the workplan. The expanded scope and possible acceleration of project schedule would increase the associated costs.

#### CURRENT STATE OF GAS FLARING DATA (COLLECTION)

*Question 6.* What is the current state of gas flaring data (collection) internationally? What can be done to improve it?

*Answer.* At present, there are no international standards for gas flaring information and there is no single international data collection system for gas flaring. The Organization of Petroleum Exporting Countries (OPEC) collects gas flaring data from its 11 members. However, the information is incomplete and the quality is uncertain. At a national level, some countries around the world collect the information and release the statistics but many countries do not. In general, the current state of global gas flaring information is poor.

The data could be improved by (a) developing internationally-accepted definitions for gas flaring and (b) developing an international system for collecting and disseminating the information. In general, it helps if global systems are encouraged and developed by multinational organizations. Organizations such as the International Energy Agency, the OPEC, the United Nations and others have influence over members and can get consensus about definitions and standards. The U.S. could assist by encouraging international organizations to develop definitions for gas flaring and to develop systems for collecting and disseminating the information.

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DEPARTMENT OF ENERGY,  
CONGRESSIONAL AND INTERGOVERNMENTAL AFFAIRS,  
Washington, DC, November 6, 2002.

Hon. JEFF BINGAMAN,  
*Chairman, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.*

DEAR MR. CHAIRMAN: On September 18, 2002, Carl Michael Smith, Assistant Secretary for Fossil Energy, testified regarding the effectiveness and sustainability of U.S. technology transfer programs for energy efficiency, nuclear, fossil and renewable energy. On October 31, 2002, we sent you the answers to three questions and one insert for the record.

Enclosed are the answers to the 16 remaining questions submitted by you and Senators Graham and Murkowski.

Also enclosed is the insert that you requested. This will complete the hearing record.



If we can be of further assistance, please have your staff contact our Congressional Hearing Coordinator, Lillian Owen, at (202) 586-2031 or Barbara Barnes at (202) 586-6341.

Sincerely,

DAN R. BROUILLETTE,  
*Assistant Secretary.*

[Enclosures].

#### RESPONSES TO QUESTIONS FROM SENATOR GRAHAM

For decades the United States and other nations have relied heavily on the petroleum reserves of the Persian Gulf. There is no doubt that this dependence carries with it significant political and economic pressures. For this reason, I am interested in the fossil fuels supplies in the Western Hemisphere—which have the potential to provide the world with vast supplies [sic] of oil and natural gas.

In light of this, I am interested in any actions that the Department of Energy may be taking to develop additional energy supplies, foster transfers of technologies to other Western Hemispheric nations, and increase cooperation on energy issues among the nations in our hemisphere.

*Question 1.* What can the DOE and the federal government do to enhance energy cooperation and technology transfers in the Western Hemisphere?

Answer. The instability in the Middle East and the volatility of oil prices provide a strong reminder of the need for continuing and developing Western Hemisphere energy cooperation as a key component in strengthening U.S. energy security. The Department has been actively involved in promoting Western Hemisphere energy cooperation to this end, both bilaterally and multilaterally.

In an effort to identify initiatives that would assist in increasing the reliability and security of the U.S. energy supply, and help restore the economic vitality and viability of many of our Western Hemisphere neighbors, the Department holds regular consultations with its neighbors; initiated cooperation under several science and technology cooperative agreements, including with Brazil, Canada, Mexico, and Venezuela; and regularly hosts policy, regulatory, and technical conferences, roundtables, and seminars. Particularly over the last ten to fifteen years, such interactions have all led to significant levels of collaboration and key technological transfers between our neighbors that have advanced U.S. and regional economic and energy security objectives.

*Question 2.* How can the Department of Energy work to find ways to increase the supplies of oil and gas, indeed of all energy resources including solar and renewables, as well as energy efficiency, in Western Hemisphere countries?

Answer. Bilaterally and multilaterally, including through interactions with other U.S. agencies and international financial organizations, the Department of Energy's overall objectives have been to develop mechanisms and relationships that will provide the Department and its constituents with expanded access to their counterparts in the region, promote the development of policy and regulatory frameworks and business practices that will attract foreign investment, encourage increased energy resource development and expand bilateral and regional energy trade.

The Department also works closely with the private sector to identify opportunities in which U.S. energy firms can invest, develop, manage and/or supply technical services—including oil and gas exploration, development, and transportation—as well as equipment and technology. The Department of Energy continuously works to encourage and promote an increased U.S. commercial presence in the Hemisphere through missions to the region, consultative roundtables and dialogues with industry, the facilitation of access to senior Western Hemisphere government representatives, and advocacy for the utilization of U.S. goods and services and transparency and contract sanctity in various countries.

*Question 3.* What steps is the Department of Energy taking to help increase cooperation on energy issues among countries of the Western Hemisphere?

Answer. To promote Western Hemisphere energy cooperation and technology transfers, increase the region's energy supply, and strengthen the energy security of the hemisphere, the Department of Energy, through public and private interactions, will continue to bilaterally and multilaterally engage its neighbors at all levels. Specific activities include:

- Leading cooperation under the Hemispheric Energy Initiative (HEI), which is the energy component of the Summit of the Americas process. The HEI is comprised of energy representatives from the 34 democratically-elected nations in the Western Hemisphere. The Ministers and/or their staffs explore possible areas of cooperation and develop partnerships for sustainable energy development and use. These initiatives reflect the countries' commitment to promote

regulatory reform, technical transfers, energy efficiency, renewable energy, rural electrification, regional integration, energy security, and increased oil and gas production and trade.

- Fostering energy cooperation and communication, including under the presidentially-mandated North American Energy Working Group, to enhance North American energy trade, development and interconnections; promote regional integration; and increase North American energy security. The U.S. Department of Energy, Natural Resources Canada, and the Mexican Secretariat of Energy are the co-leads for the trilateral consultative mechanism. Activities include exploring policies, regulations and technological innovations to encourage the expansion and acceleration of resource development, especially oil and natural gas, as well as energy efficiency, renewable energy, clean power, and nuclear energy, as appropriate; fostering discussions on ways to improve cross-border interconnections; and identifying and eliminating barriers, both physical and regulatory, to optimal energy trade.
- DOE established the Hemispheric Sustainable Energy Fund at the Inter-American Development Bank (IDB), which requires DOE approval on specific projects, to help prepare and define sustainable energy projects to the point where they may receive financing from the IDB or leverage financing from other financial institutions. The Fund fosters private sector participation in clean energy development, including renewable, natural gas, and energy efficiency, in Latin America, and provides grant and equity support for private sector application of new and innovative energy technologies and techniques. Approved projects are a compressed natural gas transportation project in Peru, an electric utility demand-side management project in Dominican Republic, and an energy efficiency project with a Brazilian water utility.
- Continuing cooperation following the DOE-hosted Western Hemisphere energy regulators conference in March of 2002, which focused on the need to create, harmonize and implement transparent and stable regulatory frameworks in order to establish a favorable climate for compatible development of the hemisphere's energy sector and greater private sector investment.
- Providing financial assistance and support to a proposal submitted by Florida International University to establish a *Center for Hemispheric Energy Cooperation and Technology*. The proposed Center would help identify and implement initiatives that will increase technology transfer within the Western Hemisphere, which will result in increased production in the hemisphere.
- Continuing bilateral energy policy, regulatory and technical interactions with Canadian and Mexican officials to promote increase resource exploration and development through increased foreign investment and energy trade, and enhanced science and technology cooperation.
- Continuing to regularly meet and interact with Canadian, Mexican, and Venezuelan energy representatives through the Department's longstanding energy consultations, other bilateral mechanisms and multilateral fora.
- Cooperating with the Chilean government on developing a market for natural gas, including as an alternative fuel for the transportation sector.
- Establishing regular consultations and expanding technical cooperation and commercial opportunities with Brazil (South America's biggest and most influential country and an economic giant).
- Undertaking bilateral and multilateral consultations and establishing cooperative activities with Bolivia and Peru regarding the development of natural gas domestic and international markets.
- Supporting energy integration in Central America and the region's effort to develop stronger transmission ties and electric system integration, including through consultations that would help develop markets for U.S. firms, enhance cross-border trade and cooperation, and foster a dialogue on regulatory reform issues.
- Maintaining linkages with the Caribbean region, especially with Trinidad and Tobago (a major exporter of liquefied natural gas to the U.S.) and the Dominican Republic.

#### RESPONSES TO QUESTIONS FROM SENATOR BINGAMAN

*Question 1.* What concrete actions have the Department of Energy taken so far towards implementing the Clean Energy Initiative (CEI) announced by the Administration at the World Summit on Sustainable Development? What is the implementation plan?

*Answer.* The Department is in the process of identifying ongoing programs that contribute to the overall organizing framework of the CEI. We have also begun a

series of interagency meetings to set priorities for projects and target countries. Perhaps most importantly, we are discussing the CEI with the private sector and other governments to develop meaningful partnerships. It is our goal to identify the most useful and effective activities—for example, the gas flaring initiative—to coordinate with the private sector and foreign parties. We have drafted an Implementation Plan and expect to begin circulating the Plan to U.S. governmental and private sector entities for input and comments in October.

In addition, the Environmental Protection Agency (EPA) is moving forward with implementation of its efforts under the Clean Energy Initiative. For EPA's partnership targeting pollution from vehicles, the Agency is working with its global partners to convene an initial meeting in November to better understand current fuel specifications and vehicle technologies in key regions, develop goals, objectives, and a detailed initial work plan for the partnership, and discuss options to coordinate partnership activities. For EPA's indoor air pollution partnership, the Agency is consulting individually with each of the current and potential partners, and will soon convene a meeting of partners to begin jointly developing a plan for implementation.

*Question 2.* Is U.S. participation in the World Bank Gas Flaring Reduction Initiative covered/expected under the CEI? If so, under which of the three points would it fall?

Answer. The U.S. Government participation in the World Bank Gas Flaring Reduction Initiative would be covered under the Energy Efficiency for Sustainable Development category of the Clean Energy Initiative (CEI). The Department of Energy has the lead for this element of the CEI. A major goal of the World Bank Gas Flaring Reduction Initiative is to provide energy savings by not flaring and venting associated gas. Energy savings would result in more efficient production and supply, not wasting gas resources in association with oil production, and realizing environmental benefits.

*Question 3.* Regarding the World Bank Gas Flaring Reduction Initiative, where will the decision—as to whether or not the U.S. will sign on—be made—the Department of State, DOE or the Administration/White House? Who will make this decision? And when?

Answer. The Department of Energy (DOE) is the lead agency and is in discussions with other U.S. Government entities, including White House offices and the Department of State, regarding the nature and scope of U.S. participation. We will keep you apprised of our progress.

#### RESPONSES TO QUESTIONS FROM SENATOR MURKOWSKI

##### BARRIERS TO THE EXPORT OF CLEAN ENERGY TECHNOLOGIES

*Question 1.* What are the principal barriers to deploying existing technologies in developing countries?

Answer. The private sector has indicated that one of the greatest challenges to exporting clean energy technologies to developing and transitional economies is often the lack of the necessary energy, transparency and environmental regulatory structures needed to build capacity in partner countries, create public-private partnerships, and disseminate information. Knowledge of the benefits of clean energy technologies and the know-how to use them are also often lacking.

In addition, the private sector has indicated that one of the greatest challenges to exporting clean energy technologies comes not from U.S. government regulation, but from competition from foreign companies that receive a higher level of export promotion support from their government. For instance, in 1998, Germany spent 17 cents per thousand U.S. dollars of GDP on export promotion and France spent 16 cents. By contrast, the United States spent only half of one cent.

*Question 2.* What additional mechanisms, policies, institutions or funding are necessary in the U.S. to achieve greater success (e.g. loan guarantees for projects)? In host countries?

Answer. Consultations with private sector representatives over the past several months indicate that the U.S. private sector has identified areas where the U.S. Government can help accelerate clean energy technology. These areas include:

- assistance to developing countries in implementing a policy, legal, and regulatory framework that will be more receptive to clean energy technologies and foreign investors;
- assistance in financial packaging so that developing countries find U.S. clean energy technologies as inexpensive as alternatives being offered by competing countries;
- access to government risk-sharing partnerships in promising but uncertain markets, including financial and technical assistance;

- assistance in removing barriers to the completion of specific field projects where U.S. government intervention may enable closure; and
- participation in discussions with regard to the application of government funds in support of export promotion programs.

In many cases, the relative importance of these different areas of support may differ between larger and smaller firms.

*Question 3.* When will the 5-year plan for the Clean Energy Technology Exports (CETE) program be complete?

Answer. The CETE 5-year strategic plan is completed and has been approved by all participating agencies and OMB. It is expected that the strategic plan will shortly be transmitted to Congress.

*Question 4.* Can CETE function usefully as a single organizing program for all international technology transfer activities?

Answer. It is possible that CETE could function as a single organizing program for all international technology transfer activities because it is a senior-level, multi-agency, multi-technology partnership that combines the resources of the U.S. federal government and the capabilities of the U.S. private sector to facilitate the export of clean energy technologies abroad, but it is not certain that it can meet all the needs of the various tech transfer programs. One thing seems obvious: CETE can go a long way toward helping to organize many of these tech transfer activities.

CETE focuses on three categories of action: (1) establishing effective structures for collaboration; (2) assisting host governments in establishing the investment frameworks that will be more receptive to clean energy technologies; and (3) enhancing the competitiveness of U.S. technologies and services in international clean energy technology markets.

In response to input from industry representatives, CETE will include three major categories of program elements: (1) timely assistance to industry in solving problems with current clean energy technology projects in developing countries; one of the mechanisms used will be a Project Assistance Team; (2) "fast track" mechanisms for facilitating and assisting industry with new projects where a federal government partnership is requested, such as in financial packaging; and (3) multi-agency CETE "signature initiatives" originated by the CETE agencies, in consultation with industry and other affected parties.

CETE will be implemented by the interagency Working Group at a high level of agency leadership, which will approve CETE program activities, approve the framework for assessing program performance, commit agency support of CETE, and submit an annual report to Congress. The Working Group will be assisted by an external Federal Advisory Committee (FAC), which will advise the Working Group regarding the appropriateness of the portfolio of activities for achieving program objectives, assist in assuring effective linkages with U.S. nongovernmental partners, annually evaluate the progress of the CETE program, and produce a publicly available annual report to the Working Group.

*Question 5.* If not, how can these programs be coordinated to maximize success and reduce overlap?

Answer. As outlined in the response to Question Four, it is possible that CETE could function as a single organizing program for all international technology transfer activities because it is a senior-level, multi-agency, multi-technology partnership, but it is not certain that it can meet all the needs of the various tech transfer programs.

*Question 6.* What is the status of the 90+ clean energy partnership agreements negotiated by DOE with other countries?

Answer. These agreements are active and cooperation is ongoing. Information can be provided on a specific agreement if desired.

*Question 7.* How do these partnerships fit into broader DOE policy goals regarding technology transfer?

Answer. These agreements promote cooperation in the development and deployment of clean-energy technologies and help create receptive import markets in which these technologies can compete.

*Question 8.* What activities are generally carried out under each?

Answer. Currently the Office of Policy and International Affairs (PI) and DOE program offices participate in many clean-energy technology agreements. These agreements pertain to energy and environmental security, energy sector reforms in foreign countries, clean energy development and deployment, and nuclear security. PI serves as the primary Department of Energy (DOE) point of contact for international relations with foreign countries and international organizations and works with DOE program offices to leverage resources and organize activities that support our energy and foreign policy objectives. Examples of such agreements include:

- With China, DOE signed a Statement of Work with the Ministry of Science and Technology in China in 1998 to develop an energy efficient building demonstration project. The project will demonstrate, in part, the role that U.S. energy efficient and renewable energy technologies can play in reducing the demand for energy in China. The construction of the building has begun. Under the project, China will provide the funding for the base building, while the U.S. private sector will contribute the incremental costs due to the energy improvements.
- In India, DOE's National Renewable Energy Laboratory (NREL) has been engaged with India's Solar Research Center (SRC) since 1993. The principal objectives were to help strengthen joint U.S./India capacities for energy technology innovation, promote technologies to increase energy conservation, and promote technologies for a cleaner energy supply. Under the Memorandum of Understanding (MOU) between NREL and SRC, concluded in 2000, DOE anticipates a resumption of, and enhanced cooperation in, renewable energy development and utilization between DOE and SRC, as well as other institutions in the U.S. and in India. The MOU, together with a resumption of fossil energy cooperative projects under the bilateral Coal Advisory Group, focused primarily on R&D capacity building to address combustion and environmental issues related to coal-fired power generation such as combustion efficiency, coal cleaning, and fly ash characterization and utilization. These activities are anticipated to have a beneficial local and global environmental impact.
- DOE also is working toward the deployment of clean energy in Peru. In July 2001, Lima, Peru, inaugurated its "Clean Cities Peru" program under a bilateral agreement between DOE and Peru's Ministry of Energy and Mines. The signed Memorandum of Understanding focuses heavily on natural gas use, and includes collaboration in the areas of energy planning and analysis, natural gas markets, pricing and deregulation, distributed generation technologies using natural gas (such as fuel cells), and planning for the "Clean Cities Peru" program and the future use of natural gas in the transport sector.

*Question 9.* What is DOE doing to remove the major obstacles to encouraging the increased production of indigenous energy supplies and the more efficient use of energy throughout North America and Latin America?

Answer. Both bilaterally and multilaterally, the Department of Energy has been actively involved in promoting Western Hemisphere energy cooperation, including through policy, scientific, and technical consultations and technology demonstration and deployment activities with Brazil, Canada, Mexico, and Venezuela, to encourage the removal of barriers to increased energy production, energy efficiency, and energy trade. Through the North American Energy Working Group, which the Department of Energy co-leads with Natural Resources Canada and the Mexican Secretariat of Energy, we are working to more fully more integrate energy markets and to identify and remove barriers to increased energy production and trade. The Department is also working through public-private dialogues, including industry roundtables and advocacy activities for U.S. companies, to encourage the implementation of governmental policies and procedures that will attract increased foreign direct investment.

*Question 10.* What are DOE's plans to foster greater cooperation among the countries in the Western Hemisphere on issues relating to energy production, cooperation, technology transfer, and sustainable energy policies?

Answer. Bilaterally and multilaterally, including through interactions with other U.S. agencies and international financial organizations, the Department of Energy plans to enhance existing relationships with key countries such as Brazil, Canada, Mexico, and Venezuela, and formalize relationships with other countries on energy policy, regulatory issues, and science and technology activities to promote the implementation of sustainable energy policies and to attract foreign investment to support expanded energy production and efficient energy practices.

The Department will also continue to work closely with the private sector to identify opportunities in which U.S. energy firms can help explore and develop oil and gas resources in various Western Hemisphere countries and provide technical services to promote enhanced efficiency and to address environmental issues.