U.S.-INDIA STRATEGIC CLEAN ENERGY PARTNERSHIP

RESPONSIBLE OIL AND GAS PILLAR

SEPTEMBER 2021

पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
MINISTRY OF PETROLEUM AND NATURAL GAS
Government of India

USAID FROM THE AMERICAN PEOPLE

U.S. DEPARTMENT OF ENERGY

USTDA U.S. TRADE AND DEVELOPMENT AGENCY

DFC U.S. International Development Finance Corporation

EXIM EXPORT-IMPORT BANK OF THE UNITED STATES

OUTLINE

During the April 2021 Leaders Summit on Climate, President Biden and Prime Minister Modi announced a high-level U.S.-India Climate and Clean Energy Agenda 2030 Partnership, to accelerate progress toward shared climate and clean energy goals. The Agenda 2030 Partnership includes two tracks of engagement: 1) the Strategic Clean Energy Partnership (SCEP), and 2) the Climate Action and Finance Mobilization Dialogue. The U.S.-India SCEP builds upon a longstanding bilateral energy dialogue focused on energy security and innovation. The revitalized SCEP will continue to advance energy security and innovation with greater emphasis on electrification and decarbonization of processes and end uses; scaling up emerging clean energy technologies; finding solutions for hard-to-decarbonize sectors; and deploying technical solutions. Engagement with the private sector and other stakeholders remains a priority to facilitate rapid technology deployment and create economic opportunities for both countries. The U.S. Department of Energy and Ministry of Petroleum and Natural Gas, Government of India lead overall engagement under the SCEP with robust interagency engagement on both sides.

STRATEGIC CLEAN ENERGY PARTNERSHIP PILLARS

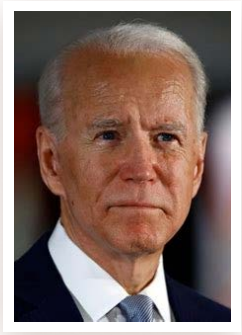
Responsible Oil and Gas Pillar

Power and Energy Efficiency Pillar

Renewable Energy Pillar

Sustainable Growth Pillar

Remarks at the Leaders Summit on Climate
(April 2021)



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"With the India-U.S. Climate and Clean Energy Agenda 2030 partnership, together we will help mobilize investments, demonstrate clean technology, and enable green collaborations."

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PILLAR OVERVIEW

Through consultations, the two sides have agreed to high-level priorities to guide the work of the pillar, noting that additional priorities can be added as needed. Priorities for the pillar are:

- Explore joint cooperation to facilitate reducing the consumption of high-polluting fuels, reducing greenhouse gas emissions, and minimizing impacts to the climate;
- Explore joint cooperation to move towards the goal of maximally abated natural gas as a cleaner alternative to coal and other fossil-based fuels for use in the industrial, transportation, and residential sectors;
- Encourage and promote investment, trade, and collaboration opportunities in the form of technology tie-ups, R&D, procurements, etc. between the companies / departments from both sides across the entire value chain;
- Explore cooperation to facilitate achieving climate goals by deploying in India carbon capture, utilization, and storage (CCUS) technology and advancing alternative fuels such as hydrogen and biofuels for transport and industry; and
- Exchange best practices for the development of India's Strategic Petroleum Reserves.

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RYAN PEAY
Acting Deputy Assistant Secretary
Oil and Natural Gas
U.S. Department of Energy

B.N. REDDY
Joint Secretary
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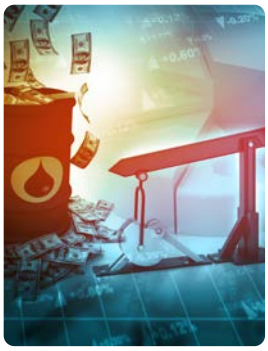

U.S.-India Low Emissions Gas Task Force (formerly the U.S.–India Gas Task Force)

The U.S.-India Low Emissions Gas Task Force, successor to the Pillar's former U.S.–India Gas Task Force, will facilitate India's vision to reduce its consumption of high-polluting fuels by increasing the use of natural gas for transportation, industrial, and residential purposes by supporting short-term and long-term clean energy transition and climate action goals. The Task Force will focus on addressing India's natural gas policy, technology, and regulatory barriers by promoting efficient and market-driven solutions aimed at meeting India's growing energy demand and greenhouse gas emissions reduction targets through its subcommittees' targeted work on GHG Emissions Abatement Technologies, Carbon Capture and Storage (CCS), Markets and Regulation, Cleaner Fuels for Industry, Cleaner Fuels for Transport, and Bio-energy, Hydrogen, and Renewable Fuels, as they intersect with India's natural gas sector.

The U.S. Department of Energy's (DOE) Safe and Resilient Clean Gas Infrastructure Technical Webinars

DOE's Safe and Resilient Clean Gas Infrastructure Technical Webinars for India's Ministry of Petroleum and Natural Gas and Indian industry will focus on DOE's balanced mix of laboratory and field-based research on methane emissions mitigation, methane emissions quantification, and modular natural gas conversion technologies.

Strategic Petroleum Reserves

DOE's Office of Petroleum Reserves and India's Strategic Petroleum Reserves Limited (ISPRL) will continue exchanges on (1) supply release and the decision process in response to an emergency; (2) operational risks and on-site emergency response; (3) operation and maintenance best practices; (4) salt cavern construction; (5) and artificial intelligence and machine learning.

Methane Hydrates

On June 4, 2021, DOE and MoPNG renewed for a five-year period their MOU concerning cooperation in gas hydrates. DOE, its National Energy Technology Laboratory (NETL), other DOE National Labs, and the U.S. Geological Survey intend to continue providing technical support for the Natural Gas Hydrate Program of India's methane hydrate exploration drilling and field production testing in India's offshore. This includes, potential cooperative efforts to conduct a Life Cycle Analysis (LCA) of economic and environmental impact of methane production from hydrates in several of India's larger known methane hydrate accumulations.

Hydrogen and Biofuels

Recently added to the Pillar are hydrogen and biofuels activities where they intersect with the Pillar's natural gas activities.

USTDA Technical Assistance and Virtual Workshops

The U.S. Trade and Development Agency (USTDA) supports feasibility studies to: evaluate and develop an implementation plan for carbon capture utilization and storage (CCUS) at an Indian Oil Corporation refinery; evaluate the development of a virtual pipeline to distribute natural gas via truck, rail, or ship to areas unserved by traditional gas pipeline infrastructure; and assess the conversion of refinery gas byproducts to ethanol for transportation fuel blending. USTDA is also providing technical assistance for India's Petroleum and Natural Gas Resources Board (PNGRB) to develop an economic basis for building out India's National Natural Gas Grid. It will also sponsor virtual workshops on energy resiliency in India with a focus on decarbonization through incorporating technologies such as carbon capture and hydrogen and renewables integration.

USAID Asia Gas Partnership Webinars

The United States Agency for International Development (USAID) has been conducting a series of technical webinars focused on best practices and global standards on the innovative development of LNG markets in South Asia and Southeast Asia under the U.S.-Asia Gas Partnership (AGP). In December 2020, a webinar focused on the key issues and prerequisites to create traded and competitive gas markets in Asia was hosted. The announcement in India's Annual Budget 2021 regarding the appointment of an independent Transmission System Operator (TSO) to manage the common carrier capacities of natural gas pipelines motivated another webinar in March 2021, on the Role of TSO in Gas in India – where learnings from global perspectives were shared. AGP plans to continue hosting these webinars focused on best practices and internationally recognized standards.

USAID Report on the Potential of LNG/Gas Cooperation in the BBINS Region

Recognizing the importance of Gas/LNG as an important constituent of the South Asia's energy basket, USAID's South Asia Regional Initiative for Energy Integration (SARI/EI) initiative has undertaken a study titled "Analytical Study to Assess the Potential of Gas/LNG for Regional Cooperation in Bangladesh, Bhutan, India, Nepal and Sri Lanka" to assess the potential for exploration, production and trade of gas in the BBINS region. The report was released in July 2021 and it highlights potential opportunities of regional cooperation. A modelling study on the economic potential of natural gas trade in South Asia is underway.

Department of Commerce Innovative and Disruptive Technologies Webinar

The Department of Commerce's International Trade Administration and India's Center of High Technology held a refinery and petrochemical webinar highlighting innovative and disruptive U.S. technologies in hydrogen, wastewater treatment and zero liquid discharge, and carbon capture, utilization, and storage (CCUS).

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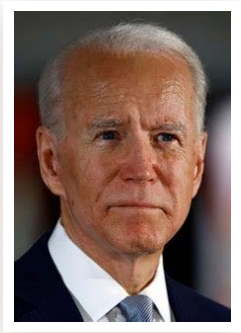

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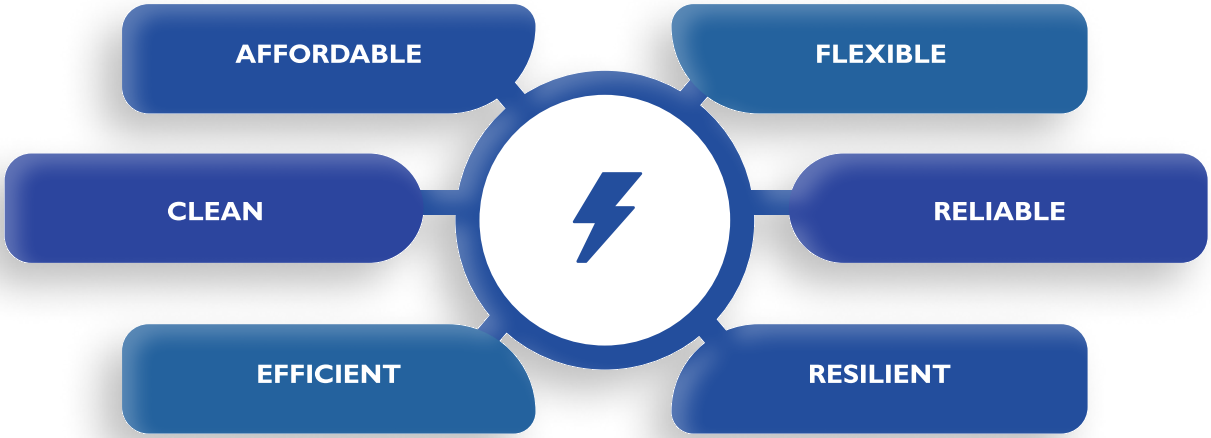
PILLAR OVERVIEW

The Power & Energy Efficiency Pillar works to improve reliability, resilience, flexibility, affordability, and sustainability of the power system. It supports reliable grid integration of the massive amounts of renewables India is seeking to install under its 450 GW goal while addressing growing energy demand. It works to strengthen and modernize grid infrastructure, including through smart grid technologies, energy storage, distributed energy resources, clean energy installation, digitization, and enhanced cybersecurity. In addition, the pillar will assess challenges and innovative opportunities for load management (e.g., from electric vehicles and grid-connected buildings). It also works to reduce emissions from thermal coal plants, including through carbon capture, utilization and storage (CCUS) technologies. The partnership aims to achieve a modern power sector that is:



The Power and Energy Efficiency Pillar has the following focus areas:

- Transforms power utilities for clean energy transition and facilitate India's power market transformation
- Supports integration of a regional power grid to enable enhanced development and deployment of renewables
- Promotes super-efficient appliances, improves energy efficiency and conservation in buildings and industries

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POWER AND ENERGY EFFICIENCY PILLAR CO-CHAIRS

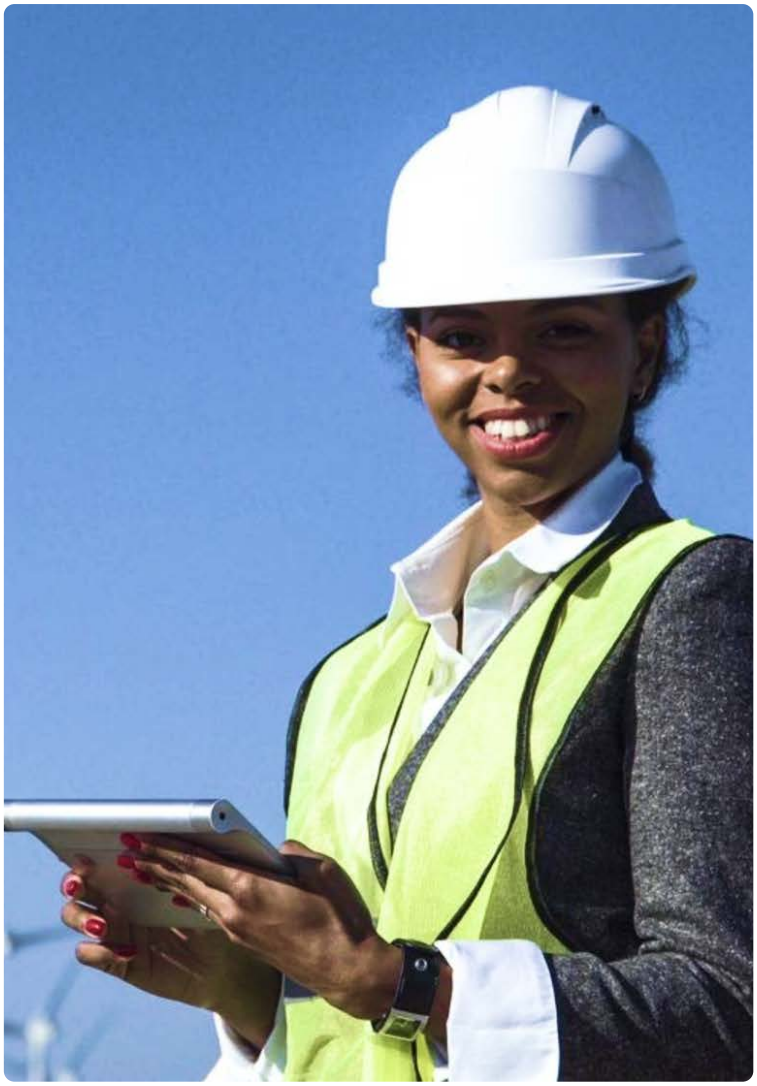
ANDREW LIGHT
Assistant Secretary
International Affairs
U.S. Department of Energy

VIVEK K DEWANGAN
Additional Secretary
Ministry of Power
Government of India

KEY ACHIEVEMENTS

- Continued advanced research on new smart grids and energy storage technologies through US-India CollAborative on Smart DiStribution System wIth STorage (UI-ASSIST), a consortium of 30 U.S. and Indian partners, for increased penetration of renewables into the grid, while providing affordable and reliable energy.
- Initiating a collaborative R&D project on CCUS that is developing essential knowledge and tools for decision-makers involved in managing emissions and permitting processes to accelerate CO2 capture projects.
- Supported development of Solar Decathlon® India, a collegiate competition to design highly efficient buildings powered by renewables. This is led by the Indian Institute for Human Settlements (IIHS) and the Alliance for an Energy Efficient Economy (AEEE).
- Developed electricity recommendations for ensuring resource adequacy to enhance grid reliability through flexible resources to meet load at minimum cost under the Flexible Resources Initiative (FRI).
- Supported BSES Rajdhani Power Limited (BRPL) to develop and pilot India's first behavioral energy efficiency program.
- Funded technical assistance for implementation of the optimal portfolio of distributed energy resources in Tata Power Delhi Distribution Limited's (TPDDL) services territory in Delhi.
- Helping BSES Yamuna Power Limited (BYPL) develop a digital technology roadmap and a platform for centralized energy data integration and more efficient distribution operations.
- Conducted workshops on standards in the EV sector under the U.S. – India Standards and Conformance Cooperation Program (SCCP).
- Showcased the value of Battery Energy Storage System (BESS) at the transmission level through a pilot in partnership with Power Grid Corporation of India Ltd.
- Developed a framework tool for distribution utilities to assess the impact of emerging technologies such as BESS, Electric Vehicles (EV), and Solar Photovoltaic (PV) on their power distribution grids.
- Developed a business case for 20 MW BESS for BRPL including a cost benefit analysis and a Detailed Project Report (DPR) in partnership with Solar Energy Corporation of India Limited (SECI).
- Piloted Automatic Generation Control (AGC) on a hydro power plant in partnership with Karnataka Power Corporation Limited (KPCL), Karnataka State Load Dispatch Centre and National Load Dispatch Centre.
- Supported Power System Operation Corporation Limited (POSOCO) on the development of National Open Access Registry (NOAR), which is an IT-based platform to automate the process of approvals for short-term access for India's power market.

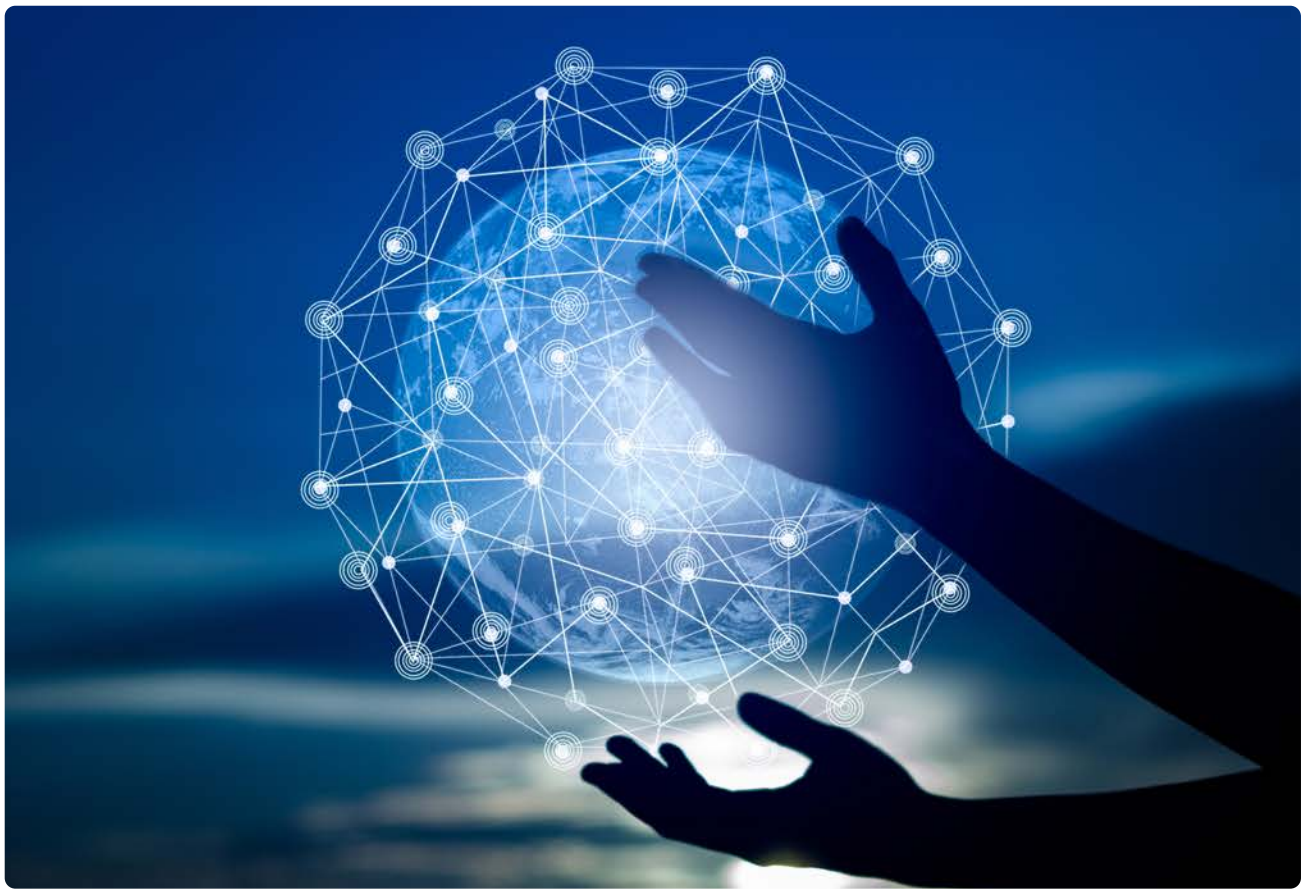
- Supported 19 states in notification of Forecasting & Scheduling and Deviation Settlement Mechanism regulations; supported implementation of Scheduling, Accounting, Metering and Settlement of Transactions in Electricity (SAMAST) Framework in eight Indian states of which SAMAST DPR of six states were approved for Power System Development Fund (PSDF).
- Supported the Central Electricity Regulatory Commission (CERC) in the redesign of the ancillary services (AS) market and draft AS regulations.
- Replicated coal flexibility pilot in partnership with the Government of Karnataka; developed detailed feasibility reports for two units of KPCL at Bellary and Raichur, and a regulatory consultation paper.
- Developed three high-quality resource material for plant operators and other stakeholders interested in flexible operation of coal. These include Minimum load/ramp test procedures for coal-based thermal power plants (TPPs), Pilot Summary Report, and Recipe book for flexibilization of coal based power plants.
- Developed an open-source interactive tool (EVOLVE — EVOlution of net-Load Variation from Emerging technologies), to help distribution utilities better understand feeder-level impacts of adding emerging technologies, such as solar PV, EVs, and BESS.
- Assessed Demand Side Management (DSM) as a tool for supporting renewable energy (RE) integration; developed an open-source modeling tool called EFFORT (EFFectiveness Of Rate sTructure for enabling demand response) that helps in modeling and designing time-of-use (TOU) tariff using optimization.
- Prepared a white paper on Development of Mechanisms to Incentivize Interstate Exchange of Renewable Energy identifying bottlenecks and recommended measures to incentivize long-term inter-state RE exchange.
- Promoted gender equality and women leaders in the energy sector through the South Asia Women in Energy (SAWIE) platform; organized the Annual SAWIE Leadership Summit and the World Sustainable Development Summit; developed a periodic mentorship program; assessed gaps and identified best practices in gender mainstreaming.
- Supported the Ministry of Power (MOP) and the National Smart Grid Mission (NSGM) in developing Standard Bidding Documents and consumer engagement guidelines for the rollout of 250 million smart prepaid meters in India – the largest such initiative in the world.
- Developed a web-based open source 'investment analysis tool' for smart investment decision making by distribution utilities for robust qualitative and quantitative assessments of financial, social, and environmental benefits of utilities modernization investments.
- Issued a report on "Power Distribution Franchisee Models in India" and the Standard Bidding Document (SBDs) for the Input based distribution franchise model (IBDF) model as part of the privatization efforts under distribution reforms of the MOP.



KEY ACHIEVEMENTS

- Developed a report on enhancing consumer centricity in the electricity distribution sector, leading to the development of a consumer index framework to assess performance of DISCOMs across quality and reliability of service and consumer service.
- Developed a white paper on establishing and operationalizing a Regional Distribution Utilities Network for power distribution companies in South Asia.
- Developed a computational toolkit and implementation framework for accelerated adoption of electric vehicles (two wheelers).
- Formally launched the 'Retrofit of Air Conditioning to Improve air quality for Safety and Efficiency' (RAISE) program in response to the COVID pandemic; successfully conducted three pilots with nearly 98% improvement in indoor Air Quality Index (AQI) compared to the outdoors.
- Supported the design of the first SuperECBC Grid Interactive Net Zero Energy buildings for Telangana government entities (TSREDCO and TSSPDCL) building in South Asia utilizing RE and responding to variations in energy use and demand.
- In partnership with the U.S. Green Building Council (USGBC), launched a whitepaper on COVID-impacts on building stakeholders and the importance of green and energy efficient strategies and technologies.
- Developed the Sustainable Public Procurement framework with a focus on Room Air Conditioners for India; launched Green Room Air Conditioners (RAC) as a new product category on Government e-Marketplace (GeM), the GOI's public procurement portal.
- Developed the National Chiller Efficiency Program (NCEEP) and implemented the first pilot of the CEEP at the Bolgatty resort in Kerala.
- Organized the seventh U.S. India Smart Grid Workshop at India Smart Utility Week 2021 sharing U.S. industry expertise in the digitization of utilities and exploring areas for technical cooperation with Indian officials, regulators, and distribution companies on smart technologies to support a clean energy transition.
- Facilitated connections between Indian government officials and U.S. companies providing innovative and disruptive technologies in the refinery and petrochemical sectors, including in alternative fuels such as hydrogen, wastewater treatment and zero liquid discharge, and carbon capture, utilization and storage.
- Developing a Clean Air Trade Mission to India to promote export opportunities in India's environmental technologies market, facilitate business matchmaking, and support India's domestic climate and environmental goals.

PRIORITIES GOING FORWARD



Looking ahead to strengthen engagement under the revitalized SCEP, the United States and India will focus on the following priorities:

- Modernize power system infrastructure and strengthen electricity systems for a more reliable, secure, efficient, affordable, and cleaner energy supply; through flexibilization and utilization of available resources, implementation of smart grids, grid integration of renewables, energy storage, distributed energy resources, ancillary services, and enhanced digitization and cybersecurity.

- Support reform of the distribution sector through new business models, increased private sector participation, incubation and deployment of smart distribution technologies, and strengthening of institutions.

- Promote energy efficiency and conservation in sectors including buildings, appliances, and industries; promote use of information and communication technologies (ICT) in energy efficiency.

- Support power market transformation and technology deployment by improving the investment climate, through improved procurement practices, ease of doing business, new business models, regulatory oversight, and private sector engagement.

- Promote industrial decarbonization in sectors like steel and cement through electrification, energy efficiency, and emerging technologies.

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RENEWABLE ENERGY PILLAR

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GOVERNMENT OF INDIA
MINISTRY OF NEW AND RENEWABLE ENERGY

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The long history of energy cooperation between the United States and India have powered lives and livelihoods. On the margins of the April 2021 Leaders Summit on Climate, President Biden and Prime Minister Modi announced the launch of a new bilateral U.S.-India Climate and Clean Energy Agenda 2030 Partnership, to advance shared climate and clean energy goals. The Agenda 2030 Partnership includes two tracks in the form of the Strategic Clean Energy Partnership (SCEP) and the Climate Action and Finance Mobilization Dialogue. The SCEP was earlier established as the Strategic Energy Partnership in 2018 and had replaced the U.S.-India Energy Dialogue, the previous intergovernmental engagement for energy cooperation. The revitalized SCEP will continue to advance energy security and innovation with greater emphasis on electrification and decarbonization of processes and end uses, scaling up emerging clean energy technologies, while finding solutions for hard-to-decarbonize sectors. Engagement with the private sector and other stakeholders will remain a priority.

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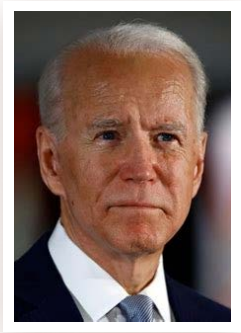

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The Strategic Clean Energy Partnership's Renewable Energy Pillar objectives are aligned to drive faster deployment of renewable energy for inclusive and resilient development, taking into account national circumstances and sustainable development priorities. The overarching goal is to enhance equitable economic development, universal energy access, and energy security in India, with broader benefits through South Asia and the Indo-Pacific region as a whole.

The Renewable Energy Pillar has the following objectives

- Supporting India to achieve 450 GW renewable energy target by 2030
- Expanding the use of distributed renewables
- Strengthening the U.S.-India relationship and improving trade ties between the two countries

THEMATIC AREAS OF THE PILLAR

Policy, Institutional and Regulatory Measures ⟷ **Demonstration, Assessment, and Tools** ⟷ **Financing Mechanisms** ⟷ **Capacity Building and Best Practices**

Cross-Cutting issues on Environment, Water, Health, and Private Sector Engagement

RENEWABLE ENERGY PILLAR CO-CHAIRS

ANJALI KAUR

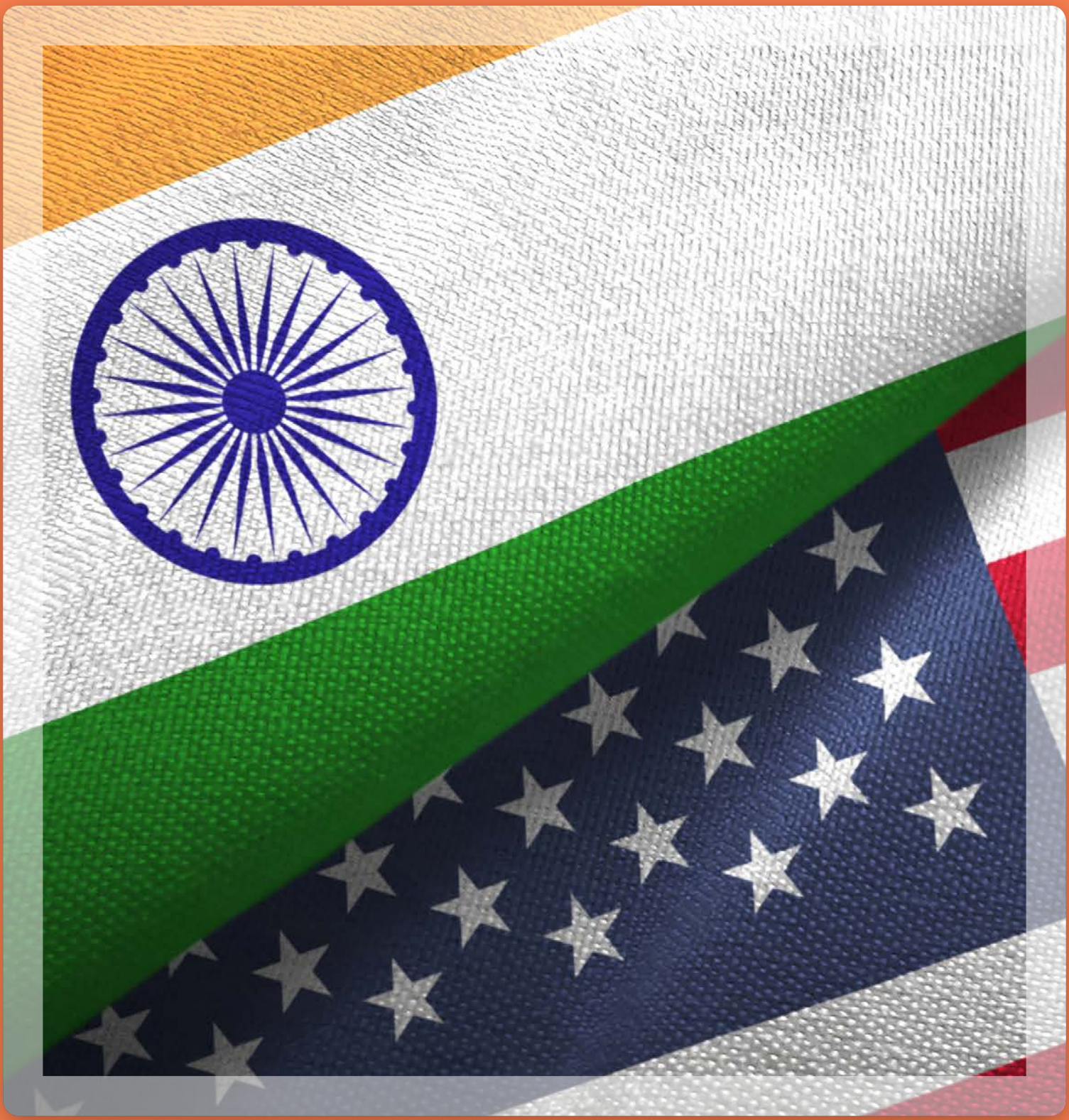
Deputy Assistant Administrator
Asia Bureau
USAID

DINESH JAGDALE

Joint Secretary
Ministry of New and Renewable Energy
Government of India

KEY ACHIEVEMENTS

- Pioneered the Renewable Energy Procurement Optimization and Smart Estimation (REPOSE) software to enable distribution utilities to forecast medium and long-term demand and better plan renewable energy resources
- Using REPOSE, demonstrated Renewable Energy uptake by up to five times, for Jharkhand and Assam while reducing costs by 8-10%. Expanded the use of the REPOSE tool to five more Indian states
- Developed model regulations on resource planning and presented it to the Technical Committee of the Forum of Regulators
- Supported the State of Jharkhand's largest power distribution utility to adopt a Super Renewable Energy Services Company business model on solar rooftops for low-paying domestic customers and launched a 25 MW pilot based on the model
- Established a market-based, dynamic 'Vendor Rating Program' with CII-GBC to improve the quality and safety of solar rooftops installations
- Developed the green time-of-day tariff concept as a win-win cost-reduction strategy for power distribution utilities and customers
- Supported the Indian Railways in developing round-the-clock tender to procure 150 MW of green power
- Supported POSOCO in developing the National Open Access Registry to automate the approval process for short-term access to the power market and bring efficiencies in market operations
- Supported 19 Indian states to notify regulations on Forecasting and Scheduling, and Deviation Settlement Mechanism to support renewable energy integration
- Supported Central Electricity Regulatory Commission in redesigning the ancillary services market, which culminated into the draft Ancillary Services regulations to help power market reforms
- Scaled flexible operations of the thermal power units in the State of Karnataka, taking the total capacity supported to 2120 MW for Renewable Energy integration
- Demonstrated viability of battery energy storage systems as modern grid assets for renewable integration. Exhibited the use of Automatic Generation Control on hydro-power plants demonstrating diversified techniques for grid integration
- Developed three open-source tools for distribution utilities – 1) assess the impact of emerging distributed technologies; 2) time-of-use tariff design; and 3) interactive dashboard to aggregate feeder impacts of distributed technologies
- Trained 2300+ professionals on grid integration, strategic Renewable Energy planning, distributed technologies, and system-friendly procurement
- Established a $41 million credit guarantee with Indian financial institutions for clean energy for small and medium enterprises in India
- Committed $415 million in U.S. Development Finance Corporation loans for five solar energy projects of 850 megawatts capacity
- Established $10 million of insurance for a private solar developer for the installation, maintenance, and sales of power to commercial clients from rooftop solar panels
- Launched partnership between the U.S. National Laboratories and the Ministry of New and Renewable Energy institutes under the South Asia Group for Energy on wind energy forecasting, sustainable bioenergy farming, and biomass cookstove testing facilities
- Supported the development of the Bio-Urja Portal and helped draft standard bidding guidelines for waste to energy projects
- Launched the U.S.-India public-private Hydrogen Task Force to study policy options, and recommend measures to scale up hydrogen technologies and reduce deployment cost
- Supported a feasibility study for a private energy developer to evaluate the viability of a 300 MW wind and solar hybrid power plant with integrated energy storage in the state of Gujarat.



SUCCESS STORIES *2020-21*

U.S.-INDIA STRATEGIC ENERGY PARTNERSHIP
RENEWABLE ENERGY PILLAR

Vendor Rating System for Solar Rooftop Installations to Accelerate Distributed Photovoltaic Market Growth in India

Technicians Inspect Rooftop Solar Panels in India

USAID collaborated with the Confederation of Indian Industry - Sohrabji Godrej Green Business Center (CII-GBC) to improve the quality and safety of solar rooftop design, procurement, and installation through predefined standards in the project cycle. With USAID's support, CII-GBC established a market-based, dynamic 'Vendor Rating Program' (VRF) for benchmarking various rooftop solar engineering, procurement, and construction companies on a uniform set of performance parameters, setting component quality and installation excellence standards. A pilot test of the rating framework was carried out in the state of Gujarat where ten vendors participated. This framework helps institutional and domestic customers make an informed choice of the vendors selected for solar PV systems, and facilitates faster financing decisions by banks. The VRF is scalable to other Asian countries, with similar quality and safety issues.

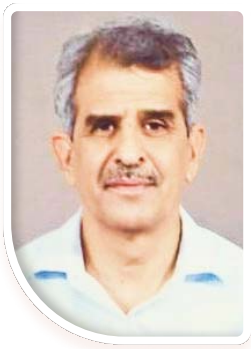
Super RESCO Model to Accelerate Solar Rooftop Adoption

To enhance the engagement of low-paying residential consumers in the solar rooftop journey using demand aggregation concept, USAID-MNRE's bilateral PACE-D 2.0 RE program designed an innovative Super RESCO model, and launched a 25 MW pilot in partnership with Jharkhand Bijli Vitran Nigam Limited (JBVNL), the State of Jharkhand's largest distribution utility. If scaled nationally, this model has the potential to save $800 million annually if 15% of power supplied to residential customers with high (>22%) transmission and distribution losses is replaced with solar rooftops. It can also enable 134,099 new job creation, and reduce carbon emission by 37,494 million tons per year.

This is a representational image used in PACE-D 2.0 RE publications

REPOSE Tool to Help reduce Power Procurement Cost for Distribution Utilities

In its second phase, USAID's Partnership to Advance Clean Energy Deployment (PACE-D 2.0 RE) worked closely with the Ministry of New and Renewable Energy, Government of India, to indigenously design and develop the Renewable Energy Procurement Optimization and Smart Estimation (REPOSE) software tool for power distribution companies (DISCOMs). This software accurately estimates consumers' electricity needs, matches demand with a power portfolio that integrates higher levels of Renewable Energy (RE) and maximizes cost-effective RE procurements. REPOSE demonstrated strategies to increase the RE uptake up to five times while reducing costs by 8-10% for Jharkhand and Assam states. The tool adoption is now expanded to the Indian states of Punjab, Orissa, Tamil Nadu, West Bengal, and Karnataka. Through the project, model regulations on resource planning have been developed and presented to the Technical Committee of the Forum of Regulators. Considering the replication potential in India and South Asia, the program conducted the first of its kind structured online certification program engaging utilities, academic institutions, and regulatory bodies from Bangladesh, Bhutan, India, Nepal, Sri Lanka and the Maldives, on resource planning and use of REPOSE.



"We greatly value our partnerships. And among all the partnerships we have, the USAID partnership stands out in terms of technical usefulness, which will support us in this journey to meet a very ambitious target."

Indu Shekhar Chaturvedi
Secretary MNRE
at the closing ceremony of the PACE-D 2.0 RE program

Supporting Indian Railways in Achieving its Decarbonization Goals

The Indian Railways is the largest rail network in Asia

Working closely with the Indian Railways and Railway Energy Management Company Limited (REMCL), USAID supported the conceptualization and design of round-the-clock (RTC) RE procurement. The work entailed conceptualizing RTC in the context of Indian Railway's traction power requirements; developing concept notes, collecting data from Haryana, Madhya Pradesh, and Rajasthan; technical and financial modelling to optimize the levelized cost of energy (LCOE), and the design of a full procurement package for a 150 MW RTC tender. This work will help the Indian Railways meet its ambitious Green Railways goal of net-zero emission by 2030 including complete electrification by 2023 and 20 GW installed solar power by 2030. The PACE-D 2.0 RE program also supported the Kolkata Metro in developing battery specifications for enhanced tunnel ventilation.

Green Time-of-Day Tariff to enable Increased Renewable Energy Consumption

Green Time-of-Day Tariff to enable Increased Renewable Energy Consumption PACE-D 2.0 RE program in partnership with the Assam and Jharkhand states developed the concept of the green time-of-day tariff (Green ToD) to help utilities effectively manage the system demand and encourage higher use of RE by the consumers during the high RE generation periods. The green ToD tariff or green power subscription, enables a shift from demand peak to supply peak by providing the necessary pricing signals to the consumers, and generating new demands for clean electricity. Analysis suggests that a modest green ToD tariff that is 10% lower than the normal tariff can result in a demand shift of 4% and generation of 0.6% new demand at the national level. The green ToD tariff can be used by states that have surplus power during the high RE generation periods, but have relatively lower demand at the same time. In collaboration with the Indian Institute of Technology, Roorkee, a one-day capacity building program on Green ToD was hosted, to secure feedback on the concept and deliberate on its applicability and adoption in Indian states.

Supporting India's Power Market Reforms

In June 2020, Central Electricity Regulatory Commission (CERC), India's central regulator introduced the real-time market (RTM) for power trading, paving the way for a more efficient electricity market and smoother integration of renewable energy. The establishment of RTM is a critical milestone in India's power sector reforms roadmap to drive the country's shift from primarily long-term generation contracts to shorter-term contracts and electricity spot markets. The growing volume in the real-time electricity market has shown its acceptance by generators, distribution utilities, and industrial consumers as a last mile resort to address imbalances in real-time. As India's long-standing partner in the reform agenda, USAID through its GTG-RISE Initiative assisted CERC in this endeavour. In parallel, USAID supported POSOCO in the implementation of the National Open Access Registry (NOAR), an IT based platform that helped reduce the duration of market transactions from the current three manual hours to 30-minutes. In addition, USAID through the GTG-RISE initiative supported CERC in the redesign of the ancillary services market through review, analysis, and simulations of various ancillary products. The program also assisted CERC in preparing the draft of the ancillary service regulations which is currently accepting public comment. These market reforms are key milestones in India's rapid strides in modernization of power systems, building a resilient power sector and integrating markets with other South Asian countries.

Empowering Indian States in RE Grid Integration

Picture Courtesy: GTG-RISE Initiative

Go Live event of AGC at the Shravanthi Hydro Plant in Karnataka

USAID supported the State Electricity Regulatory Commissions (SERC) through the Forum of Regulators (FOR) in preparing regulations to improve forecasting and scheduling (F&S) accuracy of renewable generation to support grid stability and reduce commercial losses related to forecasting deviations. The support also covered developing regulations for settling Deviation Settlement Mechanism (DSM) to incentivize RE deployment. In total, 19 states have been supported in development and notification of F&S and DSM regulations. Additionally, through the GTG-RISE initiative, USAID in 2020 supported the implementation of the Scheduling, Accounting, Metering, and Settlement of Transactions in Electricity (SAMAST) Framework in eight Indian states, taking the total number of states supported to 15 over the past few years. Currently, detailed project reports of SAMAST in 14 Indian states have been approved for the Power System Development Fund (PSDF).

Enhancing Flexible Generation for RE Integration

USAID's work on flexible operation of coal-based power plants was scaled in the State of Karnataka making a total of 2120 MW of Indian coal capacity flexible. Based on USAID's pilot projects, three high-quality publications titled - (1) Recipe Book for Flexibilization, (2) Minimum load/ramp test procedures, and (3) Pilot Summary Report - were developed as resource guides for stakeholders. These reports are based on USAID's pilot projects with NTPC Limited and Gujarat State Electricity Corporation Limited (GSECL) in India through the GTG-RISE initiative that supports large-scale integration of RE. The pilot projects demonstrated the technical feasibility and cost implications, enabled test runs at low-load and built institutional capacity, therefore contributing to the business case for policy and regulatory changes to enable grid flexibility for thermal power stations. USAID's work resulted in the Government of India, Ministry of Power's decision to announce plans of installing 80 GW flexible coal generation capacity, which will galvanize new investments in the country.

Picture Courtesy: GTG-RISE Initiative

Battery Energy Storage System at the Puducherry substation

Innovative Pilots for Large Scale Integration of RE into India's Power Grid

Through the GTG-RISE initiative, USAID successfully established the viability of innovative solutions for RE grid integration. The pilot on Battery Energy Storage System (BESS) at transmission level with Power Grid Corporation of India (PGCIL) has been live since December 2020 and demonstrates applications for grid balancing, ancillary services, load shaving, deferment of network upgrades, and peak management. Another pilot on BESS conducted for BSES Rajdhani Power Ltd (a Delhi-based utility) demonstrated the benefits of network loss reduction, peak demand management, and energy arbitrage. In addition to BESS, the Automatic Generation Control (AGC) pilot set up and test runs for two hydro plants in Karnataka have been successfully completed to demonstrate its applications for grid stability in Karnataka and Southern region. The pilot resulted in detailed technical requirements and compensation mechanisms for the generation units to participate in the AGC secondary reserve market. These results provided valuable inputs to the Government of India's National Plan on AGC roll out for all generations.

Three Open-Source Tools to Support Distribution Utilities in Distributed Energy Resources Planning

BESS room at the Puducherry substation

USAID helped develop three tools for distribution utilities to support their clean energy transition. EFFectiveness Of Rate sTructure for enabling demand response or the EFFORT initiative that helps assess the impact of customer's responsiveness towards demand side management interventions. With EFFORT, utilities can customize the level of customer's responsiveness to changes in electricity price and design time of use tariffs. The second tool is an interactive dashboard called EVOLVE (EVOlution of net-Load Variation from Emerging technologies) to help distribution utilities better understand feeder-level impacts of adding emerging technologies, such as solar PV, EVs, and BESS. The third tool, is a reusable framework, that enables utilities to assess the impacts of distributed energy sources on its power distribution grid.

Feasibility of Hybrid Renewables and Energy Storage Project

The United States Trade and Development Agency (USTDA) funded a feasibility study to support a private energy developer in India evaluate the technical and economic viability of developing a hybrid solar (100 MW) and wind power plant (200 MW) with integrated energy storage (100 MWh) in Gujarat.

Rooftop solar panels on an industrial building

$41 Million Credit Guarantee for Adoption of Clean Energy by the Micro, Small, and Medium Enterprises (MSMEs)

The micro, small, and medium enterprises (MSME) sector is one of India's key economic pillars, accounting for 29% of the country's GDP and 25% of total industrial energy consumption. The adoption of rooftop solar offers MSMEs an excellent value proposition by significantly bringing down the cost of electricity consumption, and improving the reliability of the electricity supply. In March 2021, USAID and U.S. International Development Finance Corporation (DFC) established a $41 million credit guarantees program to help finance investments by the Indian MSMEs in RE solutions, including rooftop solar installations, which will enable businesses to access reliable power and cut costs. USAID and the DFC partnered with Electronica Finance Limited, and cKers Finance, the two Indian non-banking financial companies and Encourage Capital, a US-based private equity investment and the ClimateWorks Foundation. Within three months, the two partners have provided loans for 15 projects worth $800,000 including solar projects for the textile, manufacturing, food processing, and packaging industries. The pipeline for the next six months includes loans worth $4 million covering 49 rooftop solar projects, 50 solar-powered micro-cold chains in villages, and 350 bank branches solarized in remote rural areas.

Half a Billion Dollar Financing for Solar PV Projects in India

DFC's portfolio of committed financing for construction and operation of solar projects.

$50 million — 100 MW
Rajasthan — Sitara Solar Energy Private Limited

$53 million — 105 MW
Gujarat — ReNew Sun Energy Private Limited

$142 million — 300 MW
Rajasthan — ReNew Sun Bright Private Limited

$140 million — 300 MW
Rajasthan — ReNew Sun Waves Private Limited

$27 million — 50 MW
Gujarat — Paryapt Solar Energy Private Limited

DFC has also committed $10 million of insurance for the installation, maintenance, and sales of power to commercial clients from rooftop solar panels operated by HCT Sun and is providing a $5 million loan to an impact focused non-banking institution to invest in companies focused on agriculture, education, financial inclusion, healthcare, renewable energy, and women's empowerment.

Representational image of sustainable farming

Collaboration Launched for Excellence in Renewable Energy Research and Modeling

Launched collaboration between the U.S. National Laboratories and MNRE National Institutions under the South Asia Group for Energy or SAGE initiative to collaborate on advanced RE forecasting, sustainable farming, biomass RE hybrid projects and biomass cookstove test facility. SAGE, a consortium comprising USAID, the United States Department of Energy, and three national laboratories: the Lawrence Berkeley National Laboratory, the National Renewable Energy Laboratory, and the Pacific Northwest National Laboratory, equip partner countries with critical information and implementation strategies through research, modelling and capacity building activities for energy sector-related opportunities.

Key activities currently underway include

- Partnership between NREL and NIWE to advance capabilities in wind and solar resource forecasting with the goal of improving the dispatch capabilities of utility-scale solar and wind plants
- Bioenergy collaboration between PNNL, LBNL, and NIBE on sustainable farming, agro waste management, biomass RE hybrid, and biomass cookstove testing

US-India Collaborate on Hydrogen to Support India's Clean Energy Transition

Representational image of a truck carrying gas

To accelerate India's deep decarbonization strategy and support progress in the country's clean energy transition, in June 2021, the U.S. Department of Energy (DOE) and the Ministry of New and Renewable Energy (MNRE) collaborated with the U.S.-India Strategic Partnership Forum (USISPF) to formally launch the U.S.-India Hydrogen Task Force. The public-private partnership brings together government policies and programs with industry perspectives and investments to scale up hydrogen technologies, and bring down the costs of their deployment with assessment of technology status. The steering committee has been established, with committee members and thematic working groups identified.

Innovative Demand Aggregation Pilots under U.S.-India Clean Energy Finance Task Force (CEFTF)

The Clean Energy Finance Task Force is strengthening India's ability to finance its energy security needs by sharing innovative business and finance models to help scale the clean energy sector. The Task Force supported utility-led, community-based demand aggregation pilots in Bihar, Meghalaya, and Delhi to strengthen utility solvency and develop market-based pathways away from subsidy programs. These pilots aim to demonstrate solar rooftops' role in enhancing grid flexibility, building a case for scaling up the business, and finance models. The Delhi solarize pilot to increase consumer awareness and deployment of residential solar-rooftop through community campaigns has now been completed and performance monitoring is under progress. The community engagement model pilot for semi-urban areas in Bihar and community solar feeder model for Meghalaya are in the planning and stakeholder discussion stages.

Picture Courtesy: International Solar Alliance website

Supporting India's leadership of the International Solar Alliance (ISA)

The U.S. National Renewable Energy Laboratory (NREL) provided technical assistance under the International Solar Alliance (ISA) Solar Technology Application Resource-Center (STAR-C) to develop training programs geared toward increasing solar energy knowledge among ISA member country stakeholders. NREL developed training modules and 56 pre-recorded sessions on eight topic areas covering policies for distributed and large-scale PV, technical and market integration of solar, off-grid solar, and solar heating and cooling. The training programs are offered free of cost and are available through the ISA Infopedia web platform. The Lab continues to provide outreach support to the ISA Secretariat to build awareness and use of the Solar Academy Courses.

PRIORITIES GOING FORWARD

Building on the last two years of work under the Renewable Energy pillar, and the emerging RE priorities in India, the United States and India have agreed to focus RE pillar activities to the following priorities* for the coming years. The Pillar activities will also directly contribute to the U.S.-India Climate Action and Finance Mobilization Dialogue (CAFM).

- Strengthen enabling policies and regulations at the national and state level for RE development and deployment, including addressing challenges associated with interstate RE trading
- Enhance planning processes and procurement strategies for RE
- Support innovative power-market products and enable renewable energy generators' participation in markets
- Promote deployment of energy storage to support RE such as new business models, technical assessments, supportive regulations, and policies
- Support RE grid integration by expanding and scaling the adoption of innovative technologies on battery energy storage system, flexible power generation, automated generation control, a regional platform for reserve sharing, hybrid systems, and hydrogen
- Promote distributed RE solutions for the agriculture and health sectors; as well as, micro, medium, and small enterprises
- Develop market-based solutions to address the challenges of poor-quality equipment, compensation models, and cybersecurity concerns
- Create new demand for RE, such as electric vehicles (EVs) and electric cooking
- Expand the use of renewable technologies to decarbonize transport and industrial sectors
- Support digital solutions for better management and integration of RE projects and improve cybersecurity for critical power systems infrastructure
- Promote new business models for biomass-based hybrid solutions
- Advance new business models for distributed renewables and support their replication in India and other developing countries (e.g. utility-led, community-based demand aggregation pilots)
- Enhance subnational partnerships with states and cities
- Address air pollution issues in urban areas through waste (agriculture and municipal) to energy technologies, RE-based EV infrastructure, and use of clean energy in industries
- Strengthen national RE institutions (NISE, NIWE, and NIBE) through partnerships with U.S. National Labs
- Expand the engagement of the U.S.-India business associations
- Develop innovative financing mechanisms, including refinancing vehicles to free up capital for new deployment
- Support direct financing of RE projects through debt, equity, and credit guarantees
- Build institutional and human capacity through training, workshops, peer-to-peer exchanges, and study tours
- Support regional energy integration and cooperation for faster deployment of RE resources in India and South Asia

**These priorities are under discussion with the Ministry of New and Renewable Energy.*

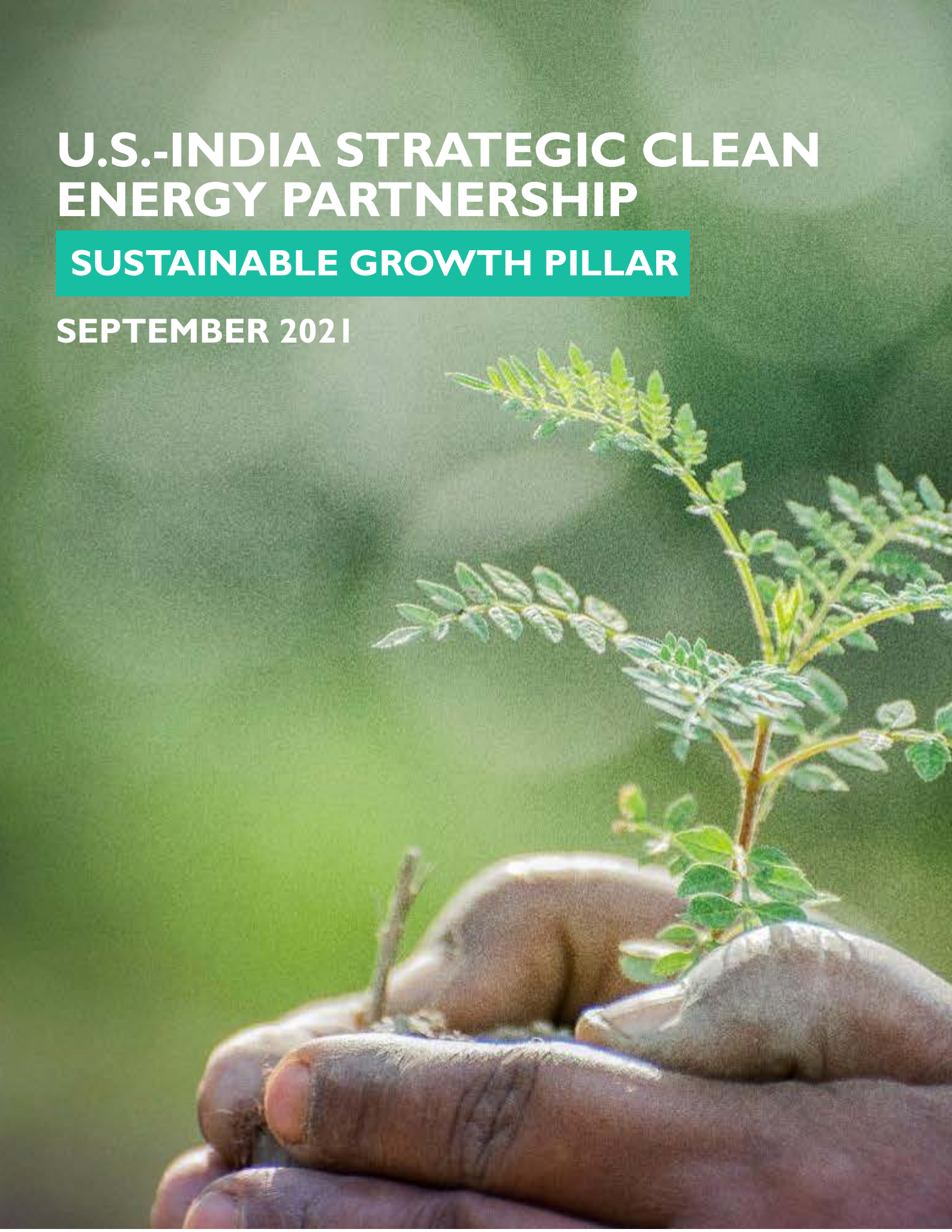
U.S.-INDIA STRATEGIC CLEAN ENERGY PARTNERSHIP

RENEWABLE ENERGY PILLAR

U.S.-INDIA STRATEGIC CLEAN ENERGY PARTNERSHIP

SUSTAINABLE GROWTH PILLAR

SEPTEMBER 2021



NITI Aayog

USAID FROM THE AMERICAN PEOPLE

USTDA U.S. TRADE AND DEVELOPMENT AGENCY

DFC U.S. International Development Finance Corporation

EXIM EXPORT-IMPORT BANK OF THE UNITED STATES

OUTLINE

The long history of energy cooperation between the United States and India have powered lives and livelihoods. On the margins of the April 2021 Leaders Summit on Climate, President Biden and Prime Minister Modi announced the launch of a new bilateral partnership to advance shared climate and clean energy goals. The U.S.-India Climate and Clean Energy Agenda 2030 Partnership includes the Strategic Clean Energy Partnership (SCEP) which was earlier established as the Strategic Energy Partnership in 2018 and had replaced the U.S.-India Energy Dialogue, the previous intergovernmental engagement for energy cooperation. The revitalized SCEP will continue to advance energy security and innovation with greater emphasis on electrification and decarbonization of processes and end uses, scaling up emerging clean energy technologies, while finding solutions for hard-to-decarbonize sectors. Engagement with the private sector and other stakeholders will remain a priority.

STRATEGIC CLEAN ENERGY PARTNERSHIP PILLARS

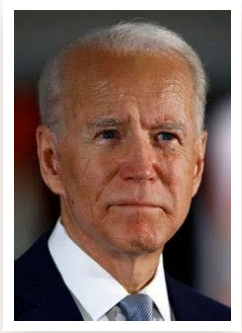
Sustainable Growth Pillar

Power and Energy Efficiency Pillar

Renewable Energy Pillar

Responsible Oil and Gas Pillar

Remarks at the Leaders Summit on Climate
(April 2021)



"I am looking forward to working with India's Prime Minister Modi in a new partnership to achieve our climate and energy goals, making this a core pillar of our bilateral cooperation. And the commitments we have made must become real."

Joe Biden
President of the United States of America

"With the India-U.S. Climate and Clean Energy Agenda 2030 partnership, together we will help mobilize investments, demonstrate clean technology, and enable green collaborations."

Narendra Modi
Prime Minister of India

THE JOURNEY SO FAR

2005

May 2005
Initiated the U.S.-India Energy Dialogue

2009

November 2009
Launch of the Partnership to Advance Clean Energy (PACE)

2017

June 2017
U.S. and India agreed to elevate the bilateral energy cooperation

2018

April 2018
Launch of the U.S.-India Strategic Energy Partnership (SEP)

2019

January 2019
Four Technical Pillars established under SEP

2020

February 2020
President Trump and Prime Minister Modi recognize SEP in their joint statement

2021

April 2021
Launch of the Agenda 2030 Partnership with renewed Strategic Clean Energy Partnership (SCEP)

September 2021
SCEP officially launched

PILLAR OVERVIEW

The Sustainable Growth (SG) Pillar under the U.S.-India Strategic Clean Energy Partnership takes a broader role in advancing low-carbon development and improving inclusive and sustainable economic growth through climate responsive strategies, long-term plans, and energy data management. India is well on its way to leverage its expanding and diverse economy, capitalize on its demographic dividend and benefit from its rapid urbanization. The country's growth could be further enhanced with addressing energy issues along with ensuring financial and environmental sustainability as a climate responsible country. India is prioritizing strategies which could improve energy security, reliability, and affordability, universal energy access, and resiliency of energy systems to cyber-attacks and extreme weather events. Such strategies also help maintain water and food security over the long-term, reduce health impacts of air pollution, and support environmental stewardship. The broad scope of the Sustainable Growth Pillar includes, but is not limited to:

The broad scope of the Sustainable Growth Pillar includes, but not limited to:

- Improving inclusive and sustainable economic growth by enhancing long-term energy development plans and strategies through robust energy planning which should be based on better energy data management and analytical tools.
- Developing tools/models and analysis for evidence-based planning and policy making.
- Conducting cross-sectoral analysis of energy policies on broader development goals, including energy-water-food-nexus, air pollution, energy access, low-carbon growth, and decarbonization.
- Promoting collaboration between Indian and U.S. research institutions for enhancing modelling capabilities and tools for low-carbon development, decarbonization and just transition.

FOCAL AREAS OF THE PILLAR

Energy Data Management

Energy Modelling

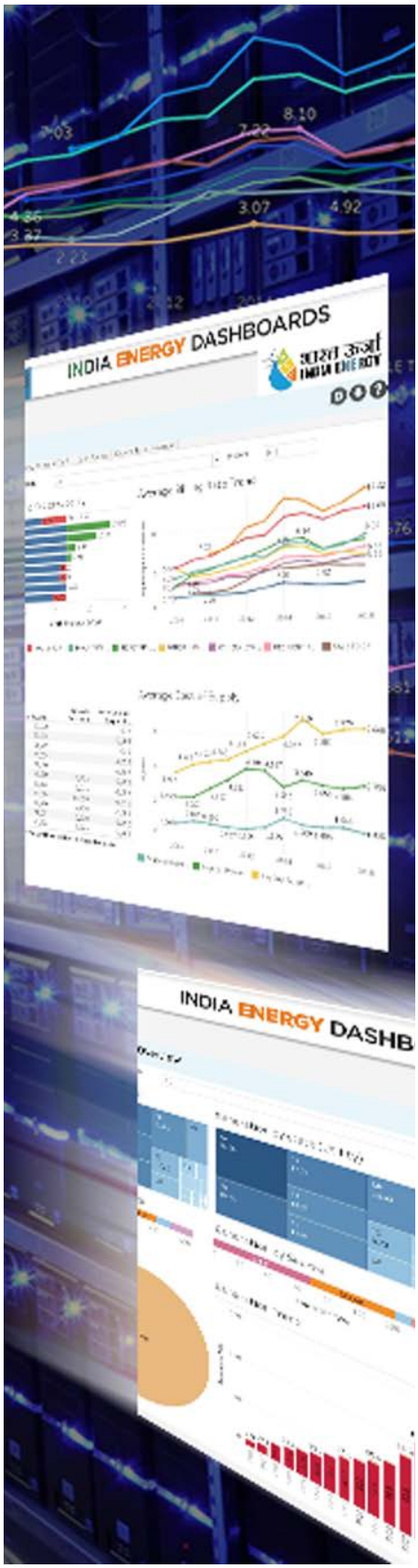
Low-carbon Technologies & Decarbonization

Just Transition from Coal

SUSTAINABLE GROWTH PILLAR CO-CHAIRS

DR. RAKESH SARWAL
Additional Secretary
NITI Aayog
Government of India

ANJALI KAUR
Deputy Assistant Administrator
Asia Bureau
USAID



Standardizing India's Energy Sector Data

Intuitive and comprehensive energy projection with reliable, robust, and validated data visualization are critical to India's sustainable energy discourse. NITI Aayog and the USAID collaborated to effectively manage India's data standardization and formats, to ensure quality. Consultative meetings of Energy Information Administration (EIA) team were organized with government data agencies such as Ministry of Statistics and Programme Implementation (MoSPI), Central Electricity Authority (CEA), Petroleum Planning and Analysis Cell (PPAC), and Ministry of Coal to share best practices and methodologies adopted by EIA in their organisation.

NITI Aayog developed India Energy Dashboard (IED) Version 1 in 2017 and Version 2.0 in 2021. The dashboard provides a single-window online platform to address gaps in data accessibility on various aspects of India's energy sector. Granularity of the data is further enhanced in this version supporting India's informed planning and policy development. Energy data published on the open portal dashboards is helping multiple stakeholders with reliable and actionable information on India's energy demand and supply side at large.

"With the rise of renewables and many other new energy technologies, the interplays between energy supply and demand sectors are now becoming increasingly critical."

Rajiv Kumar
Vice Chairman,
NITI Aayog

"The goal is to turn data into information, and information into insights to inspire those in a position to make a difference. We are moving slowly into an era where big data is the starting point, not the end. So, the IED will continue to evolve and be a pillar around which robust energy decisions are taken in India."

Amitabh Kant
CEO,
NITI Aayog

Remarks at the launch of the India Energy Dashboard (IED) 2.0, April 2021

Decarbonization Pathways in South Asia

In the decisive decade of action against climate change, there is an urgent need of a faster and deeper decarbonization. As long-term partners in India's low-carbon and inclusive growth agenda, USAID and NITI Aayog collaborated to stir dialogue on decarbonization pathways in South Asia with a virtual event at the Asia Clean Energy Forum 2021. Convening experts from Bangladesh, India, and Sri Lanka, deliberations on the technology choices, challenges, opportunities, and potential pathways in priority sectors such as power, transportation, buildings, and industry were enabled to develop future strategies. Discussions on policy and regulatory frameworks, financing barriers to be addressed, and private sector participation to support decarbonization were also stimulated. USAID and NITI Aayog will continue to explore detailed implementation strategies, including financing plans and mechanisms to mobilise green funds and private investment in low-carbon growth.

Institutionalization of India Energy Modelling Forum

Under the Sustainable Growth Pillar, the co-chairs announced the institutionalization of the India Energy Modelling Forum (IEMF) in July, 2020. It is an India-led platform for leading experts and policymakers to examine important energy and environmental related issues. The core focus of IEMF has been to build a vibrant energy modelling community in India while also building the capacity of energy modellers and decision-makers.

NITI Aayog established the governing structure of IEMF in October, 2020. The IEMF has a two-tier structure which includes the Steering Committee at the working level and Inter-Ministerial Committee led by CEO, NITI Aayog to provide direction on key research areas and feedback to the Steering Committee.

The Steering Committee includes government, industry association, academia, and policy research representation. Six task forces have been established for carrying out research and modelling. The Terms of Reference for the undermentioned key research areas have been developed and are in the process of approval by the Steering Committee.

THE SIX TASK FORCES OF IEMF

1. Low-Carbon Pathways
2. Nexus Studies
3. Economic Analysis
4. Demand Side Analysis – Transport
5. Demand Side Analysis – Industry
6. Aatmanirbhar Pathways for Energy

PRIORITIES

The Sustainable Growth Pillar supports India's inclusive and sustainable economic growth agenda by enhancing long-term energy development plans and strategies. This broader goal will be achieved through enhanced collaboration between Indian and United States (U.S.) institutions on energy data management; development of tools/models and analysis for evidence-based planning and policy making; cross-sectoral analysis of energy policies on broader development goals, and accelerated adoption of low-carbon technologies accompanying the decarbonization of critical sectors like transportation, industry, power and buildings. The SG pillar will focus on the undermentioned priorities.

1

ENERGY DATA MANAGEMENT (EDM)

A number of state and national agencies publish energy data (i.e., resource assessment, extraction, conversion, transmission, distribution, and consumption) for India. However, much of the data available is dispersed and difficult to collate due to differences in the arrangement of data sets, the use of incompatible formats and lack of standard definitions, data gaps and inconsistencies. The EDM focus area aims to promote collaboration between the Government of India (GOI) and the U.S. Energy Information Administration (EIA) to strengthen the framework for a robust energy data management system in India and enforce its strategic implementation. A committee comprising agencies from India and U.S. has been formed to enable standardization of data definitions. This will lead to the development of an energy statistics manual.

2

ENERGY AND ENVIRONMENTAL MODELLING FOR POLICY MAKING

Energy is among India's most dynamic sectors and central to achieving the country's development ambitions and economic progress. Recognizing India's expertise in this sector, this focus area aims at learning through the exchange of results from intermodel comparative exercises in which researchers from the United States and India carry out modelling exercises using different kinds of analytical tools. The India Energy Modelling Forum (IEMF) set up by NITI Aayog under this pillar, is a fine example of India-led platform for leading experts and policymakers to examine important energy and environmental-related issues. The platform also assigns a larger role to systems modelling and analysis in the Government of India's decision-making processes. IEMF's role is to enhance the level of engagement among modellers, researchers, institutions, funders, and policymakers.

3

LOW CARBON TECHNOLOGIES AND STRATEGIES FOR DECARBONIZATION

India is experiencing significant growth in emissions driven by economic growth, urbanization, rising incomes and industrialization. India's major energy consuming sectors include buildings, industries, and transportations. As India's demand for energy continues to grow at over three per cent annually, the need for reducing the country's emission intensity with sustained commitment in a low-carbon future through national commitments and policies for different sectors becomes a priority.

The U.S.-India cooperation will expand assistance to a variety of stakeholders, including Indian central and state governments, think tanks, researchers, utilities, and regulators, for developing strategies and plans to decarbonize high-emission sectors such as industry, transport, power, and buildings under the Sustainable Growth Pillar. A detailed study on decarbonization of industries particularly steel and cement will be undertaken. This will also support the development of frameworks, tools, and demonstrations for scaling up low-carbon technologies like battery, energy storage, etc. A committee comprising agencies from India and U.S. has been formed to deploy low carbon technologies and identify decarbonization strategies.

4

JUST TRANSITION FROM COAL

India's energy sector has a sustained predominance of coal being the world's second largest coal producer and fifth largest country in terms of coal deposits. Currently, coal is estimated to be meeting 45% of the country's primary energy needs and about 70% of electricity requirements. In addition, India's demand for coal is expected only to grow. The primary coal users in India are thermal power plants, but coal is also extensively used in the iron and steel, and cement sectors. Moreover, coal freight subsidizes passenger rail movement in the country. These factors clearly demonstrate how deeply coal is integral to the Indian economy. There are $40-60 billion of stranded thermal power assets placing stress on India's already troubled banking sector and undermining the flow of capital critical to the clean-energy transition.

To move away from reliance on coal, India requires a socio economic and technological shift that would benefit the states, communities, and sectors which rely on coal for both power and livelihoods. This focus area will undertake scenario analysis to model the impacts of transitioning away from coal, factoring in upsides of air quality, environment protection and water savings. It will also support the design and testing of policy frameworks that would offer economic and job growth opportunities from clean energy value chains to communities negatively impacted by the declining use of coal. A committee comprising agencies from India and U.S. has been formed to enable this just transition.

U.S.-INDIA STRATEGIC CLEAN ENERGY PARTNERSHIP

SUSTAINABLE GROWTH PILLAR