



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

October 2022



USAID
FROM THE AMERICAN PEOPLE



USTDA
U.S. TRADE AND DEVELOPMENT AGENCY



DFC U.S. International
Development
Finance Corporation



PARTNERSHIP OVERVIEW

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 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 SCEP advances 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



Renewable Energy Pillar



Sustainable Growth Pillar



Power and Energy Efficiency Pillar



Responsible Oil and Gas Pillar



Emerging Fuels Pillar

UN Climate Change Conference Glasgow 2021 (November 2021)



"We can create an environment that raises the standard of living around the world. And this is a moral imperative, but it's also an economic imperative – if we fuel greater growth, new jobs, and better opportunities for all our people."

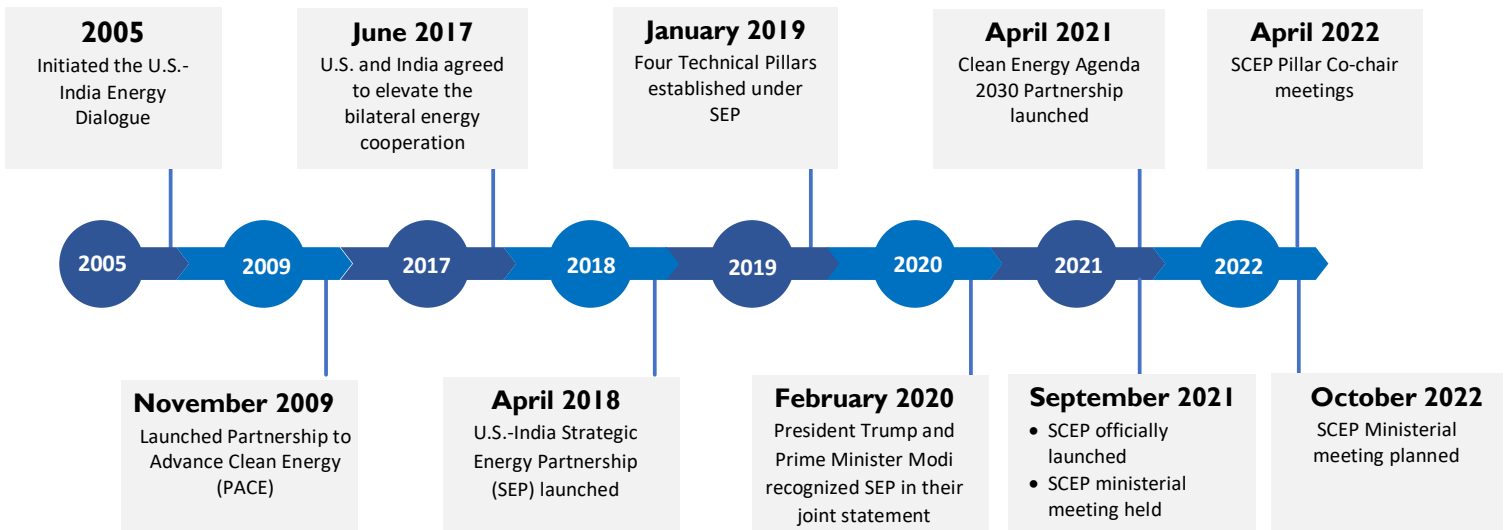
Joe Biden
President of the United States



"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



PILLAR OVERVIEW



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 in achieving 450GW 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



DINESH JAGDALE

Joint Secretary
Ministry of New and Renewable Energy
Government of India



ANJALI KAUR

Deputy Assistant Administrator
Asia Bureau
United States Agency for International Development



KEY ACHIEVEMENTS



Meeting of SCEP RE Pillar Co-Chairs-November 25, 2021



Workshop on Enabling the use of InVITs for Clean Energy Transition

- Provided inputs to the Ministry of New and Renewable Energy (MNRE) on policy changes and the development of a scheme to enable large-scale repowering of old and inefficient wind turbines in India. Identified potential sites in selected states, as well as their repowering potential and appropriate business models.
- Officially launched the National Open Access Registry (NOAR) to boost the power market efficiencies by capturing real time transactions and increase renewable energy generators' participation.
- Developed a technical report on guidelines and compensation mechanism for the Forum of Regulators (FOR) to minimize renewable energy curtailment for non-technical and grid security reasons.
- Organized a workshop on improving demand forecasting and resource planning using REPOSE for the Government of Nepal. Shared findings for improving the institutional framework for forecasting renewable energy generation based on international best practices with a number of states.
- Supported Indian Railways in the design and launch of a 1 GW tender for round-the-clock purchase of electricity with 100 percent renewable energy towards its 2030 net-zero goal.
- Assisted Indian Railways in bid design and securing open access connectivity for 14 MW solar rooftop project at their Modern Coach Factory, Raebareli and demonstrating replication potential for similar sites of Indian Railways.
- Analyzed optimal project capacity and financial feasibility for decentralized ground mounted solar projects connected to Indian Railways substations to support 1.5 GW solar deployment across India.
- Partnered with the Energy Efficiency Services Limited (EESL) for deployment of solar rooftop in six medium, small and micro enterprises (MSMEs) clusters in India.
- Scaled-up efforts for rating of solar rooftop vendors with the Confederation of Indian Industry-Green Business Center (CII-GBC) by increasing the outreach activities to reach 3000+ vendors, registering eight assessor agencies, completing the ratings for five vendors, with 40+ more vendors in the pipeline to build consumer trust in solar rooftops, thereby helping increase uptake.
- Organized regulatory training series on financial derivatives for power trading and power exchange, comprising of a series of six webinars and a regulatory study tour on financial derivatives.
- Developed the Delhi Solarize Campaign as well as a guidebook to scale up the pilot.
- Committed \$500 million in U.S. Development Finance loan to a vertically integrated photovoltaic (PV) solar module manufacturing facility of 3.3 GW capacity in Tamil Nadu, India to boost domestic solar panel manufacturing capacity.



KEY ACHIEVEMENTS

- Hosted the second workshop in a six-workshop series focused on standards and conformity assessment framework for PV power plants and rooftop installations.
- Organized a four-day masterclass on Green Hydrogen with Skill Council for Green Jobs (SCGJ) for 65 representatives from government, utilities, and research and academic institutes from South Asia.
- Launched a training course on net zero for officials of Indian Railways in collaboration with the Indian Railways Institute of Electrical Engineering, Nashik.
- Assessed technical options and feasibility for green hydrogen-powered trains by analyzing rail routes, hydrogen requirement, storage and fueling locations.
- Organized the U.S.-India Hydrogen webinar for promoting commercial partnerships in the hydrogen sector and facilitated one-on-one business meetings among interested companies.
- Kick-started technical assistance to NTPC Renewable Energy Limited (NTPC REL) for conducting feasibility study and tender design for 50 TPD green ammonia plant at an existing fertilizer plant.
- Hosted a 23-member delegation of power regulators, utility officials, and private sector players to attend DTECH 2022 and organized site visits to the U.S. power utilities.
- Finalized a report for the community solar model, which includes a feasibility assessment of the model in the states of Bihar and Meghalaya as well as policy recommendations for replication.
- Developed a handbook for enabling the use of InVITs for financing renewable energy in India providing a business case for InVITs and a detailed step by step process to use InVITs as an effort to mobilize finance for clean energy transition through innovative instruments.
- Partnered with an Indian non-banking finance corporation for an Alternate Investment Fund (AIF) with a capitalization of INR 500 crores (approximately \$70 million) to deploy capital for innovative clean and climate smart technologies.
- Inputs provided on the use of Sovereign Green Bonds to Ministry of Finance, Govt. of India.
- Launched the Global Partnership for Climate-Smart Infrastructure, connecting the U.S. industry to major clean energy and transportation infrastructure projects in emerging markets and leveraging USTDA's project preparation and partnership-building tools.



Ammonia Storage Tank at NFL, Nangal



DAA Visit to Indian Railways



Distributed solar generation site of Indian Railways



SUCCESS STORIES

(DEMONSTRATION, ASSESMENT, AND TOOLS)

Policy support for repowering of old turbines to enable better utilization of best wind resource sites in India



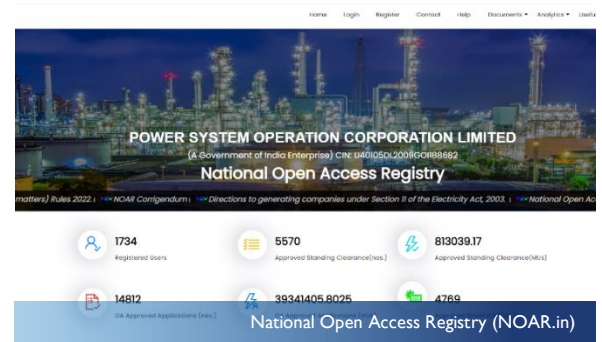
Repowering old turbines in wind-rich states and prime locations will improve wind resource utilization. The MNRE-USAID South Asia Regional Energy Partnership (SAREP) program conducted feasibility studies for repowering existing sites in Gujarat, Maharashtra, and Tamil Nadu. The micro siting for selected sites revealed that repowering existing wind sites with newer and larger turbines can result in an increase of 2-4 times in annual electricity generation.

The program developed the outlines of a policy, including project-selection criteria, incentives framework including compensation for existing owners, and business models for repowering, and presented recommendations for developing a policy and a scheme to the

Ministry of New and Renewable Energy (MNRE), Government of India to enable large-scale repowering of 10,000+ MW worth of wind capacity. Once implemented, the policy and associated scheme will create a market for larger and more efficient wind turbines, thus leading to new investment, creation of green jobs, and aiding the increase of clean energy deployment in the country.

India's National Open Access Registry (NOAR) launched to facilitate easier and faster access for greater renewable energy participation in electricity markets

USAID has conducted various grid integration pilots to test and validate technologies and solutions to support renewable energy integration in India under its Greening the Grid-Renewable Integration and Sustainable Energy (GTG-RISE) initiative. In one such pilot, USAID supported Power System Operation Corporation (POSOCO), designing and developing the National Open Access Registry (NOAR). NOAR is a centralized electronic platform that automates the short-term open access approval processes in the power market. The integrated platform is accessible to all stakeholders in the power sector, including open access customers (both sellers and buyers), power traders, power exchanges, National/Regional/State LDCs and others. The platform provides automation in the workflow, and transparency to achieve shorter turnaround time for participants of short-term electricity market that comprise about 10 percent of all India demand.



India's redesigned ancillary services market enacted for large scale integration of renewable energy in the grid

With increasing variable generation in the Indian power system, the need for ancillary services is rapidly increasing to support large scale deployment of renewable energy. USAID supported the Central Electricity Regulatory Commission (CERC) in redesigning the ancillary services market regulations, which were released in January 2022. The support included review of international practices on various ancillary services products and methods of procurement, evaluating the pros and cons of various alternatives, simulations of such alternatives to understand the best possible model for adoption, estimation of indicative pay-outs to resource providers, and assistance for drafting of the regulation. After the release of the national level regulation, there is also a need for a regulatory framework for a state-level ancillary mechanism. In this context, the Forum of Regulators (FOR) has established a technical committee to scrutinize various state-level challenges and evolve a comprehensive ancillary services framework at that level. SAREP is providing technical assistance to FOR's technical committee and will develop a detailed roadmap for state level implementation.



SUCCESS STORIES

(DEMONSTRATION, ASSESMENT, AND TOOLS)

Established formal engagement with the Forum of Regulators (FOR) for supportive regulatory frameworks

USAID is partnering with FOR to develop regulatory frameworks, guidelines, and state implementation roadmap for scaling renewable energy and its grid integration. SAREP is providing support to various technical committees of FOR on resource adequacy, state level ancillary services mechanism, management of RE curtailment, green energy open access, energy storage, and green hydrogen.

Areas of formal engagement with Forum of Regulators:

- Resource adequacy framework
- Ancillary Services
- Energy storage and Electric Vehicles
- Renewable Energy Certificate mechanisms
- Framework on RE curtailment
- Advanced technologies
- Green Tariffs

As part of the engagement thus far, SAREP has developed a report on regulatory framework for energy storage and electric vehicles and regulatory guidelines to minimize renewable energy curtailment for reasons other than technical and grid security.

Deployment of tools and practices for strategic planning for renewable energy REPOSE

MNRE-USAID SAREP expanded the work undertaken by USAID's Partnership to Advance Clean Energy Deployment (PACE-D 2.0 RE) in partnership with the MNRE, to improve resource planning for renewable energy. The use of Renewable Energy Procurement Optimization and Smart Estimation (REPOSE) software tool for power distribution companies (DISCOMs) was expanded to several states and South Asian countries.



REPOSE Workshop Nepal, 11th-12th April 2022

Initiated sub-national support to states and cities for clean energy deployment



Visit to Telangna Load Dispatch Centre

USAID bilateral programs with MNRE and Ministry of Power (MOP) have extensively worked with states and cities on clean energy deployment. The MNRE-USAID SAREP program is counting this with a focus on new implementation approaches and business models, demonstration, financing mechanisms, capacity building, network of states/cities, private sector engagement, and policy and regulatory support for high potential clean energy opportunities. The focus of implementation will be on renewable energy (large scale and distributed), energy efficiency, electric vehicles, waste to energy, green hydrogen, and net zero cities. USAID SAREP program held consultations and meetings with senior energy sector officials in seven states

- Madhya Pradesh, Haryana, Karnataka, Assam, Andhra Pradesh, Telangana, and Gujarat, of which it recommended Madhya Pradesh, Haryana, Karnataka, and Assam to MNRE for uptake of program activities.



SUCCESS STORIES

(DEMONSTRATION, ASSESMENT, AND TOOLS)

Indian Railways launched India's first tender for round-the-clock purchase of electricity with 100% renewable energy

India's growing economic needs include vast transport investments, from which the derived energy demands will have a huge impact on global markets. Achieving a net-zero carbon emitter status for Indian Railways by 2030 is a key component of India's global climate commitment. MNRE-USAID SAREP is providing extensive support to Indian Railways to expand the use of renewable energy and energy efficiency in its operations. SAREP helped Indian Railways design and issue a tender for the supply of 1000 MW round-the-clock (RTC) power from grid-connected renewable energy. This is the first tender in the country for RTC purchase of electricity with 100 percent renewable energy component. SAREP program has helped Indian Railways develop the tender documents, undertaking a detailed analysis of various possible scenarios of configuration, impact of various parameters as part of the project design on tariffs, and a detailed analysis on Indian Railways' energy costs with and without RTC. Multiple consultations with the industry sector were held and the feedback incorporated into the design. The success of this tender will greatly help Indian Railways in achieving its net-zero carbon emission target by 2030.



Indian Railways maximizing use of distributed solar power generation

MNRE-USAID SAREP assisted Indian Railways in bid design and securing open access connectivity for 14-MW solar rooftop project at their Modern Coach Factory (MCF), Raebareli. MCF is an open access customer, and the site has an existing 3 MW solar plant. SAREP's assistance demonstrated a new arrangement for the Railways where electricity generated from the solar rooftop plant can be fed into the transmission network which other facilities of Indian Railways can draw at other points in the state. SAREP also supported the Railways in obtaining clearance for grid connectivity and increasing the limit for open access from the state authorities. Based on the success from this project, Indian Railways plans to replicate this model for its other similar sites.

USAID also supported the Railways in its program to set up medium-size solar projects across the country, which will inject the power generated directly into railways' traction substations. There are about 500 such substations in India with an estimated potential to absorb 1,500 MW of solar capacity. SAREP supported Indian Railways in conducting a critical analysis of the optimal solar power capacity that can be interconnected to each traction substation within the constraints of no export of solar electricity to the national grid and while minimizing the wastage of excess solar generation.

Indian Railways declared its Energy Compact goals in 2021 as part of UN High-level Dialogue on Energy (HLDE), outlining clean energy goals and actions for the next decade. Increasing the share of renewable energy, energy efficiency in traction, manufacturing units, and non-traction are key areas identified by Indian Railways to achieve net zero carbon emission by 2030.

Creating market opportunities for Pumped Hydro Energy Storage (PHES) in India

PHES is a proven and efficient way to store energy, and can play an important role in facilitating India's improved energy security and transition to a lower cost, low-carbon electricity market that requires flexible, dispatchable, and peak power capacity. USAID's SAREP is providing technical assistance to Central Electricity Authority (CEA) to promote Pumped Hydro Energy Storage (PHES) in India. SAREP is developing a PHES site attractiveness tool so that PHES sites can be compared, and a pool of good sites can be identified. The tool will have technical and economical parameters based on which sites can be ranked. The potential of PHES exists in neighboring countries such as Nepal, Bhutan, and Sri Lanka. Once developed, the tool will also be useful for these countries.



SUCCESS STORIES

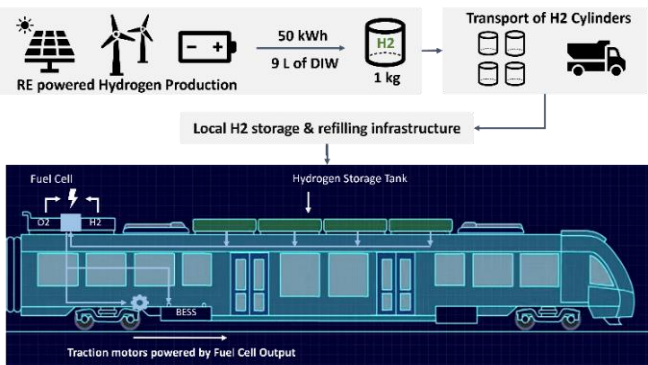
(DEMONSTRATION, ASSESMENT, AND TOOLS)

Developing green hydrogen ecosystem in India



Green hydrogen is emerging as a critical component of GOI's clean energy and climate strategy. In 2021, GOI announced several efforts to expand the use of green hydrogen including the GH Mission and GH policy, which also increased interest from state governments and private sector entities. Other South Asian countries are also increasingly looking towards hydrogen as an alternative source of fuel to reduce their carbon footprint and meet their growing energy needs. USAID, U.S. Department of Energy, and the U.S. Department of Commerce are undertaking a number of activities focused on technical assessment, capacity building, and forging partnerships with private sector stakeholders.

- **Market Research on Green Hydrogen Opportunities in South Asia** - USAID developed a report titled 'Market Research Report on Green Hydrogen' which analyzes key offtake opportunities and enablers of green hydrogen in six South Asian countries
- **Masterclass on Green Hydrogen** - USAID organized a four-day masterclass on green hydrogen with the Skill Council for Green Jobs (SCGJ) in which 65 representatives from government, utilities, and research and academic institutes from Bangladesh, Bhutan, India, Nepal, Sri Lanka, and the Maldives took part. Participants attended sessions on hydrogen fundamentals, South Asian policy trends, technology and applications, economics, global standards, and regulatory aspects.
- **Business to Business Engagement on Green Hydrogen** - The United States Foreign Commercial Service (US FCS) organized a U.S. India Hydrogen webinar for promoting commercial partnerships in the hydrogen sector and facilitated one-on-one business meetings among interested companies to initiate business discussions.
- **Green Hydrogen Pilot at National Fertilizers Limited:** USAID kick-started technical assistance to National Thermal Power Corporation Renewable Energy Limited (NTPC-REL) to conduct a techno-commercial feasibility and tender design for a 50-tons-per-day green ammonia plant in National Fertilizers Limited (NFL), Punjab. The facility will generate green ammonia locally using 100% renewable electricity and integrate with the existing ammonia plant of NFL. The study covers the technical aspects of ammonia generation and storage infrastructure that is best suited to the site. The assistance will help NTPC-REL in ascertaining technical and commercial viability of such projects and support in planning future projects based on green hydrogen.
- **U.S. India Green hydrogen task force:** The task force formally launched in 2021 had its high level meeting of committee members this year.
- **Feasibility assessment of Green Hydrogen Powered Trains:** Assessed technical options and feasibility for a pilot on green hydrogen-powered trains by analyzing rail routes, hydrogen requirement, identification of storage and fueling locations, and preparation of technical specifications.



SUCCESS STORIES

(DEMONSTRATION, ASSESMENT, AND TOOLS)

Accelerating deployment of solar rooftop in MSMEs

- Despite a potential of 16-18 GW of rooftop solar in micro, small, and medium enterprises (MSMEs) across India, less than 1 GW has been implemented thus far. When scaled, this approach offers the opportunity to unlock solar rooftops for an important customer segment. USAID is providing technical assistance to work on addressing the barriers which are restricting the solar rooftop uptake in MSMEs. USAID and US International Development Finance Corporation (DFC) have also established a \$140 million credit guarantee program with Ratnakar Bank Ltd, Caspian Impact Investment, Electronica Finance Ltd (EFL) and cKers Finance to enable financing for small scale project developers, technology providers, and end users for adoption for clean energy technologies.
- USAID is providing technical assistance to Energy Efficiency Services Limited (EESL) to design a solar rooftop program for six high-potential MSME clusters in the states of Haryana, Gujarat, and Maharashtra.
- EFL disbursed 265 loans for rooftop solar to MSMEs, largely in Gujarat, Maharashtra, Tamil Nadu, Karnataka, National Capital Region, and Rajasthan, covering 18.2 MW. This facility has enabled EFL to increase project size without additional collateral and work with larger EPCs.



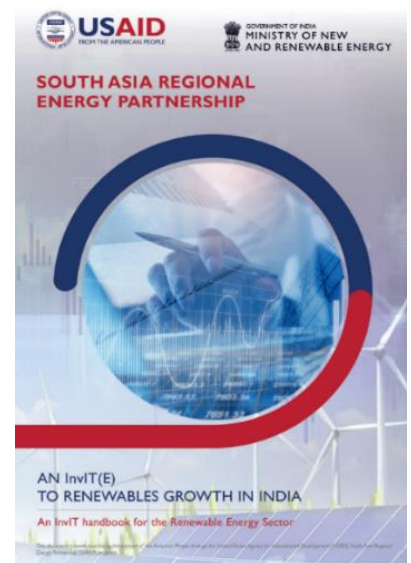
SUCCESS STORIES

(FINANCING MECHANISMS)

Mobilizing innovative financing instruments for clean energy deployment in India

Clean energy financing is necessary for India to meet its clean energy commitments. India has set a target of installing 500 GW of RE by 2030 as part of its climate goals. This means that the country needs to set up nearly 35 GW every year. Such a large deployment of Green Capacity would necessitate mobilizing \$500 billion over the next eight years. To enable this, MNRE-USAID SAREP has worked to facilitate the use of new and innovative financing instruments by large developers, financial institutions, and PSUs for clean energy deployment. This will include expanding the use of innovative instruments such as green bonds, alternate investment funds (AIFs), Infrastructure Investment Trusts (InvITs), etc. for which USAID is taking a series of actions outlined below –

- **InvIT Handbook:** Developed a knowledge product in the form of a handbook titled 'An InvIT(E) to Renewable Energy Growth in India' providing a business case for InvITs and a detailed step by step process for them.
- **Financing Strategy for NTPC Green:** Formed partnerships with NTPC REL, Indian Railways and Power Finance Corporation (PFC) Limited, developed a framework for financing strategy for large corporates/PSUs, developed recommendations on the use of Sovereign Green Bonds and shared them with the Ministry of Finance, Govt. of India.
- **Climate Smart Fund:** Providing support to an Indian NBFC to design and establish an Alternate Investment Fund (AIF) to deploy capital for innovative clean and climate smart technologies to the tune of INR 500 crores (about \$70 million).



Financing to boost domestic manufacturing and alternative supply chains

US DFC committed a \$500 million loan to First Solar's new venture of setting up a vertically integrated photovoltaic (PV) solar module manufacturing facility of 3.3 GW capacity in Tamil Nadu, India to boost domestic solar panel manufacturing capacity. The investment is an effort to drive alternative supply chains through climate finance.

Hybrid solar and wind power plant with integrated energy storage underway in Dwarka, Gujarat

The United States Trade and Development Agency (USTDA) is funding a feasibility study for a private energy developer in India, to evaluate the technical and economic viability of developing a hybrid solar (100 MW) and wind power plant (200 MW) with integrated battery energy storage (100 MWh) at Dwarka in Gujarat, India. The feasibility study is on the verge of conclusion and covers in-depth technical assessments and conceptual design, economic and financial analysis, legal and regulatory analysis, and an implementation plan. This project was one of two highlighted by US President Joe Biden at the launch of the I2U2 Partnership between the US, UAE, Israel, and India in July 2022.

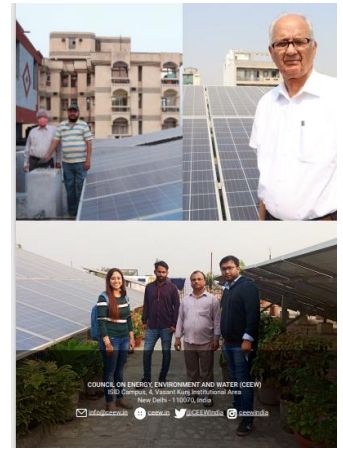
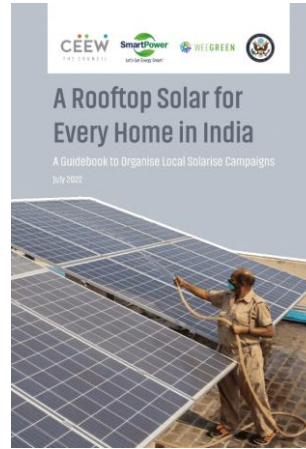


SUCCESS STORIES

(FINANCING MECHANISMS)

Demand aggregation pilots put utilities and consumers at the forefront of harnessing solar power

The U.S.-India Clean Energy Finance Task Force (CEFTF) led by the U.S. Department of State has been working on utility-led, community-based demand aggregation pilots. These pilots recognize the critical role of Indian states and utilities in energy policymaking. The Delhi Solarize campaign pilot, which was held under this task force, sought to increase consumer awareness and deployment of residential rooftop solar through community campaigns. The performance report of the campaign, as well as the guidebook to scale up pilots, were finalized. Further, the CEFTF also finalized a report for the community solar model, which includes a feasibility assessment of the model in Indian states of Bihar and Meghalaya, as well as policy recommendations with potential applicability across India.



SUCCESS STORIES

(CAPACITY BUILDING AND BEST PRACTICES)

Building consumer trust in solar rooftops

Enhancing the quality and safety aspects of rooftop solar projects in India is important to build consumer trust and ultimately enhance large-scale adoption of solar rooftops. For this, USAID partnered with the Confederation of Indian Industry-Green Business Center (CII-GBC) to scale the Vendor Rating Framework (VRF) to rate solar rooftop vendors in the country. Under the program, CII notified eight assessor agencies to provide rating services across the country. A public awareness campaign was designed for the rating program, along with targeted outreach to vendors, financing agencies, and large public and private organizations. These outreach programs conducted with CII-GBC reached out to over 3,000 vendors and resulted in enquiries from about 147 vendors. Following this, the CII initiated the process of rating 46 vendors, of which five have been rated. Further, mobile and web applications for registration of vendors are now live. CII-GBC also signed an MOU with Small Industries Development Bank of India (SIDBI) for promotion of rated vendors for financing rooftop solar project.



Capacity building among government officials on best practices in renewable energy procurement

The USTDA's Global Procurement Initiative (GPI) educates public officials in emerging markets on how to establish procurement practices and policies that integrate life-cycle cost analysis and best value determination in a fair, transparent manner. USTDA is developing the Regional Energy Procurement Program for South Asia (REPPSA), which envisions capacity building of procurement officials in Nepal, Maldives, Sri Lanka, and on best practices in renewable energy and sustainable procurement. The USTDA is starting a similar program specifically for Indian partners for which state-specific, energy sector-focused stakeholder consultations were held.

Improving renewable energy forecasting institutional framework and capacity



USAID is providing support to improve the current institutional framework and institutional capacity for forecasting of RE generation to meet India's enhanced target of non-fossil generation capacity by 2030. Based on review of international experience on type of forecasting, institutions involved in RE forecasting, model used, and horizon of forecasting, gaps in the existing framework and key takeaways for India were identified and presented to National Institute of Wind Energy (NIWE), India and the MNRE. The final report will soon be available.

The National Renewable Energy Laboratory (NREL), USA, also partnered with NIWE to advance capabilities in forecasting for RE to improve dispatch capabilities of utility-scale solar and wind plants. The NREL assisted with implementing solar forecasting methods, analyzing, and validating forecasts, and will provide quality assessment methods to apply to future data. NREL has developed a prototype for implanting its Physics-based Smart Persistence model for intra-hour forecasting of solar radiation (PSPI) and the NIWE has started using this model to produce forecasts for multiple sites in India. In addition, NREL has also started supporting NIWE in implementation of data imputation techniques, and capacity building in implementing forecasting and data imputation methods.



SUCCESS STORIES

(CAPACITY BUILDING AND BEST PRACTICES)

Peer-to-peer partnership between US-India System Operators and Regulators

USAID undertook several activities to strengthen the capacity of system operators, regulators, and other key stakeholders on issues related to grid integration. These include a bootcamp workshop on financial derivative instruments in power trading and power exchanges, regulatory series on financial derivatives in the power sector comprising a series of six webinars, and a regulatory study tour on financial derivatives



South Asia Group for Energy (SAGE) partnership to drive excellence in bioenergy and hybrid biomass renewable energy systems

SAGE, a consortium consisting of USAID, the US Department of Energy (DOE) and their National Laboratories (PNNL, LBNL and NREL) partnered with Indian institutions to conduct joint research, develop methodologies, and capacity building of partner governments in South Asia.

As part of bioenergy collaboration between PNNL, LBNL and National Institute of Bio-Energy (NIBE), the partnership is providing insights regarding the cost benefits associated with shifts to increased sustainable farming practices and the environmental impacts of addressing agricultural waste burning within India. PNNL and NIBE finalized the scientific article entitled "Integrated Analysis of Increased Bioenergy Futures in India". This manuscript investigated the sustainability implications of increasing the use of bioenergy in the power sector. The PNNL team, in collaboration with NIBE and LBNL, participated in three separate webinars and conferences to present findings from both the Hybrid Bioenergy and the Sustainable Farming work plans. LBNL and PNNL are collaborating with NIBE to assess the techno-economic potential of biomass and hybrid biomass-renewable energy systems for India's evolving grid based on biomass supply chain and fuel availability constraints. The results, insights and conclusions of the study were shared with MNRE and USAID during a webinar on the future of bioenergy in India. LBNL and PNNL also wrote articles on the results of this analysis. LBNL is also assisting NIBE scientists in preparing the necessary documentation needed for the International Organization for Standardization certification of biomass cookstoves testing laboratory.



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

