U.S.-India Partnership to Advance Clean Energy (PACE)

An initiative of the U.S.-India Energy Dialogue

A Progress Report
June 2013

USAID
FROM THE AMERICAN PEOPLE

"The relationship between the United States and India will be one of the defining partnerships of the 21st century."

- Barack Obama
The President of the United States

A Progress Report by:
The Department of Commerce (DOS), Department of Energy (DOE), Department of State (DOS), Export-Import Bank of the United States (Ex-Im), Overseas Private Investment Corporation (OPIC), U.S. Agency for International Development (USAID), and U.S. Trade and Development Agency (USTDA).

Photos courtesy of the U.S. Government Websites (or as otherwise indicated).

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U.S.-India Partnership to Advance Clean Energy (PACE)

An Initiative of the U.S.-India Energy Dialogue

The U.S.-India energy relationship is a core element of the transformed U.S.-India strategic partnership. The United States is committed to enhancing energy cooperation with India in light of the central role that energy plays in a wide range of priority issues – from climate change and energy security to energy access, economic growth, trade and investment.

The long-standing bilateral relationship on energy between the world's two largest democracies has evolved over the years - beginning with the construction of large-scale infrastructure projects dating back to the 1950s and continuing on to targeted technical assistance, and research, deployment and testing programs in recent times. In 2005, the U.S. and Indian Governments established the U.S.-India Energy Dialogue to enhance mutual energy security, promote increased energy trade and investment, and facilitate the deployment of clean energy technologies.

The U.S.-India energy cooperation was further strengthened when President Obama and Prime Minister Singh met in November 2009 and the two Governments signed a Memorandum of Understanding to Enhance Cooperation on Energy Security, Energy Efficiency, Clean Energy and Climate Change, which established the U.S.-India Partnership to Advance Clean Energy (PACE).

PACE focuses on spurring low carbon inclusive development by supporting research and deployment of clean energy. Since its launch, the program has achieved several significant milestones, including strengthening institutional and human capacity; improving the enabling environment; mobilizing financing for clean energy; and increasing awareness and understanding of new clean energy technologies. The U.S.-India energy partnership focuses on enhancing energy security and accelerating the adoption of clean energy by supporting, creating and nurturing clean energy innovations via public-private collaboration, innovative financing mechanisms and cutting-edge technologies. In the coming years, the two nations will use their collective strengths to accelerate research and deployment of clean energy, which is important not just for the U.S.-India partnership, but also for the world.

Partnership to Advance Clean Energy

PACE-R

- A Joint Clean Energy Research and Development Center (JCERDC) established in November 2010 by the U.S. Department of Energy (DOE) and Planning Commission of India to promote clean energy innovation.
- Supports R&D in three priority areas: (1) solar energy, (2) energy efficiency of buildings, and (3) second-generation biofuels.
- A five-year initiative for which DOE and the Government of India (GOI) each are making USD 25 million available (subject to appropriations). Consortia members have pledged matching funds of USD 75 million, for total public-private funding of USD 125 million.
- Lead GOI Counterparts: Planning Commission and Ministry of Science and Technology.

PACE-D

- Designed to tackle multiple clean energy deployment opportunities, including energy efficiency, renewable energy and cleaner fossil.
- Supported by seven U.S. agencies:
  - Department of Commerce (DOC)
  - Department of Energy (DOE)
  - Department of State (DOS)
  - Export Import Bank of the United States (Ex-Im)
  - Overseas Private Investment Corporation (OPIC)
  - United States Agency for International Development (USAID)
  - United States Trade and Development Agency (USTDA)
- Lead GOI Counterparts: Ministry of Power, Ministry of New and Renewable Energy and Ministry of Petroleum and Natural Gas.

Recent Highlights
Since 2012 Energy Dialogue

Nearly USD 2 billion Mobilized for Clean Energy Finance: Since PACE's inception, the seven U.S.agencies including the Department of Commerce (DOC), the Department of Energy (DOE), the Department of State (DOS), the Export-Import Bank of the United States (Ex-Im), the Overseas Private Investment Corporation (OPIC), the U.S. Agency for International Development (USAID), and the U.S. Trade and Development Agency (USTDA), have mobilized about USD 2 billion in public and private resources for clean energy projects in India.

Support to four Indian States for Institutional Strengthening: USAID, and the Ministries of Power and of New and Renewable Energy, via the PACE-D Technical Assistance Program, have identified four states - Madhya Pradesh, Rajasthan, Karnataka and Haryana - in which it will work to strengthen the institutional framework and regulatory environment. It is also supporting the institutional and capacity development of the state nodal agencies to enable them to develop and deploy more effective clean energy policies and programs.

Support for Smart Grid Development: USAID is supporting the Government of India in monitoring and implementing a USD 150 million, fourteen smart grid pilot projects that have been initiated by the Ministry of Power. At the same time, USTDA is working with the private sector to support smart grid development. It is supporting four Indian distribution utilities - Calcutta Electric Supply Corporation Limited (CESC), Bangalore Electricity Supply Company Limited (BESCOM), Reliance Infrastructure Ltd. and TATA Power Delhi Distribution Limited (TPDDL) - on smart grid studies and pilot projects.

Indian Renewable Energy and Energy Efficiency Policy Database (IREEED): DOE and Ministry of New and Renewable Energy collaborated to develop an online database of renewable energy and energy efficiency policies, regulations, and incentive programs for the benefit of project developers, businesses, and consumers. The beta version of the database is available at *www.IREEED.org.*

Energy Dialogue in September 2012: The U.S.-India Energy Dialogue Steering Committee reviewed the Working Group progress in Washington on September 28, 2012. In addition to the meetings of four working groups, DOE and the U.S. India Business Council (USIBC) organized a public-private roundtable on the "Changing Calculus of Energy Security" as well as meetings between the U.S. and Indian consortia members of the U.S.-India Joint Clean Energy Research and Development Center (JCERD).

Establishment of New Working Group under the U.S.-India Energy Dialogue: In May 2013, the U.S.and India signed a statement of principles elaborating a set of cooperative activities and creating a sixth working group under the U.S.-India Energy Dialogue to focus on Sustainable Growth.

Events and Trade Missions: The U.S. Commercial Service, Department of Commerce, participated in a green innovation finance panel at the Smart Grid Development workshop hosted by the Asian Development Bank in March 2012. Similarly, the U.S. Commercial Service facilitated the visit of the OPIC Board members to Mumbai in May 2012. Programs such as these provide an important platform for U.S. firms to learn about and capture clean energy opportunities in India. U.S. Commercial Service will also be supporting an official delegation of Government of India officials and private sector to GridWeek 2013 in October 2013 in Washington D.C.

U.S.-India Energy Dialogue

The United States and India share a rich history of energy-sector cooperation going back to the 1950s,including the launch of DOE's deep engagement with India following Secretary of Energy Hazel O'Leary's1994 Presidential Mission on Sustainable Energy and Trade. This cooperation has expanded over time, as concerns over energy security and the climate impact of carbon emissions pushed energy to the top of the U.S.-India agenda. This culminated in the launch, in May 2005, of the U.S.-India Energy Dialogue – a mechanism for cooperation designed to enhance mutual energy security, promote increased energy trade and investment, and facilitate the deployment of clean energy technologies. The governments also actively engage with the Indian and American business communities through the Dialogue to promote trade and investment in the energy sector.

Led by the U.S. Secretary of Energy and the Deputy Chairman of the Planning Commission of India, the U.S.-India Energy Dialogue is a genuine "whole-of-government" undertaking that provides a high-level platform for engagement by a diverse array of governmental bodies from both countries. Work under the Energy Dialogue is organized into six working groups – Power and Energy Efficiency, New Technology and Renewable Energy, Coal, Oil and Gas, Civil Nuclear Energy, and Sustainable Growth. PACE is implemented and monitored through this Dialogue.

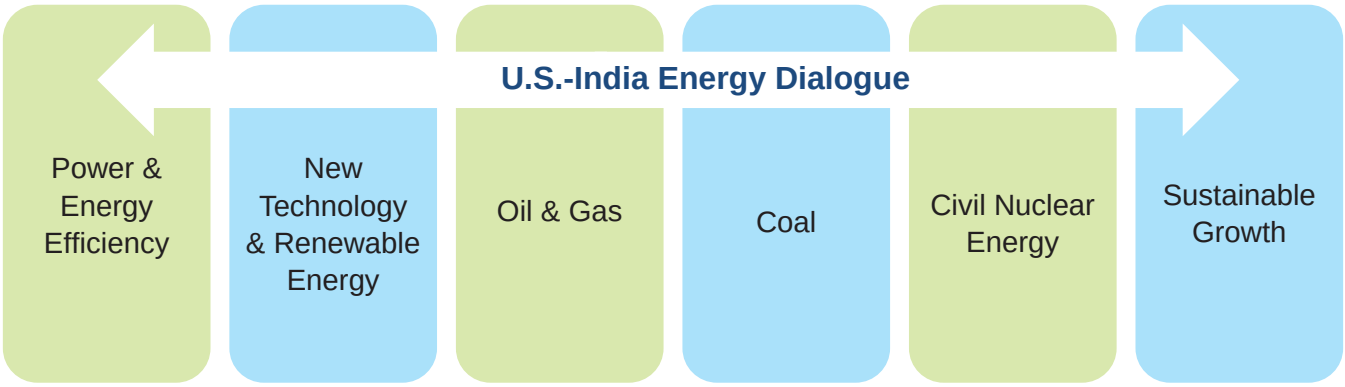
Energy Dialogue Meetings in September 2012

The Steering Committee of the U.S.-India Energy Dialogue last reviewed Working Group progress at the U.S. Department of Energy headquarters in Washington on September 28, 2012. The meeting was co-chaired by the then Energy Secretary Steven Chu and Indian Planning Commission Member for Energy B.K. Chaturvedi. In addition to four working group meetings, there were other side events such as the public-private roundtable on the "Changing Calculus of Energy Security" organized by the DOE and the U.S. India Business Council (USIBC); and meetings between U.S. and Indian consortia members of the U.S.-India Joint Clean Energy Research and Development Center. The meetings signaled a renewed commitment to enhancing co operation under the Energy Dialogue, with particular emphasis opportunity for electrical grid cooperation; expanding markets for solar and wind energy technologies; addressing barriers to clean energy deployment; energy efficiency in order to avoid more expensive supply-side investment; shale gas resource assessments and information-sharing for responsible exploration; coal technology development; and discussion of oil markets and implications for energy security.

Credit/DOE

Former U.S. Energy Secretary Steven Chu and Planning Commission of India Member B. K. Chaturvedi open the U.S.-India Energy Dialogue in September 2012.

Working Groups

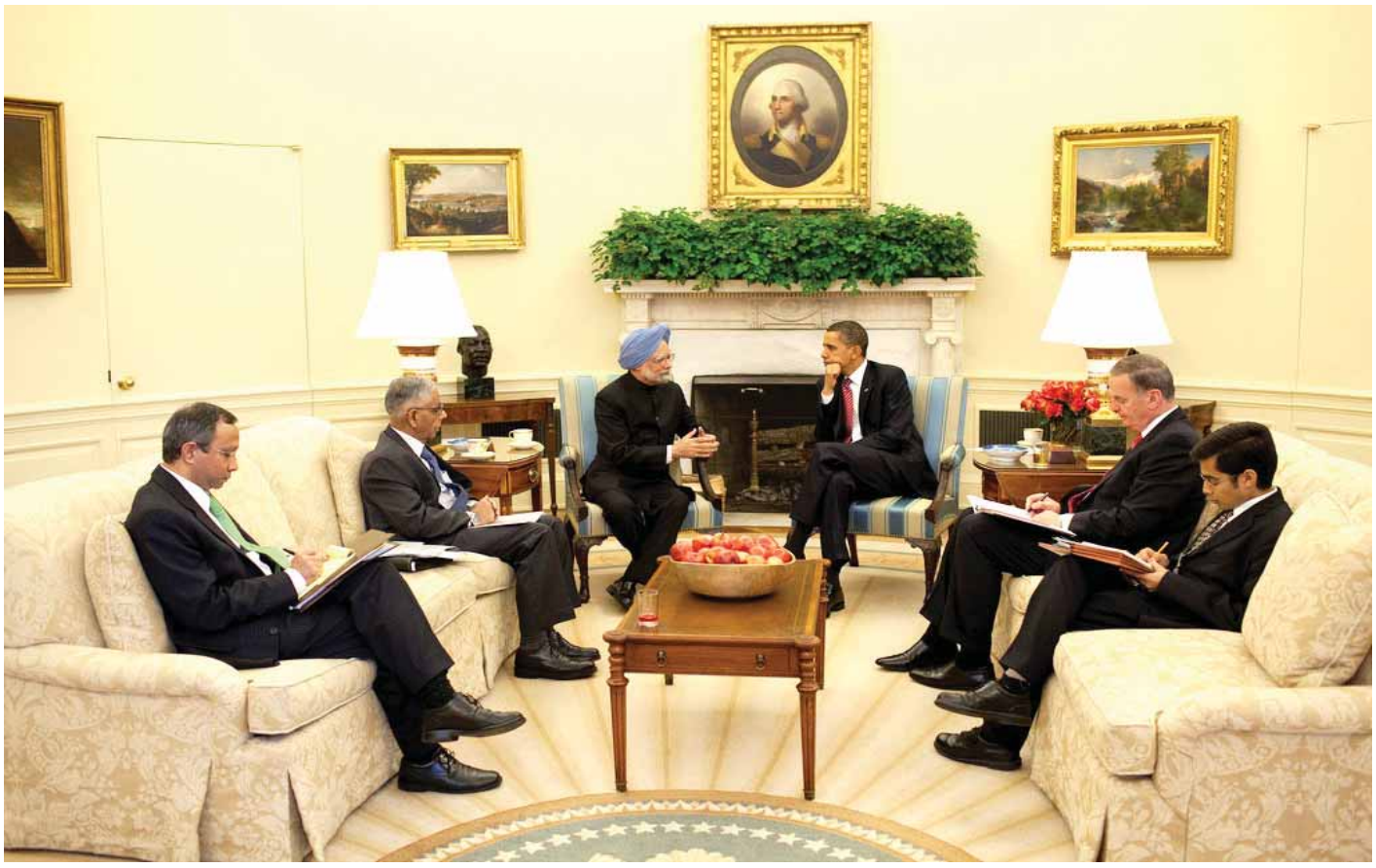


- **Power and Energy Efficiency:** The Power and Energy Efficiency Working Group is co-chaired by DOE and USAID on the U.S. side, and by the Ministry of Power on the Indian side. The broad goals of the group are to advance understanding of efficient and reliable generation, transmission, and distribution of electricity; promote the deployment of energy conservation practices to improve the efficiency of energy use; and promote trade and investment in the power and energy efficiency sectors. The group is responsible for monitoring and implementing the power and energy efficiency elements of PACE. Some notable accomplishments achieved through U.S.-India cooperation on power and energy efficiency include: reduced CO_2 per kilowatt hour of electricity generated by coal through efficient coal conversion under the USAID Green house Gas Pollution Prevention (GEP) program; creation of the Bureau of Energy Efficiency; and establishment of India's first Energy Conservation Building Code (ECBC) with support under the USAID Energy Conservation and Commercialization (ECO) project. The group's current activities cover smart grids, grid integration of renewables, demand side management, micro-grid development, supply-side efficiency from existing fossil power generation, implementation of the ECBC, buildings-to-grid collaboration, waste heat utilization, and energy efficiency technology deployment, among others.

- **New Technology and Renewable Energy:** The New Technology and Renewable Energy Working Group, co-chaired by DOE's Office of Energy Efficiency and Renewable Energy and Government of India's Ministry of New and Renewable Energy, is responsible for implementing and monitoring the renewable energy component of Partnership to Advance Clean Energy - Deployment. The Working Group is working to promote the adoption and deployment of clean energy by driving down renewable energy costs towards grid parity, decreasing uncertainty for clean energy investment, and building institutional capacity for investment and deployment. Major focus areas include solar resource assessments and tools; photovoltaic (PV) module testing and characterization; wind turbine testing and wind resource assessments; renewables-to-grid integration and off-grid renewables; state-level cooperation to strengthen the policy and regulatory framework for renewable energy deployment; and clean energy finance. Recent accomplishments include: development of a satellite-based solar map of India, demonstrating the potential resource to policy makers and developers; USD 700,000 in funding for feasibility studies for solar PV projects in India; training in solar technologies for Indian financial institutions; and training on solar radiation ground measurement and solar system analysis for government, academia, and the private sector in India.

- **Oil and Gas:** The Oil and Gas Working Group, co-chaired by DOE and India's Ministry of Petroleum and Natural Gas, aims to strengthen mutual energy security and promote increased trade and investment through a variety of collaborative activities. Accomplishments to date include development of more attractive fiscal regimes for oil, gas and coalbed methane exploration and production investments; study missions and technical assistance in refinery modernization; energy data exchanges; capacity building to strengthen offshore safety practices and oil & gas regulation; joint scientific research in methane hydrates; and cooperation that helped inform the establishment of India's strategic oil stockpile.

  Cooperation is taking on a new character with the rise of production of unconventional oil and gas in the United States and the potential for unconventional gas development in India offers important opportunities for new engagements and increased trade and investment. One example includes cooperation led by the Department of State to exchange knowledge and expertise in shale gas, including resource characterization and assessment. USAID through an interagency agreement with Commercial Law Development Program (CLDP), U.S. Department of Commerce provided technical support on legal, regulatory, and environmental aspects to the Indian Ministry of Petroleum and Natural Gas (MOPNG) to develop its shale gas resources and regulatory framework. Moving forward, the Working Group expects to build on past accomplishments and continue to engage in discussions on global market developments and on cooperative programs that will enable India to address its substantial dependence on oil and gas imports, and manage a strategic oil stockpile that will enable it to mitigate the adverse effects of potential disruptions in world oil markets. In addition, DOE and MOPNG are renewing a long-standing Memorandum of Understanding for Cooperation in Gas Hydrates, in order to enable continued information sharing and research.



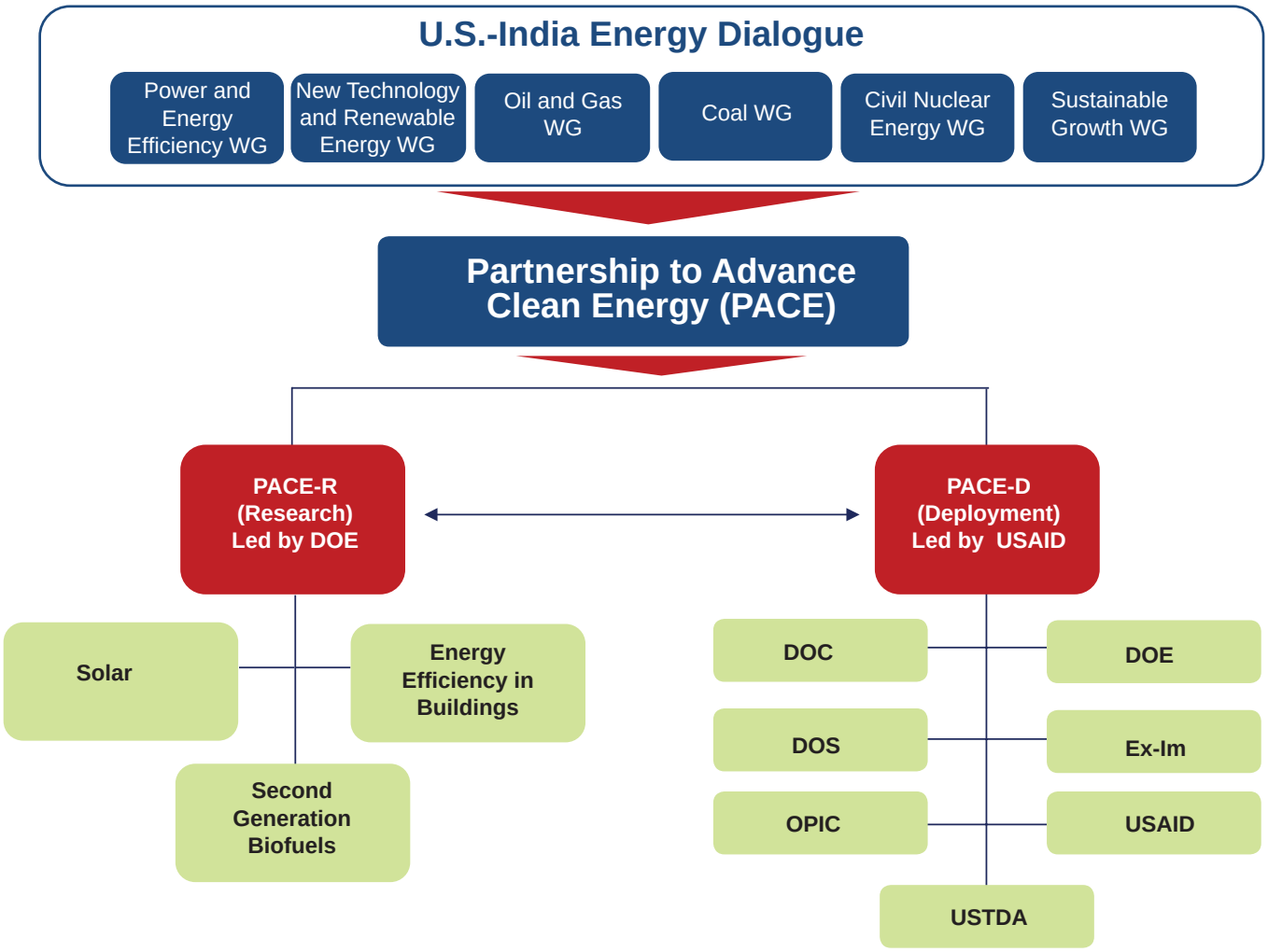
U.S. President Barack Obama and Prime Minister of India Manmohan Singh in Washington, D.C.

- **Coal:** Co-chaired by DOE's Office of Fossil Energy and India's Ministry of Coal, the Coal Working Group conducts a number of joint projects and exchanges focused on the efficient and environmentally responsible use of coal. The Working Group plays an important role in U.S.-India energy cooperation given the key role coal plays in power generation in both nations. Accomplishments include promoting the use of coal washeries and advanced coal beneficiation techniques to improve the efficiency of coal use in India; the establishment of a Coalbed Methane Clearinghouse with support by USTDA and U.S. Environmental Protection Agency; technical exchanges on improved coal mining techniques and underground coal gasification; geospatial mapping and remote sensing projects, applied to land reclamation for sustainable mining; and other activities.

  Work is ongoing to develop programs to improve mining techniques and safety, new activities related to underground coal gasification, as well as a number of other joint projects. The Working Group also focuses on promoting increased trade and investment in the coal sector and works with the private sector to identify areas of collaboration with the business community on joint activities. As part of the outcomes from the September 2012 Energy Dialogue, the Working Group is considering new areas of cooperation, including 3D Seismic Surveys and Pre-Combustion Moisture Removal of Raw Lignite.

- **Civil Nuclear Energy:** The Civil Nuclear Energy Working Group fosters exchanges between the Department of Energy and the Nuclear Regulatory Commission (NRC) and India's Department of Atomic Energy and Atomic Energy Regulatory Board on peaceful nuclear energy-related initiatives. Since 2006, the Civil Nuclear Energy Working Group has been engaging in technical and scientific discussions on nuclear energy-related initiatives, practices, research interests, regulatory oversight and the view of the role of nuclear energy in meeting global energy requirements. As part of this initiative, the two nations have been working to develop a scope for nuclear energy R&D cooperation, building upon the U.S.-India 123 Agreement, which went into effect in October 2008. The two sides are discussing possible nuclear energy R&D collaboration in a number of areas, including advanced austenitic for light water reactor applications, characterization of manufacturing defects in reactor components, constitutive modeling of austenitic and nickel-based alloys, and high-temperature reactors. The next meeting of the Working Group is scheduled to take place in Mumbai in July 2013.

- **Sustainable Growth:** The Sustainable Growth Working Group was launched in May 2013 and is co-chaired by India's Planning Commission and USAID. The areas of cooperation under this Working Group include: methodological approaches; analytical tools; data and data management systems; best practices; and options for the development and adoption of clean technologies. It will also focus on exploring detailed implementation strategies, including financing mechanisms, to mobilize private investment in this sector.



Note - WG: Working Group

U.S. Agencies: Areas of Support in Clean Energy

	DOC	DOE	DOS	Ex-Im	OPIC	USAID	USTDA
Energy Access		✓	✓			✓	✓
Renewable Energy	✓	✓	✓	✓	✓	✓	✓
Smart Grid	✓	✓	✓		✓	✓	✓
Building Efficiency		✓	✓		✓	✓	✓
Industrial Efficiency		✓	✓			✓	
Cleaner Fossil	✓	✓	✓			✓	✓
Clean Energy Finance			✓	✓	✓	✓	

Partnership to Advance Clean Energy (PACE)

As part of the U.S.-India Energy Dialogue, the two countries signed a Memorandum of Understanding on November 24, 2009, creating the Partnership to Advance Clean Energy (PACE). It is the flagship program on clean energy between the U.S. and India, and operates a jointly managed set of activities related to energy security, clean energy and climate change issues.

PACE focuses on accelerating the transition to high-performing, low-emission, and energy secure economies. It aims to bolster joint efforts to demonstrate the viability of existing clean energy technologies, as well as to identify new technologies that can increase energy access and security. PACE also focuses on engaging the private sector, local governments, industries, and other stakeholders in sharing best practices on sustainable low carbon growth. Since its inception, PACE has mobilized significant resources from both governments and the private sector to promote clean energy scale-up.

Working under auspices of the U.S.-India Energy Dialogue, PACE is an interagency effort, which combines the resources of several U.S. agencies and GOI Ministries. PACE has two components: a research component, known as PACE-R, and a deployment component, known as PACE-D.

U.S. President Obama and Prime Minister of India Manmohan Singh in the White House.

"Partnership is a key theme in the implementation of PACE-D. Together with the Government of India, we hope to capitalize on these partnerships and take these experiences to other parts of the world.

Many other countries can benefit from India's experience in moving towards a low carbon economy."

– Nancy J. Powell
Honorable Ambassador of
United States to India

PACE-D Technical Assistance Program

In July 2012, the U.S. Agency for International Development (USAID) launched a five-year technical assistance program, in partnership with India's Ministry of Power and the Ministry of New and Renewable Energy, to support clean energy deployment in India. The USD 20 million program focuses on strengthening institutional and regulatory frameworks, building capacity, and improving access to finance at the national and state levels. The focus areas of the program include:

- improving end-use energy efficiency,
- increasing renewable energy supply,
- accelerating the use of cleaner fossil technologies,
- building the capacity of technical and non-technical stakeholders, and
- facilitating financial closure of clean energy projects.

Credit/USAID

Launch of USAID PACE-D TA Program on July 31, 2012. From left to right: Mr. William Hammink, USAID/India Mission Director; Mr. Girish Pradhan, Secretary, MNRE; Ms. Nancy Powell, Honorable Ambassador of United States to India; and Ms. Jyoti Arora, Joint Secretary, MOP.

Clean Energy Finance

India's clean energy sector requires innovative financing mechanisms to sustain its growth trajectory. As part of the overall PACE initiative, the U.S. has established a Clean Energy Finance Center at the American Center in New Delhi to support the financing of clean technology. The Center identifies potential projects that require feasibility study, finance and insurance coverage and facilitates related transactions between U.S. and Indian clean energy businesses. The Center has been jointly established by USTDA, OPIC and ExIm.

Innovative Financing Mechanisms

Clean energy finance is a vital cross-cutting component under USAID's PACE-D Technical Assistance Program. A detailed analysis was undertaken to identify barriers in the financing of clean energy projects and evaluate different financing mechanisms available for energy efficiency and renewable energy. The study has made specific recommendations on innovative mechanisms for grid connected renewable energy, off-grid renewable energy and energy efficiency. These include green bonds, technical insurance products, a high net-worth individual fund and an energy savings insurance facility.

Credit/USAID

Finance workshop held on April 22, 2013 in Mumbai under the USAID PACE-D TA Program.

The TA Program has also set up advisory teams - one each for energy efficiency and renewable energy finance. These advisory teams include senior bankers, policy makers, technology experts and investors whose expertise and experience will guide the program to develop and implement the innovative financing mechanisms. The first advisory team meeting was held on April 23, 2013 in Mumbai to discuss the practicality of the different proposed financing mechanisms.

Development Credit Authority (DCA) Initiatives

Orb Energy received a six-year, 50% portable credit guarantee from USAID's Development Credit Authority (DCA) mechanism to help the company secure a loan of up to USD 4 million and prove the commercial viability of its business model. It is a revolving guarantee with an authorized amount of USD 2 million. This guarantee will support Orb Energy to reach its growth target of establishing 500 branches by 2016. Consumers will benefit from reduced spending on kerosene and diesel, while obtaining a reliable source of energy. By establishing a strong track record of successful projects, the credit guarantee will also allow Orb Energy to secure larger debt financing from local Indian commercial financial institutions in the future without a guarantee.

USAID has signed a DCA Portable Guarantee with **Northern Light Capital Group** to mobilize USD 100 million in financing for Nereus Capital. This investment can bring 300-500 MW of clean energy generation over the next five years in India. The fund will also promote off-grid renewable energy to improve access to energy for the communities that previously had limited or no access to electricity.

Insurance and Financial Products

Financing Solar Projects

In 2011, Ex-Im Bank became the first international financing institution to finance a solar-power project under the Indian government's Jawaharlal Nehru National Solar Mission to develop 20,000 megawatts of solar power by 2022.

Ex-Im Bank is today one of the largest financiers of renewable energy projects in India, with an aggregate value of over USD 350 million, supporting 289 MW of generation since January 2011. In addition, the bank has nearly USD 100 million (600 MW) of solar energy transactions in India under consideration.

Its most recent investment in the Indian clean energy sector is a USD 9 million loan to Miasolé, a California-based solar module manufacturer. Miasolé supplied thin-film solar panels to a PV project in Rajasthan which was commissioned in February 2013.

Mobilizing Investments in Clean Energy

OPIC has committed over USD 500 million, and mobilized more than USD 450 million in additional private sector capital in India's clean energy sector.

In 2012, OPIC committed USD 250 million in financing to help IDFC, India's premier infrastructure lender, expand its lending to renewable energy and infrastructure projects, providing much-needed long-term capital to the country's effort to keep pace with the sectors' massive potential. Currently, IDFC plans to use these funds to support generation activities such as wind projects. Moving forward, OPIC expects that some of the funds will be used to support energy efficiency programs, and anticipates additional projects being committed in 2013.

Its recent investments in India include ESP Urja, Applied Solar Technologies (India) Private Limited and Azure Power, among others. In addition, OPIC has provided risk insurance products to support renewable resource projects in India such as SEP Energy India Pvt. Ltd. and Azure Power.

Since PACE's inception, nearly USD 2 billion has been mobilized in public and private resources for clean energy projects in India with the collective efforts of U.S. agencies including DOC, DOE, DOS, Ex-Im, OPIC, USAID and USTDA.

Renewable Energy

India is proactively pursuing clean energy options and implementing programs at the central and the state levels to promote the use of renewable energy. India has an installed capacity of 28 GW of grid-connected renewable energy (as of March 2013) and has set an aggressive target of doubling its existing renewable energy capacity by 2017. India can leverage the experience and expertise of the U.S. in the renewable energy sector. The two countries are already jointly working on a wide array of initiatives for reliable, clean, and affordable electricity.

PACE-R Renewable Energy Consortia

Solar Energy Research Institute for India and the U.S. (SERIIUS)

A PACE-R initiative, the Solar Energy Research Institute for India and the U.S. (SERIIUS) seeks to develop a borderless environment for collaboration and research on emerging, revolutionary solar electricity technologies and work towards the long-term success of India's Jawaharlal Nehru National Solar Energy Mission and the U.S. Department of Energy (DOE) Sun Shot Initiative.

The program is currently conducting fundamental and applied research in three key areas: sustainable photovoltaic, multi-scale concentrated solar power, and solar energy integration.

The key objectives of the consortium are:

- Perform high-impact R&D, analysis, and assessment in solar technologies;
- Identify and quantify critical technical, economic, and policy issues for solar energy development and deployment in India;
- Establish collaborative project structure and joint intellectual property management;
- Cultivate effective bi-national collaboration including culture and outreach; and
- Develop a vibrant solar workforce.

The National Renewable Energy Laboratory (NREL) and Indian Institute of Science-Bangalore are the leadorganizations on this project.

Visiting Scholars Program

The Visiting Scholars Program is an exchange program co-organized by funds from SERIIUS and McDonnell Academy Global Energy and Environmental Partnership (MAGEEP). Under this program, eight students per year are provided scholarships to go on short visits through an exchange program coordinated by MAGEEP at Washington University in St. Louis. Four students from each country will receive USD 5,500 to cover travel and living expenses and will be required to stay a minimum of eight weeks at the visiting laboratory.

U.S.-India Consortium for Development of Sustainable Advanced Lignocellulosic Biofuel Systems

The Biofuels Consortium is a collaborative effort focused on second-generation biofuels R&D under the PACE-R initiative. The project focuses on sustainable feedstock cultivation and supply, biochemical conversion technologies for production of second generation biofuels with minimal environmental impact, and analysis of overall sustainability and supply chain of feedstock and biofuel.

The project is divided into three areas: feedstock development and supply, bio-refinery technologies and sustainability analysis. The objectives for feedstock development and supply program area are to improve feedstock production potential and feedstock quality using marginal lands that are drought or flood prone. Similarly research will be done on bio-refinery technologies to develop a biocatalyst for the production of butanol from switch grass hydrolysate, and to develop products from bio refinery waste streams to minimize environmental impact and maximize revenues. The sustainability analysis focuses on development of certification protocols and sustainability standards, assessment of energy requirements and emissions, and performing economic analyses. As part of this initiative, scientists from the U.S. and Indian consortia visited the Stan Mayfield Biorefinery Pilot Plant, Florida in January 2013.

The University of Florida and the Indian Institute of Chemical Technology, Hyderabad are the lead organizations on this project.

Credit/DOE

Scientists from the U.S. and Indian Consortia visiting the Stan Mayfield Biorefinery Pilot Plant, University of Florida in January 2013.

PACE-D Renewable Energy Component

Scaling up Renewable Energy in India

The renewable energy technologies component of the USAID PACE-D Technical Assistance (TA) Program is working to improve access to clean energy through scale-up of renewable energy power generation by driving down costs towards grid parity and supporting cost-effective off-grid applications. It will build capacity to design and implement supportive enabling environment, create new financial instruments, and implement renewable energy programs for faster and more cost effective deployment of renewable energy resources.

The TA Program has developed partnerships with three states - Madhya Pradesh, Rajasthan, and Karnataka - to strengthen the institutional frame work and regulatory environment at the sub-national level to increase deployment of renewable energy. It will enhance institutional capacities of the state nodal agencies and regulatory agencies to assist in strengthening the regulatory, planning and design process to accelerate the deployment of renewable energy.

USAID is supporting the establishment of an apex body for renewable energy - the Indian Energy Platform Federation (IREF) - by facilitating a partnership with American Council on Renewable Energy (ACORE). IREF aims to create a common platform for renewable energy stakeholders to collaborate, address barriers to renewable energy development in India and facilitate market transformation.

USAID, in collaboration with the Ministry of New and Renewable Energy, is working on market-driven deployment of energy storage technologies. These technologies play a crucial role in addressing the issues around the grid integration of renewable energy, peak shaving, improving the commercial viability of renewable energy projects and enhancing decentralized delivery of energy.

Clean energy finance is an integral cross-cutting component of the USAID PACE-D TA Program. The program has identified and evaluated several financial, fiscal and policy mechanisms to leverage new sources of domestic and international capital for clean energy projects in India.

Going forward, USAID will facilitate partnership between Indian regulators such as the State Electricity Regulatory Commissions and the Forum of Regulators (FOR) with regulators in the U.S. to share best practices and learning around clean energy regulations.

The program is also gearing up to work with Microfinance Institutions to develop a Micro-finance Revolving Fund to make small and medium sized investments in the community/ entrepreneurship-based renewable energy projects. The program's coordinated approach will engage policy makers, regulators, developers, financers and users, and develop plans for each of these stakeholders.

Support for Solar Deployment

Solar Photovoltaic Reliability Study: U.S. DOE's National Renewable Energy Laboratory (NREL) is collaborating with India's Solar Energy Centre (SEC) to increase understanding of performance of solar photovoltaic (PV) modules in different climatic environments over long periods of time, and to help develop testing procedures to improve product reliability. This will address issues of quality assurance and PV reliability that can otherwise slow solar technology deployment.

Feasibility Studies for Utility Scale Solar PV Projects: USTDA is supporting Astonfield Renewables Private Ltd. in its efforts to prepare the design and deployment of two solar PV power projects in India – a 5 MW plant in Bankura, West Bengal and a 45 MW plant in Phalodi, Rajasthan. The feasibility study, being carried out by CH2M Hill, aims to provide technological and economic assessments of both solar projects, and to assist Astonfield with permitting requirements and a plan for full implementation.

Solar Resource Assessment: High quality, long-term data is a vital component of solar project development. NREL is updating solar maps for India with new data obtained on aerosol optical depth from the Indian Space Research Organization. NREL, in collaboration with SEC, is analyzing model output compared to Ministry of New and Renewable Energy collected ground data to provide an indication of the model performance in the Indian environment. The goal is to improve characterization of the Indian solar resource for developers and suppliers. NREL is also incorporating the new data into an online graphing tool that allows users to do simple PV output analysis. The goal is to provide public solar data in a user-friendly format with simple analysis capabilities.

Wind Resources

Wind Turbine Testing

National Renewable Energy Laboratory (NREL) is working with India's Centre for Wind Energy Technology (C-WET) to build the technical capacity of their scientists on testing approaches used for the characterization of turbine performance and data analysis.

Under this program, NREL trained C-WET scientists on the characterization of turbine performance and loads under International Electrotechnical Commission (IEC) standards and on the analysis of test data. These tests are being applied by C-WET scientists at their facilities in Chennai, the results of which will be shared with NREL.

Advanced Wind Resource Assessment

DOE/NREL and C-WET are collaborating to enhance existing wind resource characterizations for priority areas in India, with the objective of improving wind resource estimates in India using downscaling methodologies. The first area of focus is in Uttarakhand and the second one is in Gujarat.

Energy Storage

Energy storage technologies will play a crucial role in mainstreaming and scaling renewable energy technologies as they address two key issues of renewable generation: 'fluctuating' generation and inability to 'regulate' the generation to match demand. Work on energy storage is increasing globally and all major economies have specialized focus on this area.

USAID is working with MNRE, through the PACE-D Technical Assistance Program, to develop a roadmap for development of energy storage pilot projects in the country. Under this component, the range of energy storage technology options available today is being mapped with a summary analysis of their costs, performance and maturity levels. The study also outlines the key applications and potential technology options available in the global market for deployment in India.

Renewables-Grid Integration

In collaboration with Gujarat Energy Transmission Corporation Limited (GETCO), DOE/NREL is analyzing the flexibility of existing electricity generation assets as a first step in assessing the potential for renewable penetration in the state of Gujarat. The aim is to identify strengths and opportunities for the existing grid system to incorporate increased penetration of variable renewable energy in India.

Energy Access for Inclusive Growth

Increasing energy access to the remote corners of the country is a top priority for the Indian Government. India fortunately has an abundant renewable energy resource potential that can be leveraged to address energy access issues and also ensure the economic and social upliftment of the rural population. Under PACE-D, various U.S. agencies are working closely with the Government of India and private firms to improve deployment of off-grid technologies in rural India. These initiatives include innovative business models and technologies for micro-grids, microfinance, entrepreneurship capacity building, skills training, feasibility studies, testing and certification of products, etc.

Promoting Energy Service Delivery through Micro-Grid Technologies:

- **Husk Power:** In 2009, OPIC committed a USD 750,000 loan to Husk Power for the development of 36 rice husk-powered generation facilities. The company uses rice husk, an agricultural waste available in abundance, to generate clean energy for the local populations. The firm has now installed 80 mini-power plants that serve over 200,000 people in more than 300 villages in Bihar.

- **Mera Gao**: Recipient of a USAID grant under the Development Innovation Ventures program, Mera Gao is developing micro-grids in the state of Uttar Pradesh. Through these micro-grids, this for-profit business is providing lighting and phone charging services to the “base of the pyramid” population. The services are extremely affordable, and are half the cost of kerosene. By end June 2013, less than two years after receiving its grant, Mera Gao will have reached 300 villages, and serve 8,000 families.

Solar micro-grid project by Mera Gao in a village.

Credit/Mera Gao Power

- **Solar Micro-Grid Feasibility Study:** USTDA is partially funding a feasibility study grant for Azure Power for the development of a Rural Micro-Grid Solar Power project that will be deployed in remote non-electrified villages in India. The study will assess and provide planning assistance for two 500 kilowatt photovoltaic solar pilot projects in the states of Chhattisgarh and Gujarat. Azure Power has selected U.S. firm Energy and Environmental Economics, Inc. to perform the study.

- **Gram Power**: A USAID grantee, Gram Power's vision is to provide affordable, flexible, and sustainable power to 1.2 billion of the world's poor living without reliable electricity. It has developed an integrated smart micro-grid technology that offers an innovative power management unit (PMU) in every home; distributed storage to minimize investment and losses related to centralized battery banks; and DC transmission technology to prevent theft.

- **Technical Approach for Solar Mini-Grid Development in India**: Villagers, particularly in the remote hilly areas, tend to opt for diesel generators as a faster path to electrification instead of waiting for grid infrastructure. To address this challenge, DOE/NREL collaborated with the Government of India on solar mini-grid development. It has developed a technical approach for solar mini-grid development in India, based on the electricity capacity and demand data from Leh district supplied by the Ladakh Renewable Energy Development Agency.

Supporting Development Innovation:

- **SCALE Program:** USAID provided a grant USD 200,000 to SELCO Foundation to help establish the Center for Innovation for the Poor, and a network of four clean energy laboratories across India focused on off-grid renewables. The labs will develop, test and scale approaches to address energy needs of impoverished communities across the country. This is an important example of how home-grown, Indian innovators can be supported to solve energy access challenges.

- **Simpa Networks:** Simpa has received a grant from USAID to test an innovative approach for financing solar photovoltaic home systems, in which customers incrementally pre-pay for services using mobile telephones. The grant will be utilized to scale up this approach to 12,000 households and Small and Medium Enterprises (SME) over the next two years, and evaluate the socio-economic benefits of the model.

Scaling up Energy Access Solutions through Effective Networks:

- **Country-wide Network for Energy Access and Off-grid Renewable Energy:** USAID has engaged the Council on Energy Environment & Water (CEEW) to explore the opportunities for the creation of a country-wide network for energy access and off-grid renewable energy to overcome barriers to scale. This network could consolidate the initiatives and efforts of existing networks, and provide a basket of additional services to a range of stakeholders.

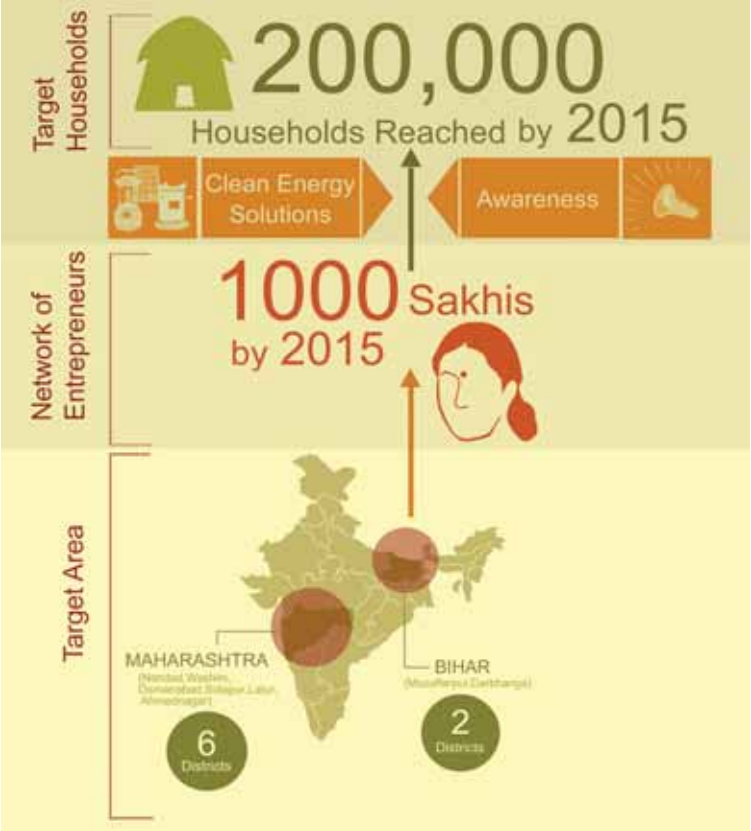
Credit/CEEW

CEEW's Roundtable Discussion on 'Countrywide Network for Off-Grid Renewable Energy and Energy Access', May 10, 2013.

- **Women's Entrepreneurship in Clean Energy (wPOWER):** USAID and Department of State's Partnership on Women's Entrepreneurship in Clean Energy (wPOWER) has a broad objective of empowering women to engage in economic growth opportunities related to clean energy.

  USAID awarded a USD 1 million grant to a local Indian organization, Swayam Shikshan Prayog (SSP), to implement wPOWER in the states of Maharashtra and Bihar from October 2012 to October 2015.

  Key components of wPOWER include developing an innovative and sustainable public-private partnership model, facilitating access to finance, training and capacity building of women entrepreneurs on business management skills and clean energy technologies, and promotion of clean energy technologies.



Credit/wPOWER/India Program

The goal of wPOWER is to empower women as entrepreneurs with practical training, business support and exposure to markets. SSP will facilitate linkages between the women entrepreneurs' network and institutional partners to co-create a win-win strategy for enhanced access to technologies, finance and new markets. A network of over one thousand women entrepreneurs is expected to provide energy access solutions to over 200,000 rural households. Learning and innovations developed and tested under the wPOWER/India will be shared with wPOWER/Africa counterparts.

Indian Renewable Energy and Energy Efficiency Policy Database (IREEED)

DOE and Ministry of New and Renewable Energy (MNRE) collaborated to develop an online database of renewable energy and energy efficiency policies, regulations, and incentive programs for the benefit of project developers, businesses, and consumers. MNRE launched the beta version of the database at the fourth Clean Energy Ministerial (CEM4) in April – available at *www.IREEED.org*. IREEED is seeking feedback on the beta version and will be making revisions through September 2013, when the finalized site will be launched.

IREEED will include: summaries of policies, regulations, and incentive programs for the central government and all states in India; a search function; links to policy and regulatory documentation; links to resources on energy efficiency and renewable energy; summary information on the most pertinent policy types, including Generation-Based Incentives and Renewable Purchase Obligations.

Energy Efficiency

Energy efficiency is the fastest, cheapest, and cleanest way to help India meet its increasing power demands. Investments in energy efficiency can help ensure that the booming growth in Indian cities, towns and villages can be made sustainable and also help meet its emission reduction targets. U.S. agencies are working with the Government of India and private sector to support smart grid development and promote energy efficiency in the buildings and industrial sector.

Smart Grid

India took its first step towards adopting smart grid technologies in 2009 when the USAID's Distribution, Reforms, Upgrades and Management (DRUM) program prepared a white paper on smart grid vision for Indian power sector and organized an international conference. This was followed by a number of similar initiatives by USAID, DOE and USTDA including supporting the development of smart grid roadmap for seven utilities, a pilot at Bangalore Electricity Supply Company (BESCOM) and a training module on Smart Grid.

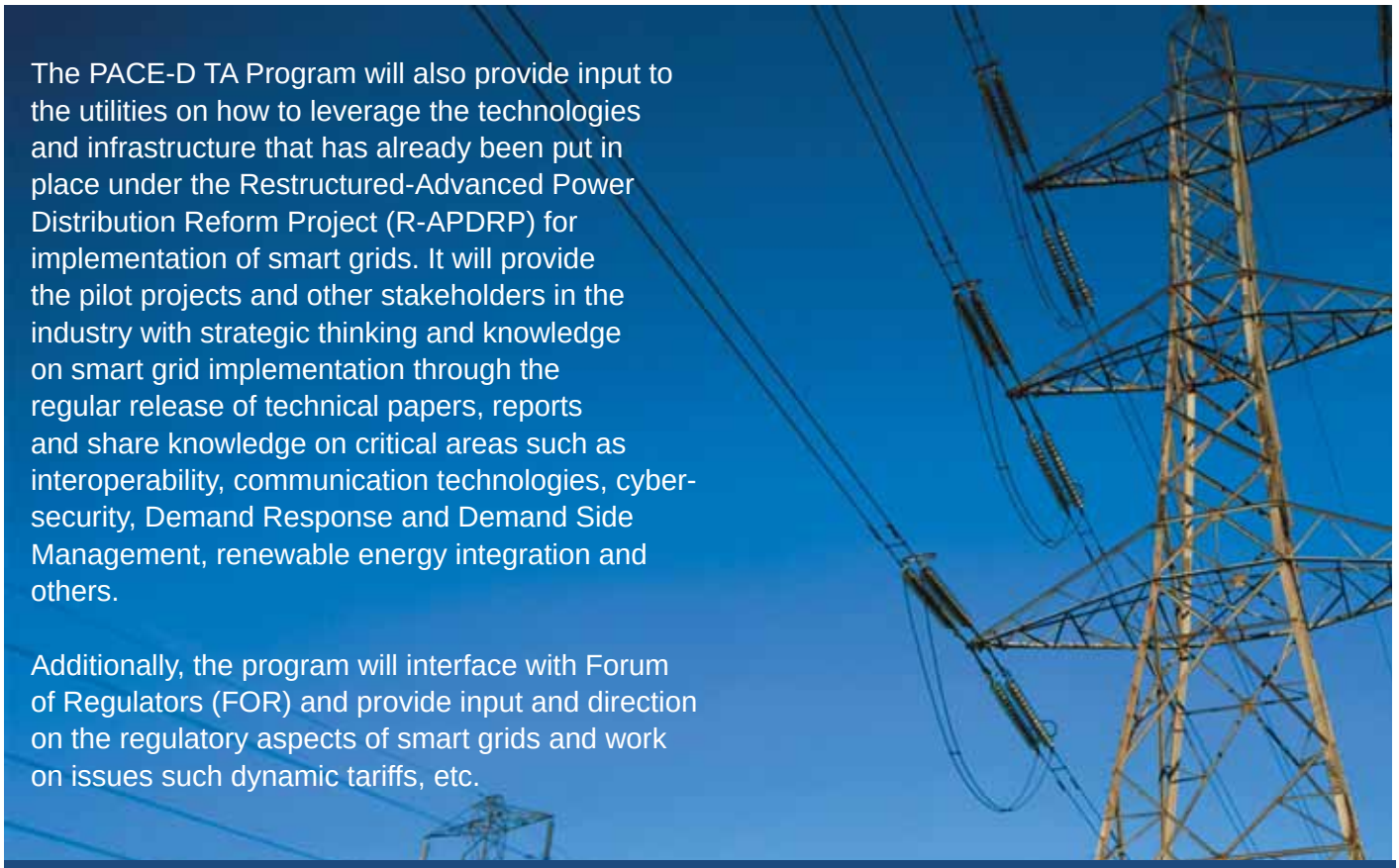
Today, the Ministry of Power has a comprehensive plan for smart grid implementation in the country and is supporting smart grid pilot implementation in 14 state-owned utilities across the country. These pilots, valued at USD 150 million, will be implemented over a period of 18 months. The Indian Smart Grid Task Force (ISGTF) is coordinating the smart grid activities on behalf of the ministry.

The pilots are jointly funded by the Ministry and the respective state utilities and will showcase various smart grid technologies such as Advanced Metering Infrastructure, Demand Response and Demand Side Management, Distribution Management System, Distributed Generation, Outage Management, Peak Load Management and Loss Reduction. The successful implementation of these pilots will provide an opportunity for the Indian power sector to leapfrog towards advanced technological and automated solutions for overcoming current challenges of distribution losses, peak demand, and integrating renewable energy resources.

Implementation Support to GOI's Smart Grid Pilot Projects

USAID's PACE-D Technical Assistance Program is assisting the ISGTF and the Ministry of Power to evaluate and monitor the implementation progress of the 14 smart grid pilots. Some of the support will include developing the technology assessment criteria, examining financial return on investments, developing new business processes, and other critical smart grid priorities.

The program will also serve as a knowledge sharing platform to disseminate pilot implementation success stories, lessons learned, technology updates and serve as a technical helpline for the pilot implementation teams. It will develop a comprehensive capacity building program for the pilots focused on effective implementation of their focus activities. It will also facilitate national and international site visits for the pilot project teams to help them visualize the benefits of operationalization of smart grid technologies. The program will also support in quantifying the benefits of smart grid implementation and assist in developing a plan for scaling up the pilot projects at a national level.



The PACE-D TA Program will also provide input to the utilities on how to leverage the technologies and infrastructure that has already been put in place under the Restructured-Advanced Power Distribution Reform Project (R-APDRP) for implementation of smart grids. It will provide the pilot projects and other stakeholders in the industry with strategic thinking and knowledge on smart grid implementation through the regular release of technical papers, reports and share knowledge on critical areas such as interoperability, communication technologies, cyber-security, Demand Response and Demand Side Management, renewable energy integration and others.

Additionally, the program will interface with Forum of Regulators (FOR) and provide input and direction on the regulatory aspects of smart grids and work on issues such dynamic tariffs, etc.

USTDA Grants for Smart Grid Development

Smart Grid Roadmap for the Calcutta Electric Supply Corporation Limited (CESC): The study, which is being performed by Tetra Tech ES, Inc., aims to develop requirements and specifications to address a range of electrical grid improvements and smart grid investments, including the integration of smart meters and automated meter reading into CESC's distribution system.

Bangalore Electricity Supply Company Limited (BESCOM): USTDA is supporting a feasibility study to develop the requirements and specifications for a smart grid implementation plan that will enable the integration of smart meters and automated meter reading into BESCOM's electricity distribution system. The study, which is being performed by KEMA, Inc., will advance BESCOM's efforts to meet the challenge of improving the efficiency and reliability of its power supply amidst a growing demand from its diverse customer base.

TATA Power Delhi Distribution Limited (TPDDL): The feasibility study is developing requirements and specifications for the implementation of smart grid technologies. TPDDL plans to improve power quality and reliability for its customers by adopting a distribution automation system and network reliability augmentation program. The study, being carried out by Quanta Technology LLC, is designed to improve the efficiency and reliability of TPDDL's one-million customer distribution system and help provide application models for other electricity distribution networks in India.

Reliance Infrastructure Limited (RIL): This feasibility study and pilot project will assess the commercial viability of and conduct a pilot on a demand side management (DSM) power system developed by Innovari, Inc. The pilot will demonstrate the use of Innovari's advanced DSM system in managing peak demand with commercial and industrial consumers in Reliance Infrastructure's Mumbai distribution operation.

Building Efficiency

Buildings account for 33 percent of the total electricity consumed in India. With an estimated 70 percent of the buildings stock projected for 2030 yet to be built, the Indian Government is working towards developing an energy-efficient building sector. It launched the Energy Conservation Building Code (ECBC) in May 2007, as a first step towards this objective. The U.S. Government has been supporting the Bureau of Energy Efficiency (BEE) in promoting its endeavor to the building efficiency sector via USAID's Energy Conservation and Commercialization (ECO) Project and the U.S. Department of Energy's various engagements at the national and state level.

PACE-R Building Energy Efficiency Consortium

BERKELEY LAB
LAWRENCE BERKELEY NATIONAL LABORATORY

U.S.–India Joint Center for Building Energy Efficiency Research and Development (CBERD)

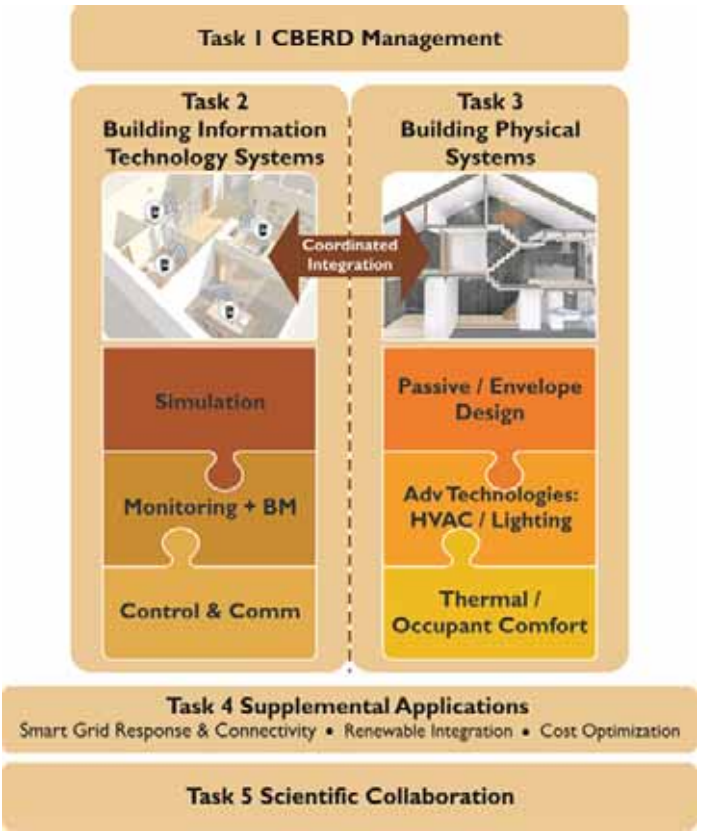
CEPT University

The U.S.-India Joint Center for Building Energy Efficiency Research and Development (CBERD), a consortium of U.S.-Indian institutions under PACE-R, is conducting collaborative research to promote clean energy innovation in building energy efficiency with measurable results and significant reduction in energy use. CBERD emphasizes the strength and expertise of both U.S. and Indian industrial participants, and the research benefits to both U.S. and Indian businesses. The outcome-based R&D will result in significant energy savings by driving development of effective technologies and their implementation across buildings, via new construction in India and retrofits in the United States.

The project strategy addresses key building energy efficiency research by focusing on two key technology areas and one application area: Building Information Technology (BIT) Systems; Building Physical Systems (BPS); and Supplemental or Crosscutting Applications. The project has already completed the framework for scientific collaboration and has initiated the academic collaboration with its R&D and institutional partners. It has created a project website (*www.cberd.org*) to keep stakeholders abreast of the latest developments.

CBERD is meeting its goals and objectives through the R&D selection that addresses the key barriers to low energy buildings to provide synergy and leverages efforts in both nations; developing a team consisting of each nation's premiere experts, and developing organizational, collaboration, and management structures that will ensure R&D success.

The Lawrence Berkeley National Laboratory (LBNL) and CEPT University, Ahmedabad are the lead organizations on this project.



PACE-D Building Energy Efficiency Component

Energy Conservation Building Code (ECBC) Implementation

USAID, via the PACE-D Technical Assistance Program, is supporting the Bureau of Energy Efficiency to promote energy efficiency in the building sector. These activities build upon BEE's past activities in the buildings sector and will be centered around the Energy Conservation Building Code (ECBC) Implementation under India's 12th Five Year Plan (2012-2017), with a strategic vision of leapfrogging the vibrant Indian green building sector towards Net Zero Energy Buildings (NZEBs).

As part of this initiative, the program is facilitating the process of the technical update of the ECBC 2007 through a consultative process. The technical update is being undertaken to reflect the changes in the market scenario, make the code more appropriate to the construction practices in India and move Indian buildings towards net-zero energy status in the future.

In addition, the program will assist BEE in ECBC implementation by supporting the development of rules and regulations for compliance, delivering training programs on ECBC and supporting the development of ECBC compliance tools.

The program will also focus on the promotion of NZEBs and low-energy heating, ventilation andair-conditioning (HVAC) systems by creating awareness, disseminating knowledge and supporting the implementation of NZEB and HVAC retrofit pilot projects in different climatic zones of India.

Artist Impression of NZEB office building of Haryana Renewable Energy Development Agency (HAREDA) in Panchkula

Credit/HAREDA

Net Zero Energy Buildings (NZEB)

USAID's PACE-D TA Program is supporting two pilot projects – Nalanda University in Bihar and Uttar Haryana Bijli Vitran Nigam Limited (UHBVNL) headquarters in Chandigarh – for NZEB demonstration. These pilot projects will demonstrate the technical feasibility of the NZEB concept and also provide the opportunity to engage stakeholders across the building value chain and disseminate information about tools, technologies, costs, performance, and measurement and verification data over a period of time. A two day international seminar on NZEB was organized on May 16-17, 2013 to create interest and disseminate knowledge about NZEB definitions, policies, and case studies that can help achieve net zero goals forbuildings in India.

Nalanda University—Net Zero Campus

One of the world's oldest known center for learning - Nalanda University (fifth century AD to 1197 AD) - is being revived in India, with international support from sixteen countries from the East Asian Summit (EAS). USAID, via its PACE-D TA Program, has signed a MOU with the Nalanda University for the development of a net zero (energy, water and waste) campus in Rajghir, Bihar. The University is located around 100 km from Patna, adjacent to the ruins of the ancient seat of learning.

Technical support is being provided under the program to develop the technical specifications and evaluation criteria for the net zero energy campus master planning and building design; and to identify experts for the net zero energy viability assessment of the international architectural design competition entries.

The program will further support the University in evaluating energy efficiency and renewable energy options for the campus, facilitate partnership with key stakeholders in the buildings industry and create awareness about Nalanda's NZE success. The University is expected to begin its academic session in 2014.

Credit/Nalanda University

Ruins of the old Nalanda University.

Credit/Nalanda University

Model of the Nalanda University Academic Block.

DOE's Energy Efficiency and Sustainable Cities Programs

DOE is working to support **Energy Conservation Building Code (ECBC) implementation** in Rajasthan and Tamil Nadu. DOE's Pacific Northwest and Brookhaven National Laboratories (PNNL), along with the Alliance to Save Energy, are collaborating with local government bodies and other stakeholders to help accelerate the successful implementation and enforcement of ECBC. PNNL designed a roadmap for ECBC implementation in Rajasthan, which has already made the code mandatory, and is in the process of implementation

Through LBNL, DOE is working with India's Infosys, Metro Valley, and GreenSpaces to improve **energy efficiency performance of exemplary Indian IT office buildings**. LBNL published a Best Practice Guide for High Performance Office Buildings in India and has completed the technical evaluation of a plug load controlling device in collaboration with Infosys and U.S. companies to identify new markets for plug-load energy efficiency. DOE is also working through LBNL to transfer U.S. best practices and foster private-public partnerships focused on improving the **energy efficiency of Indian data centers.**

DOE through LBNL has developed a **road mapping tool for improving energy intensity** and is implementing it in Pune and Jaipur to help the cities meet their carbon targets. The City Implementation Tool for Environmental Action is based on a bottom-up framework driven by macro-economic parameters that allows cities to forecast their energy and water consumption to 2030. The tool allows city governments to select and prioritize areas of energy and water savings and emissions reduction potential through appropriate efficiency interventions. LBNL helped facilitate the signature of a Memorandum of Understanding between Pune and San Jose and is now working on a similar partnership between Jaipur, Rajasthan and Fremont, California.

DOE and the World Resources Institute (WRI) launched a project that will catalyze **innovative urban development** and renewable energy in Bangalore, and establish a model for national replication. WRI will partner with large developments in Bangalore to incorporate renewable energy and adopt urban development solutions that promote energy efficient travel. The project also aims to promote energy procurement strategies at commercial and industrial companies in Bangalore in ways that build local support for sustainability and clean energy.

DOE through LBNL is also exploring opportunities for adoption of **Buildings to Grid** in India. By fostering public-private partnerships and facilitating demonstration of new technologies, DOE expects to accelerate and facilitate demand-side interactions with electricity supply to promote energy efficiency and electricity reliability.

Industrial Efficiency

Indian industries, including the power sector, account for more than 50 percent of total energy consumed in the country. This fast growing industrial sector has a unique opportunity to increase production efficiency and profitability by applying energy efficient best practices in industrial plants. The efficiency achievements in Indian industry in the recent past are impressive, but sporadic. Significant opportunity exists to scale these up across the country.

Perform, Achieve and Trade (PAT) Implementation

Under the PAT scheme, USAID's PACE-D Technical Assistance Program is supporting the Bureau of Energy Efficiency in developing the normalization protocol and monitoring and verification protocol for the two sectors that are most challenging as well as energy intensive - Sponge Iron (SI) and Pulp & Paper (P&P). The program has prepared a roadmap which details out an approach for developing the normalization approach for the SI and P&P sector.

Waste Heat Utilization

A Waste Heat Utilization (WHU) assessment study for the industrial sector was undertaken by the USAID's PACE-D TA Program. This study analyzed data from the sponge iron plants, boilers, and SME forging units in the states of Chhattisgarh, Odisha and West Bengal. The data analysis identified SI as a high potential sector for deployment of WHU technologies. The program has now started a detailed study for the SI sector which includes a WHU technology and deployment assessment analysis using data from five SI plants which will help make WHU potential projections for the enitire sector.

The TA Program is also preparing a draft report that lays out a strategy for increased market penetration of WHU technologies in the Indian industrial sector. The strategy will be prepared after review of current market penetration of high, medium and low temperature WHU technologies. The report would also include a review of global experiences on WHU policies; identifying critical success factors, challenges and barriers to wide scale deployment of WHU technologies.

Institutional Strengthening

Three states - Haryana, Karnataka and Rajasthan - have been selected for institutional support under the USAID's PACE-D TA Program to develop EE policies and programs. The focus is on enhancing and strengthening the organizational, institutional and resource capabilities of the state nodal agencies and support them to effectively develop, plan and implement the energy efficiency programs as per the central and state policies. This initiative will facilitate roll-out of EE program implementation such as ECBC and PAT and support development of smart grid at the state level.

Cleaner Fossil

U.S agencies such as USAID and DOE's National Energy Technology Laboratory (NETL) have a long history of working with the Government of India to facilitate knowledge transfer on improved operational efficiency and Renovation and Modernization of existing coal fired power plants. USAID, in partnership with DOE/NETL, set up the Center for Power Efficiency & Environmental Protection (CenPEEP) under the Greenhouse Gas Gas Pollution Prevention Program as a self-sustaining institution to promote cleaner fossil technologies in India.

CenPEEP continues to serve as a key resource to demonstrate new technologies and disseminate information on efficiency improvement and environmental performance in power plants. Building on the legacy of the previous programs, USAID, with the support from Department of State, is now working on a range of cleaner fossil activities under the PACE-D Technical Assistance Program.

Support for Shale Gas Development

Department of State and USAID, through the Commercial Law Development Program (CLDP), supported the Government of India to develop a policy and regulatory framework for shale gas. The program supported a workshop in Delhi for identifying and developing a regulatory and fiscal regime most conducive to foreign investment in exploration and production of shale gas. A study trip was also organized in January 2013 to understand the legal, regulatory and environmental aspects of shale gas exploration. The delegation included representatives from the Ministry of Petroleum and Natural Gas, Ministry of Environment and Forests and from several oil companies. Following this, a workshop on Shale Gas Implementing Regulations was organized in New Delhi in April 2013. The GOI is revising the draft shale gas policy to include potential conventional hydrocarbons regulation along with shale regulation and make a "unified policy". CLDP experts provided inputs and comments to the draft shale gas policy.

Feasibility Studies to Develop Shale Gas Resources

USTDA is supporting two feasibility studies to assess the potential for shale gas development in concession areas licensed to two Indian firms - Essar Oil Limited and Deep Industries Limited. In order to commence exploratory drilling, both companies need technical expertise to identify the best concession areas, which the study will provide. The development of shale gas would provide a much needed additional domestic energy resource to the Indian economy, which currently depends on coal and oil for more than 80 percent of its energy needs, much of which is imported.

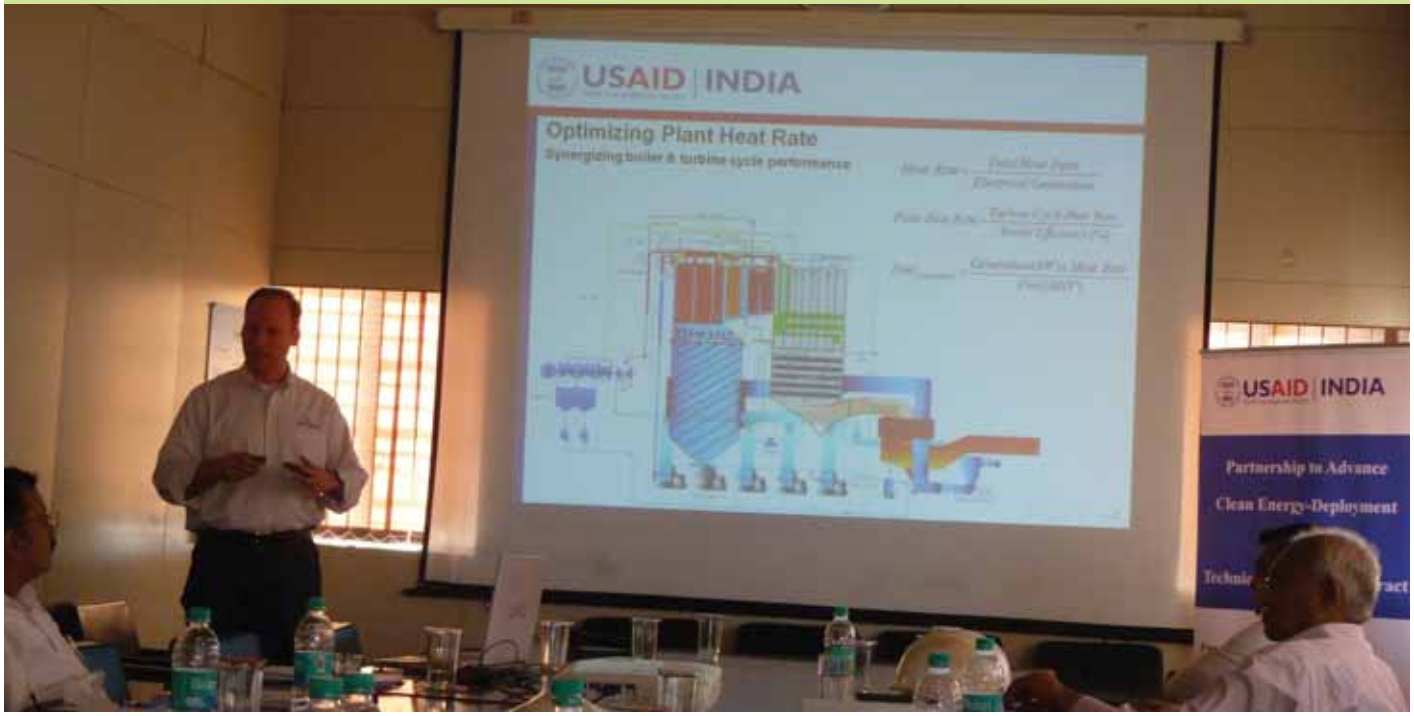
Operational Efficiency of Coal-based Power Plants

In order to reduce greenhouse gas emissions and save costs by reducing the amount of coal needed to produce electricity, USAID and NTPC, India's largest power producer, are partnering on improving the operational efficiency of a new breed of thermal power plants using supercritical technology as well as the heat rate in two state utilities under the USAID's PACE-D Technical Assistance (TA) program.

The TA Program is working on developing two reports – a Baseline Benchmarking Study and Best Practice Manual for Supercritical Technology – that will be used as a reference point and standard templates for all supercritical units planned in the country. The studies, being made with inputs drawn from operations at NTPC's Sipat Supercritical Thermal Power Plant, will specifically focus on boiler reliability and coal blending demonstration. The heat rate improvement at the two state owned utilities, Chandrapur and Panipat, are expected to be made over a period of 2-3 years, based on an implementation plan that is being prepared under the program.

The TA Program will also introduce practices and tools for optimal coal blending as India increases its use of imported coal, which must then be mixed with local coal with different characteristics. It will conduct a feasibility study focused on customizing the VISTA™ (formerly CQIM™) model to Indian conditions. Based on the study, it will also promote the use of a customized model at coal-fired utilities to save coal and reduce GHG emissions.

As a part of the program, USAID is also planning to set up a Heat Rate Alliance with Indian-U.S. power utilities, service providers, and vendors to improve operational efficiency of the coal-based thermal power plants. The Alliance will catalyze services for operational efficiency, facilitate development of a skilled workforce, promote best practice sharing, and connect service providers with vendors/suppliers. In addition, it will focus on training programs, study tours and an international conference to further enhance human resource capabilities in the sector.



Credit/USAID

Capacity Building Workshop on Heat Rate Improvement at Chandrapur, Maharashtra, March 2013.

Clean Energy Ministerial

The Clean Energy Ministerial (CEM) is a high-level global forum to: 1) promote policies and programs that advance clean energy technology, 2) share lessons learned and best practices, and 3) encourage the transition to a global clean energy economy. The high level dialogue that takes place through the CEM, as well as the technical cooperation through CEM initiatives, enhances bilateral efforts and reflects the countries'commitment to addressing global energy and climate challenges. The Government of India hosted the fourth meeting of the CEM (CEM4) in April 2013, bringing together energy ministers and other high-level delegates from the world's leading economies with Indian Prime Minister Manmohan Singh providing the opening remarks.

Credit/DOE

Inauguration of CEM4, April 17, 2013. From left to right: Montek Singh Ahluwalia, Deputy Chairman, Planning Commission of India: Manmohan Singh, Prime Minister of India and the then U.S. Energy Secretary Steven Chu.

U.S.-India collaboration takes place through six CEM initiatives:

- India and U.S. co-lead the **Super-efficient Equipment and Appliance Deployment (SEAD)** initiative, which includes a strong focus on consumer and business electricity savings through the adoption of higher efficiency standards. SEAD technical analysis informed the development of India's Super-Efficient Equipment Program (SEEP) - an innovative program to provide incentives for the production of ceiling fans that are twice as efficient as the average fans currently on the market. Once fully implemented in 2016-17, SEEP is expected to save 2 billion kilowatt-hours of electricity annually. SEAD also facilitated a technical exchange in India that resulted in the country becoming the first in the world to comprehensively regulate the performance, safety, and quality light-emitting diodes.

- India and the U.S. also co-lead the **21st Century Power Partnership** which works to advance integrated policy, regulatory, financial, and technical solutions for the deployment of renewable energy in combination with large-scale energy efficiency and smart grid solutions. At CEM4, India and the World Bank Institute launched the South-South-North Knowledge Exchange Facility that aims to facilitate learning in a number of key clean energy areas among emerging economies, while deriving relevant experience from developed countries.

Credit/DOE

Inauguration of CEM4 Innovation Showcase Pavilion, April 16, 2013. From left to right: South Africa Minister of Energy, Elizabeth Dipuo Peters, the then U.S. Energy Secretary Steven Chu and Montek Singh Ahluwalia, Deputy Chairman, Planning Commission of India.

- India actively participates in the **International Smart Grid Action Network (ISGAN)**, which works to spur the accelerated development and deployment of smarter, cleaner electricity grids. India recently co-authored two ISGAN discussion papers addressing dynamic tariff models for demand response and the role of processes, people, and policies in smart grid outcomes.

- At CEM4, the Government of India announced the first-ever database featuring national and state clean energy and energy efficiency policies and incentives in India. Developed through support from the **Clean Energy Solutions Center** and collaboration between India's Ministry of New and Renewable Energy and the U.S. Department of Energy, the Indian Renewable Energy and Energy Efficiency Policy Database disseminates renewable energy and energy efficiency policies, regulations, and incentive programs for the benefit of project developers, businesses, policy makers, and consumers.

- As members of the **Electric Vehicles Initiative (EVI)**, the U.S. and India are undertaking work to identify real-world economic and environmental benefits and costs of electric vehicles (EV) in the Indian market. India is aiming to be a leader in EV sales through its National Electric Mobility Mission Plan 2020 with a target of 6-7 million EV sales to be achieved by 2020. Work through EVI will support India's policy and technology development to achieve this plan.

- India is also highly active in the Cool Roofs and Pavements Working Group of the **Global Superior Energy Performance Partnership**. India is implementing a cool roof action plan to promote cool surface deployment in low-income housing, create workforce training and certification programs and develop a materials and product testing lab infrastructure. India's Sustainable Urban Climate Change and Energy Efficiency Development is leading the implementation.

Focus on Off-grid Renewable Energy at CEM4

A round table discussion was held on "Opportunities with Rural Mini-Grid Systems in Developing Countries" at CEM4. The roundtable was attended by key stakeholders from the GOI, private sector, non-for-profit organization, donors and U.S. government agencies.

Other Initiatives

U.S.-India Energy Cooperation Program

The U.S.-India Energy Cooperation Program (ECP) is a public-private partnership between member companies and the governments of the United States and India. Organized by the United States Trade and Development Agency (USTDA), the ECP was established at the American Chamber of Commerce in India in 2010 to leverage private sector resources in both the U.S. and India to promote the commercial development of clean energy projects and to support the sustainable development of India's energy sector. USTDA, in coordination with ECP member companies, has supported several reverse trade missions, pilot projects and feasibility studies in India. The ECP focuses on smart grid expansion, solar power generation, green buildings/energy efficiency, and unconventional gas development.

Credit/ECP

Seminar on "U.S. India Energy partnership: Emerging trends and Business Prospects" organized by ECP on March 6, 2012.

ECP is actively supporting rollout of Energy Conservation Building Code (ECBC) implementation, particularly in the states of Gujarat and Tamil Nadu.

Three ECP member companies - United Technologies, Quanta Power and Ingersoll Rand - exhibited their clean technologies at the Innovation Showcase Pavilion at the fourth Clean Energy Ministerial Meeting (CEM4) in New Delhi on April 16-18, 2013.

DOC: Role in Facilitating Partnerships

- U.S. Commercial Service, DOC participated in a green innovation finance panel at the Smart Grid Development workshop hosted by the Asian Development Bank in March 2012. This initiative focused on emphasizing CS' role in promoting the USG Trade Finance Center in New Delhi.
- U.S. Commercial Service facilitated the visit of the Members of the Board of Directors of Overseas Private Investment Corporation (OPIC) to Mumbai in May 2012. The Board Members interacted with stakeholders to learn about the existing Indian investment situation.
- U.S. Commercial Service will be supporting and participating in the U.S. Department of Commerce certified 7th Renewable Energy India (REI) Expo scheduled to be held in Greater Noida, during September 12-14, 2013.
- U.S. Commercial Service will be supporting and organizing a buyers delegation of Indian businessmen to RETECH 2013 scheduled to be held during September 9-11, 2013 in Washington, D.C. RETECH is the largest trade gathering of renewable energy sector in the U.S.
- U.S. Commercial Service will be supporting and organizing an official delegation of Indian government officials and private sector to attend GridWeek 2013 scheduled to be held during October 28-30, 2013 in Washington, D.C.

PACE-D Interagency Efforts

Azure Power Inc.: An independent power producer, Azure has one of the largest portfolios of operating solar projects in India. The firm's association with the U.S. Department of Commerce (DOC) began in January 2008 when Azure participated in a Clean Energy Technology Trade Mission organized by the U.S. Commercial Service and the office of the Market Access and Compliance.

Today, many of Azure's projects in India are financed by U.S. Government Agencies like Overseas Private Investment Corporation (OPIC) and Export-Import Bank of the United States (Ex-Im). For example, in 2010, OPIC signed an agreement with Azure Power to finance its 10 MW solar photovoltaic (PV) project in Gujarat. Similarly, its 40 MW project in Rajasthan, which was commissioned in February 2013, is financed by Ex-Im. In 2012, USTDA supported Azure Power with a feasibility study grant for the development of a "Rural Micro-Grid Solar Power" project that will be deployed in remote non-electrified villages in Chhattisgarh and Gujarat. Azure Power selected U.S. firm Energy and Environmental Economics, Inc. to perform the study, which is currently underway.

MiaSolé: U.S. Commercial Service, DOC introduced the California-based MiaSolé, a leading developer of copper indium gallium selenide (CIGS) thin-film photovoltaic solar panels, to the Indian market. The firm participated in the ministerial "Delhi International Renewable Energy Conference 2010" in New Delhi and showcased their product.

The company is today installing several projects in the states of Gujarat, Rajasthan, Tamil Nadu and Maharashtra with total capacity of more than 100 MW to be implemented in the next one year. It recently signed a solar module supply agreement with an Indian project developer, KSK Energy Ventures Limited, for 11.6 MW of CIGS thin-film modules. This project, commissioned in February 2013, is supported by Ex-Im Bank via a USD 9 million loan.

Credit/MiaSolé

11.6 MW solar farm in Rajasthan: Financed by Ex-Im, modules supplied by U.S. firm MiaSolé, and supported by U.S. Commercial Service.

"I see the future of India-U.S. partnership with confidence and optimism."

- Manmohan Singh
Honorable Prime Minister of India