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MINISTRY OF NEW AND RENEWABLE ENERGY

PARTNERSHIP TO ADVANCE CLEAN ENERGY–DEPLOYMENT 2.0 RENEWABLE ENERGY PROGRAM (PACE-D 2.0 RE)

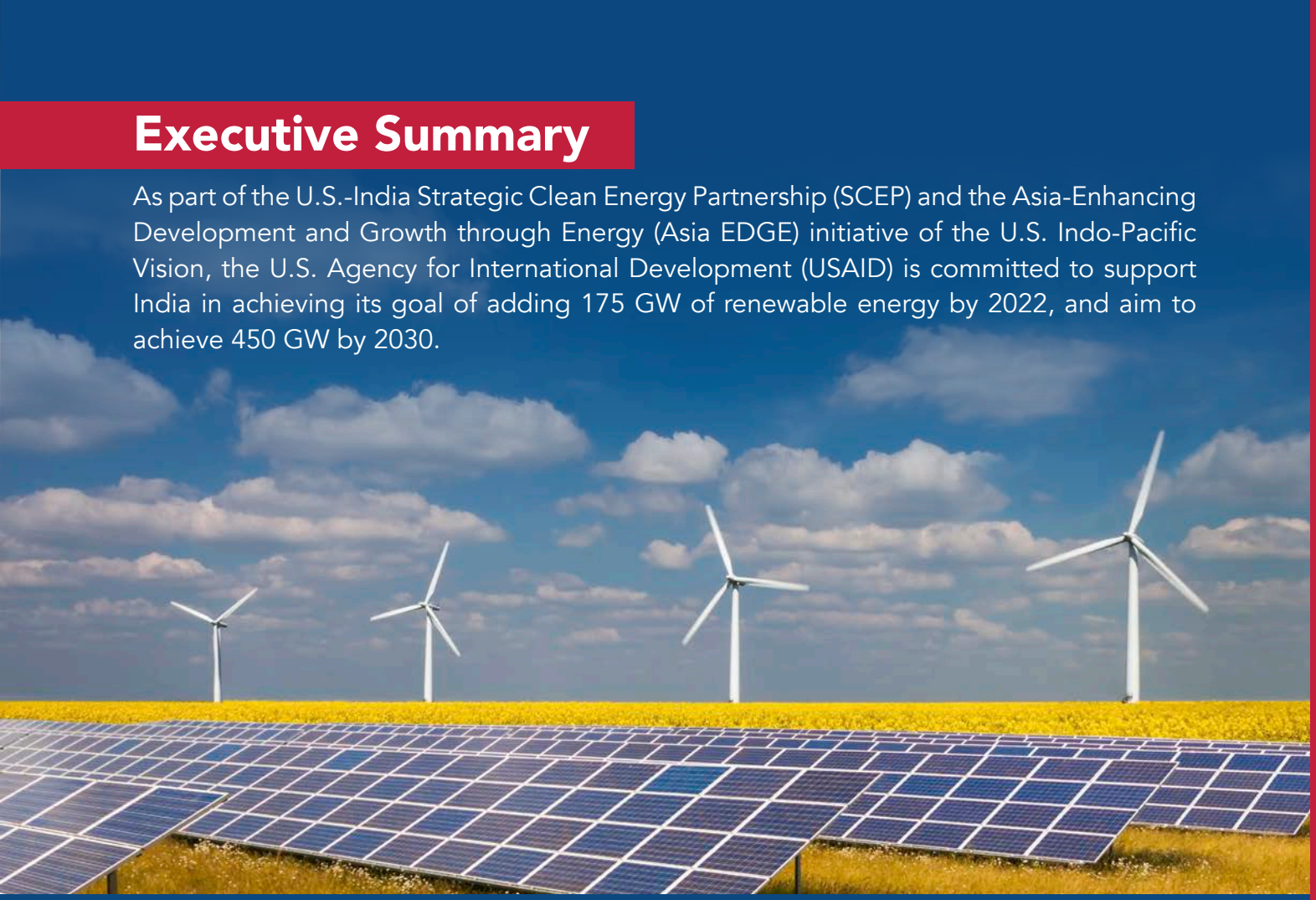
IMPACT REPORT

JANUARY 2019 - JUNE 2021

PACE-D 2.0 RE
IMPACT REPORT

Executive Summary

As part of the U.S.-India Strategic Clean Energy Partnership (SCEP) and the Asia-Enhancing Development and Growth through Energy (Asia EDGE) initiative of the U.S. Indo-Pacific Vision, the U.S. Agency for International Development (USAID) is committed to support India in achieving its goal of adding 175 GW of renewable energy by 2022, and aim to achieve 450 GW by 2030.



USAID's Partnership to Advance Clean Energy–Deployment 2.0 Renewable Energy (PACE-D 2.0 RE) the second phase of U.S.-India PACE-D initiative was implemented in partnership with the Indian Ministry of New and Renewable Energy (MNRE) to help national and state partners provide reliable, clean energy to consumers at an affordable price

India's power sector has transformed in the last decade, doubling power generation capacity from 132.33 gigawatts (GW) in 2007 to 370 GW in 2020 and achieving 100 percent electrification. It is now the world's third-largest producer and consumer of electricity and ranks fourth in wind power, fifth in solar power, and fourth in total renewable capacity, including hydropower. Nevertheless, the sector still faces several challenges: energy demand and fossil fuel imports are both increasing as the population climbs toward 1.5 billion; power distribution companies (DISCOMs) are in poor financial condition; and air pollution has precipitated a public health crisis. To address these and other challenges, the Government of India has set a renewable energy (RE) target of 175 GW by 2022 including the 40GW of solar rooftop energy by 2022 and aim to achieve 450 GW by 2030.

MNRE-USAID PACE-D 2.0 RE partnered with the states of Assam, Gujarat, and Jharkhand, Indian Railways, Solar Energy Corporation of India (SECI), Confederation of Indian Industry, Godrej Green Business Center (CII-GBC), and other agencies to improve strategic energy planning, scale grid-connected distributed renewable energy, and adopt innovative renewable energy procurement models. PACE-D 2.0 RE is part of Scaling Up Renewable Energy (SURE), a global USAID program that helps partner countries enhance their energy security and open paths to self-reliance through competitive renewable energy markets.

The MNRE–USAID PACE-D 2.0 RE program, in two years, delivered several innovative and state-of-the-art solutions to enable achievement of RE targets in a reliable and cost-effective manner:

Long-Term and Medium-Term RE Planning Software Tool for DISCOMs

PROGRAM COMPONENT 1

Under the guidance of national agencies, power industry, and IT experts, PACE-D 2.0 RE developed the DISCOM Renewable Procurement Optimization and Smart Estimation (REPOSE) software tool. REPOSE helps to accurately forecast mid- and long-term power demand, simulate various renewable energy scenarios, optimize costs, and provide mid term and long term renewable energy plans for utilities and states.

DISCOMs in Assam, Jharkhand, Punjab, Orissa, and Karnataka states have successfully adopted and utilized this tool. With the help of REPOSE, Assam developed a renewable energy procurement plan to increase the use of RE to 30 percent by 2030 while reducing the power procurement cost by 5 percent compared to the usual scenario. The tool can be used for a region to further optimize cost and RE utilization.

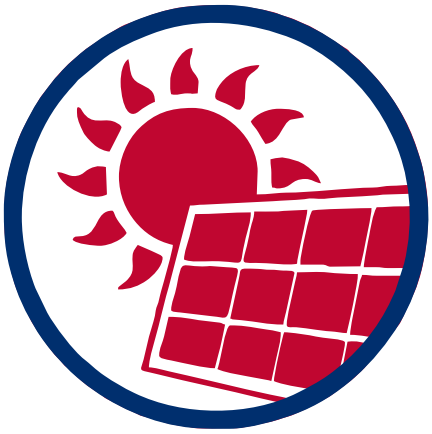
Super RESCO Model for Deployment of Solar Rooftop with Low-Paying Customers

To enhance the engagement of residential consumers in the solar rooftop journey, the PACE-D 2.0 RE program developed an innovative Super RESCO model and demonstrated how deployment of solar rooftops for low-paying customers can benefit the customers and DISCOMs and create local jobs. It is estimated that this model has the potential to save $800 million annually if 15 percent of residential power supplied to residential customers with high T&D losses comes from solar rooftops. PACE-D 2.0 RE partner state, Jharkhand is piloting a 25 MW project using the Super RESCO business model.

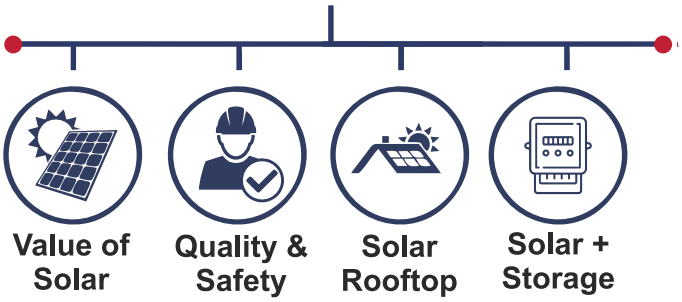
Market-Based Approach to Enhance Quality and Safety of Rooftop Solar Projects

Policymakers, investors, and customers were concerned about the quality and safety of solar rooftop deployment. In response, the PACE-D 2.0 RE program in partnership with the Green Business Center of the Confederation of Indian Industries (CII-GBC) established a market-based dynamic Vendor Rating Program. This rating program will help improve the quality and safety of the 33 GW of solar rooftops expected to be installed in the coming years.

PROGRAM COMPONENT 2



Scaling Grid-Connected Distributed RE



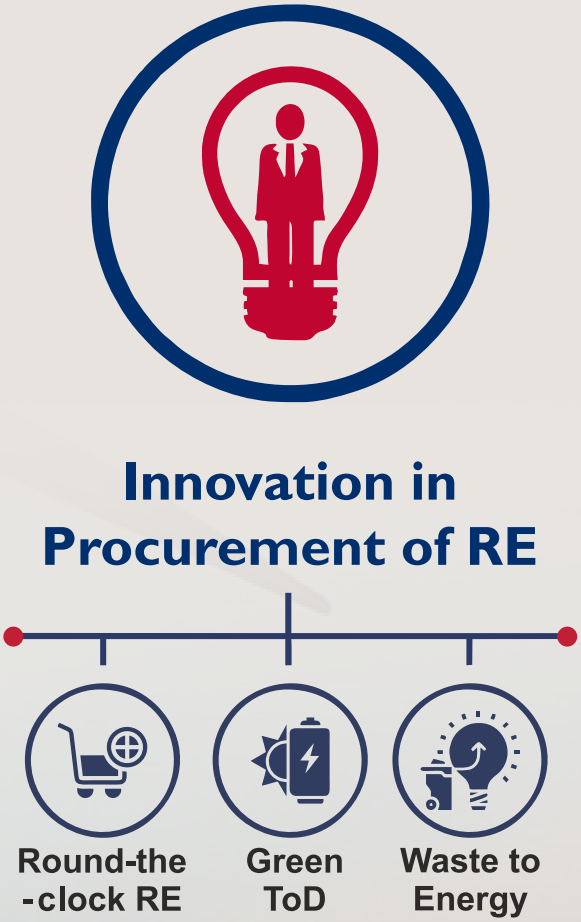
Sharing Benefits of Low-Cost RE with Customers

The PACE-D 20. RE program in partnership with the Assam and Jharkhand developed the concept of the green time-of-day tariff (Green ToD) to help the states utilize low-cost renewable energy during the day. The green ToD tariff incentivizes the use of renewable energy by shifting demand from the supply shortage time and generating new demands.

Analysis suggests that a green ToD tariff that is a modest 10 percent lower than the normal tariff will result in a demand shift of 4 percent and generation of 0.6 percent new demand at the national level. The green ToD tariff can be used by states that have surplus power during the high renewable energy generation period.

Innovative RE Procurement Designs to Increase RE Use at Reduced Cost

PROGRAM COMPONENT 3



Based on international experience, the program introduced the concept of system-friendly procurement of renewable energy to reduce integration costs. The Solar Energy Cooperation of India made use of the concept in procurement of 1.6 GW of RE power, and Indian Railways is planning to procure 150 MW under a program promoted round-the-clock power model.

An analysis conducted with the REPOSE software suggests that innovative RE procurement, such as profile matching of RE and demand, can help DISCOMs increase RE use by 10 to 15 percent and reduce cost by 5 to 10 percent.

To scale these innovative solutions, MNRE–USAID PACE-D 2.0 RE worked with national and state-level partners to develop and adopt enabling policies, regulations, tools, and methodologies that would set up DISCOMs for success during and after the pandemic and help India achieve its renewable energy goals. Capacity-building efforts intensified with virtual webinars and professional trainings. The program also made efforts to scale its successful approaches across the South Asia region, launching an online certification program on strategic energy planning. Through two training programs 123 utility professionals were trained, and efforts are underway to institutionalize the training program with a premier Indian technical institution

With support from PACE-D 2.0 RE, program partner states and institutions are better able to plan, finance, and implement innovative solutions that accelerate India's transition to a clean energy economy. DISCOMs are now more strategic, innovative, and efficient. They also have adopted more market-driven approaches to attract private sector investments in renewable energy technology. States are seeing an increase in private investment in the renewable energy market and are training the workforce in the skills needed to transition to the clean energy economy. Institutions are better equipped to respond to energy and climate challenges and support communities and individuals to have clean, lower-cost, and reliable electricity.

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Strategic Energy Planning

Energy resource planning determines when, where, and how to invest. When done well, today's decisions address tomorrow's needs and challenges. Strategic energy planning helps predict consumers' electricity needs more accurately, makes renewable energy procurement more cost effective, and matches electricity demand with the renewable resources leading to minimum system integration cost. The cost of purchasing power accounts for 60 to 70 percent of DISCOMs' total costs. Better—more strategic—resource planning has the potential to reduce cost by 5 to 10 percent. These savings not only improve DISCOMs' financial health but also help transfer the benefits to consumer at reduced tariffs and more sustainable energy.

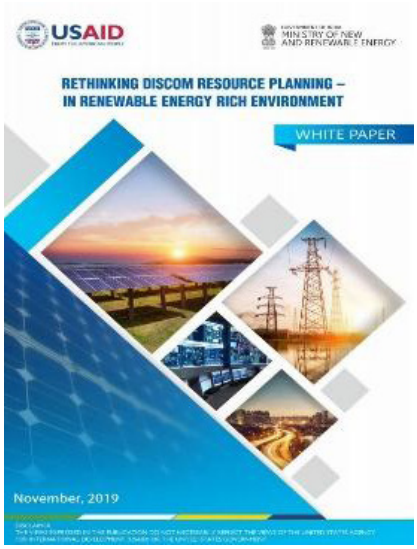
PACE-D 2.0 RE has worked on four interconnected activities:

1. Development of a white paper;
2. Development of a software tool for resource planning by DISCOMs in RE-rich environments;
3. Model regulatory framework for regulators to adopt best practices in resource planning; and
4. Capacity-building of power sector professionals for resource planning.

By applying strategic and innovative resource planning approaches, India can accelerate the transition to a clean energy economy, making power supplies more green, reliable, and cost-effective.

White Paper

The PACE-D 2.0 RE program catalyzed a national dialogue that resulted in a white paper, "Rethinking DISCOM Resource Planning in a Renewable Energy–Rich Environment." The paper helps states and agencies understand the need for better planning and what it will take to get there. It highlights the importance of resource planning in a renewable energy–rich scenario, covering international best practices compared to local practice. This was the first paper to provide a comprehensive assessment of national and state-level planning practices.



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It helped identify critical gaps and recommended (i) increasing awareness of the importance of resource planning; (ii) creating a regulatory framework for resource planning, (iii) developing software tools, (iv) making risk and uncertainty management an integral part of resource planning; and (v) building capacity of workforce at all levels.

DISCOM REPOSE Software Tool

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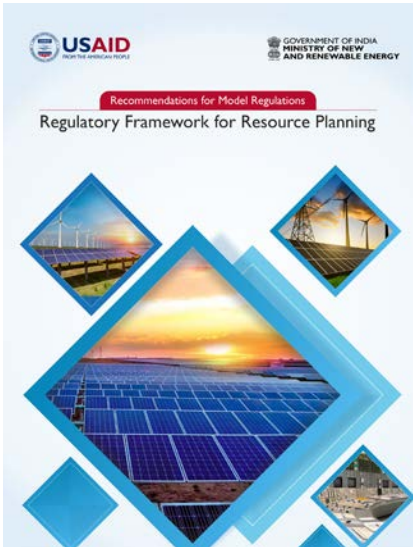
Globally, several software tools are available for long- and medium-term resource planning. The global tools do not address adequately the requirements of the Indian power sector which is transitioning from coal dominance to RE dominance. In addition, they are costly, license based and require specialized workforce to operate them. PACE-D 2.0 RE developed the REPOSE software specifically to address India's energy planning needs, and the tool is now used by Assam, Jharkhand, Karnataka, Punjab, Odisha, Rajasthan, and Tamil Nadu. REPOSE helps DISCOMs more accurately estimate consumers' energy needs, match demand with a power portfolio that integrates renewable energy, and maximize cost-effective renewable energy procurements. It also incorporates new technological advancements such as demand response, electric vehicles, and energy efficiency.

REPOSE consists of three modules: demand forecasting, resource mapping, and power procurement. It also comes with a user manual and a training guidebook that are now publicly available for use by all DISCOMs in India and by other countries across the region.

With the help of REPOSE, DISCOMs in partner states Assam and Jharkhand have developed strategies to reduce power purchase costs by five to ten percent ($35 million annually for each DISCOM) and increase the share of electricity from renewable energy to 30 percent by 2030.

Regulatory Framework

In consultation with various state and national agencies, PACE-D 2.0 RE developed model regulations for medium- and long-term load forecasting, resource planning, and power procurement and presented them to the Central Electricity Regulatory Commission (CERC), Forum of Regulators, State Electricity Regulatory Commissions, several DISCOMs, and the regulatory commission of 12 states. Adoption of these regulations would result in a standardized approach to energy planning that would clear a path for DISCOMs to function efficiently and lead to savings across India.



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Capacity-Building

In 2020, PACE-D 2.0 RE laid the foundation to replicate its resource planning strategies throughout the region. I A six-week online certification program was developed to prepare women and other young professionals in South Asia to develop resource plans for their utilities using REPOSE. More than 43 professionals from 22 institutions in Bangladesh, Bhutan, India, Maldives, Nepal, and Sri Lanka have graduated from the program.

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Delivered by national and international experts, the training program was developed under the guidance of Advisory committee comprising of experts from Central Electricity Authority, IIT Kanpur, partner state DISCOMs (Assam and Jharkhand), and BSES-Delhi.

PACE-D 2.0 RE also engaged over 200 policymakers, power utility planners, and regulators in a panel at the 2020 Asia Clean Energy Forum to promote knowledge exchange among Asian countries facing similar challenges. As a result of the program's regional work, Nepal may adopt a new regulatory framework to improve resource planning.

Given the high demand for upskilling utility planners and regulators, the program hosted its second cohort in 2021, where 80 professionals from 12 organizations in Jharkhand, Karnataka, Odisha, Punjab, Tamil Nadu, and West Bengal were given hands-on experience with the REPOSE software.

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Scaling Grid-Connected DPV

Grid-connected distributed photovoltaics (DPV), also known as rooftop solar, has seen wide deployment in India and features prominently in the government's plans for a transition to clean, reliable, and affordable energy for all. To implement this plan, the Government of India has set the target of 100 GW of solar by 2022, with 40 GW targeted to come from rooftop solar. As of September 2020, only 6 GW had been installed.

PACE-D 2.0 RE worked with MNRE to scale DPV by establishing compensation for rooftop solar, encouraging low-paying consumers to use it, improving its quality and safety, and developing technical standards and interconnection regulations for DPV-plus-storage.

Innovative Business Model for Rooftop Solar PV Pilots for Low-Paying Consumers

Rooftop solar photovoltaic (PV) systems are reducing the cost of electricity, but low-paying (consumers with subidized tariff) are unable to make use of this technology. Despite government subsidies that cover up to 40 percent of project costs for 3 kW capacity, rooftop solar is too expensive for many residential consumers. However, adequate penetration of solar rooftops in the residential consumer base will make it much easier for India to achieve its 2022 targets.

To increase participation in the residential rooftop solar program, PACE-D 2.0 RE conceptualized the Super Renewable Energy Company (Super RESCO) business model for solar PV systems that will benefit low-paying consumers and DISCOMs. In this new public-private partnership, the DISCOM acts as a Super RESCO between the developers and consumers. Consumers grant RESCOs the use of their roof for a solar PV system, then receive financial compensation or a discounted electricity bill from their DISCOM. DISCOMs aggregate the power demand and sign power purchase agreements with RESCOs to buy the solar energy. RESCOs make the capital investment and operate the solar PV systems. According to PACE-0 2.0 RE's financial and economic


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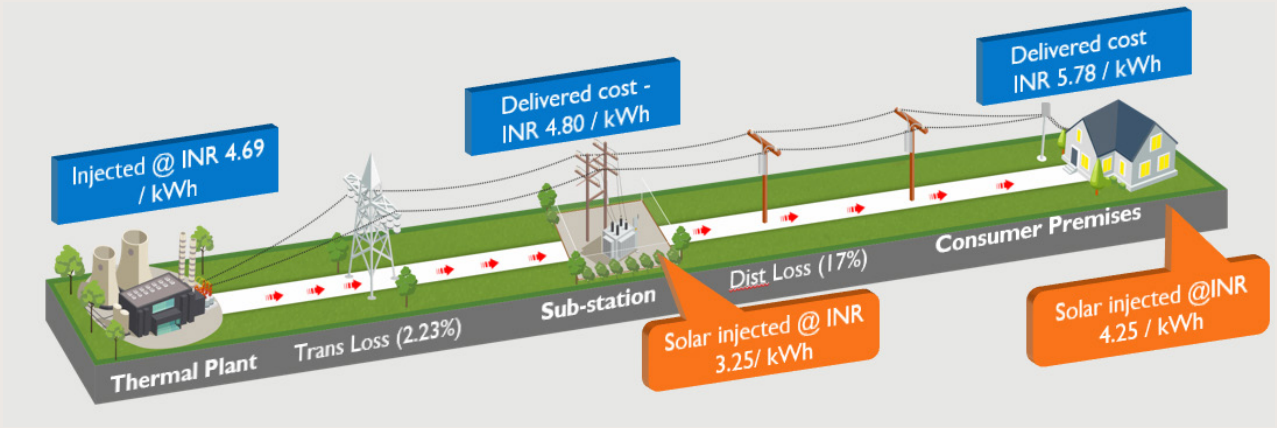
analysis, the deployment of 250 megawatts peak (MWp) of solar rooftop in Assam will result in an investment of $140 million, generation of 1,250 new jobs, and reduction of 350 million tons of carbon emission annually. It will also result in an annual savings of $14 million for APDCL, the state's DISCOM.



Similarly, in Jharkhand, the replacement of 15 percent of residential consumption by solar rooftop will result in systemic gains of $100 million and the creation of over 4,000 jobs. The Super RESCO model supports a reduction in aggregate technical and commercial losses which lowers the cost of supply and the subsidies burden.

Using this model, DISCOMs will be able to meet their solar renewable purchase obligation targets without having to purchase renewable energy certificates. Finally, by bringing the generation source closer to the load, the Super RESCO model reduces system capacity, improves last-mile power reliability and quality, and reduces greenhouse gas emissions by meeting more energy demand with renewable sources.

In April 2021, JBVNL floated a tender of 25 MW capacity of rooftop solar PV for low-paying consumers using the PACE-D 2.0 RE-developed Super RESCO model. PACE-D 2.0 RE also developed a white paper on how the Government of India can rollout the Super RESCO model nationally. If solar PV rooftops are scaled nationally and reach a 15 percent penetration level at 22 percent T&D losses, then DISCOMs will save $788 million annually, 134,099 new jobs will be created, and carbon emissions will be reduced by 37,494 million tons per year.

Market-Based Approach to Enhance Quality and Safety of Rooftop Solar Projects

The quality and safety of rooftop solar PV systems and their installation is a concern to government, regulators, DISCOMs, responsible vendors, and consumers. Many vendors try to increase their competitiveness and win jobs by compromising on quality and safety to cut costs; other contractors and installers simply lack capacity or knowledge. The complexity of the installation makes it difficult for consumers who have limited knowledge to evaluate vendors' work. While policymakers and regulators have set standards for solar PV projects, monitoring is needed to ensure on-the-ground compliance with these standards.

Based on active stakeholder engagement, interviews, and other research, PACE-D 2.0 RE in partnership with the U.S. National Renewable Energy Laboratory (NREL) produced "Distributed Solar Quality and Safety in India—Key Challenges and Potential Solutions," a report released at the U.S.-India Strategic Energy Partnership Ministerial meeting in July 2020. It recommends ways to improve the quality and safety of solar PV systems and their components, workmanship during installation, and operations and maintenance throughout the life of each system. The study found that design quality, installation operations and maintenance, and component quality contribute 15 percent, 35 percent, and 50 percent to the overall quality of solar PV rooftops.

PACE-D 2.0 RE partnered with the Confederation of Indian Industry-Green Busines Council (CII-GBC) to develop, refine, and launch the Vendor Rating Framework (VRF) that would require installers to be rated based on a system's compliance with standards determined by MNRE and state government and other parameters relevant to ensuring the vendor is capable of quality work. PACE-D 2.0 RE worked with CII-GBC to develop a complimentary online resource for rooftop solar consumers, investors, and developers that would monitor, evaluate, and rate vendors' work. This rating system will incentivize vendors to participate and continually improve the quality of their installation services, which will also increase the generation efficiency of installations.

PACE-D partnered with Gujarat Energy, Research and Management Institute (GERMI) to pilot and test the VRF with ten rooftop solar vendors in Gujarat that were responsible for the design, procurement, and installation of solar PV rooftops or distributed PV systems. The pilot reinforced the utility and effectiveness of the VRF in identifying low-cost measures to improve quality and safety. The pilot suggested assessors require training and necessary equipment. The solar vendors

who participated in the pilot supported the VRF and informed that the report findings were useful for improving the workmanship in their rooftop installations.

The VRF will help create a network of high-performing solar integrators and engineering, procurement, and construction companies that adhere to MNRE and state government quality and safety installation standards. It will help boost the confidence levels of lenders and users and ultimately help the Government of India reach its solar rooftop targets.

Enabling Distributed PV Plus Storage

Pairing behind-the-meter energy storage systems with DPV creates a system that can act as both generation and load. The combination can help shift excess solar generation to different periods in a day. Unused generation can be stored during peak solar generation hours and used to reduce net peak loads. This shifts demand to the daytime, when solar generation is plentiful. DPV-plus-storage can also provide backup power to meet demand during grid outages, powering hospitals or emergency shelters during crises. This unique and disruptive technology is capable of providing a range of important services to customers, utilities, and India's entire power system.

In DPV-plus-storage programs, policymakers and regulators have an opportunity to create new market opportunities for consumers, DISCOMs, and project developers while making significant strides toward their clean energy goals.

PACE-D 2.0 RE conducted five DPV-plus-storage workshops in Assam, Gujarat, and Jharkhand to sensitize them about the importance of this technology and share lessons learned from the United States on promoting DPV-plus-storage. In collaboration with the National Renewable Energy Laboratory (NREL) and Lawrence Berkeley National Laboratory, PACE-D 2.0 RE developed "An Overview of Behind-the-Meter Solar-Plus-Storage Program Design: With Considerations for India." The white paper recommends regulatory considerations to facilitate DPV-plus-storage programs for customers and offers a framework as well as a suite of policies, programs, and regulations to enable DPV-plus-storage as the cost of storage declines. A recent publication by

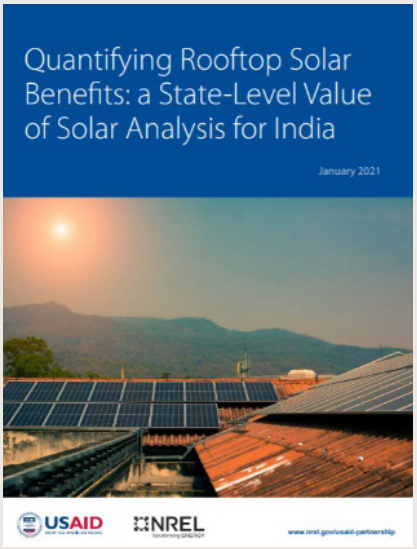
NITI Aayog—India's Energy Storage Mission—highlights the Government of India's goal to reduce the cost of batteries to $60/kWh by 2030 by promoting battery manufacturing plants.

NREL in partnership with PACE-D 2.0 RE developed a white paper that recommends regulatory considerations to facilitate DPV-plus-storage programs for customers and offers a framework as well as a suite of policies, programs, and regulations to enable DPV-plus-storage as the cost of storage declines. PACE-D 2.0 RE and NREL worked with the Gujarat Electricity Regulatory Commission (GERC) to identify amendments its net-metering regulations to include behind-the-meter DPV-plus-storage that will benefit consumers. DISCOMs can reduce operational and capital expenditures, manage network congestion, reduce peak demand, or even drive new revenue with customer-centric DPV-plus-storage offerings. Consumers can improve the quality and reliability of their electricity and reduce their bills by installing DPV-plus-storage.

Value of Solar Analysis: A Tool for Determining Solar Tariffs

In most states in the United States, the value of solar analysis is used to evaluate rooftop solar policies with quantitative evidence. It can drive policy changes, such as fairer, more cost-reflective rooftop solar compensation, or it can confirm the effectiveness of current policies.

Indian utilities generally perceive rooftop solar systems as negatively affecting their revenue because they lose high-paying (cross-subsidizing) customers, such as commercial and industrial consumers. Showing the true value of solar energy, such as its environmental and health benefits, reduced network congestion, and lower costs, can help increase DISCOMs' support for rooftop solar and bolster states' efforts to incentivize adoption.



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PACE-D 2.0 RE with NREL conducted an analysis to identify the value of solar generation based on other supply-side resources, the transmission network, and the environmental value in Gujarat and Jharkhand. Policymakers, regulators, and other stakeholders can use the analysis to determine whether to adjust compensation mechanisms for rooftop solar in light of concerns around cost-shifting between customers who do and do not adopt the systems. This data-driven approach could drive adoption where it is most beneficial and maintain deployment without exacerbating cost-shifting.

The program presented its results to the electricity regulatory commissions of Gujarat and Jharkhand in a report: "Quantifying Rooftop Solar Benefits: A State-Level Value of Solar Analysis for India." PACE-D 2.0 RE also developed a simplified model to help Jharkhand determine the optimal solar tariff. Performed using a PLEXOS model, the main analysis suggests that the short-term value of solar is $0.03–$0.06/kWh across the scenarios considered for Gujarat and Jharkhand when the environmental and health value are excluded. With environmental and health consideration, value of solar expands the benefits to the range of $0.07 - $0.10/ kWh for Gujarat and Jharkhand respectively.

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Innovative Procurement Strategies for Renewable Energy

As the share of renewable energy in power systems grows, system integration challenges and associated costs increase. The Central Electricity Authority estimates that grid integration costs already make up close to half of the bid prices in energy procurements. PACE-D 2.0 RE is partnering with MNRE to deploy more renewable energy while reducing integration costs.

System-Friendly Renewable Energy Procurement

India needs to auction 40 GW of solar and wind capacity every year until 2030 to meet its renewable energy goal of 450 GW of 450 GW. System-friendly procurement can support a higher uptake of renewable energy and can improve the match between power supply and demand by securing more dispatchable renewable energy to meet demand, even during peak times. With the help of the Solar Energy Corporation of India, India has tried a model suggested by PACE-D 2.0 RE for RE procurement. The model supports use of RE beyond the hours of its availability at a price competitive with fossil fuel–based generation. PACE-D 2.0 RE's analysis and recommendations influenced the nature of competitive energy bidding in India.

PACE-D 2.0 RE conducted six workshops and webinars on this topic to encourage system-friendly RE procurement with DISCOMs, the Central Electricity Regulatory Commission, State Electricity Regulatory Commissions, Solar Energy Corporation of India, MNRE, and developers, financiers, and institutions in Ahmedabad, Delhi, Guwahati, and Ranchi.

PACE-D 2.0 RE published "System-Friendly Competitive Procurement for Renewable Energy in India," a white paper released at a workshop on November 1, 2019, in Delhi. This was the first white paper in India to recommend procurement of renewable energy power based on the profile of system demand rather than absolute megawatts. One of the key recommendations in the white paper was to move toward round-the-clock use of renewable energy and issue policy

directions. MNRE and the Ministry of Power recognized the importance and issued the guidelines for procuring renewable energy for round-the-clock (RTC) power.

System-friendly procurement minimizes system integration costs and maximizes the utilization factor of RE by incorporating renewable energy considerations according to the demand profiles in the award decision. It minimizes transmission costs by procuring electricity from installations with fewer grid integration challenges. It also minimizes intermittency by procuring complementary firm power that reduces the need for system balancing. DISCOMs can use the PACE-D 2.0 RE–developed REPOSE software for simulation studies and to use the future demand profile to develop the RE procurement profile.

After the successful bid of a 1.2-gigawatt (GW) time-block tender worth $1 billion in January 2020, the Solar Energy Corporation of India launched another bid in March 2020 for 5 GW of round-the-clock power worth $4 billion. PACE-D 2.0 RE provided lessons learned and global best practices in innovative and system-friendly competitive bidding to SECI to incorporate into these tenders. The SECI bid marked a significant step toward system-friendly procurement of renewable energy in India that will allow DISCOMs to procure more renewable electricity at reduced generation and integration costs. Based on the success of "round-the-clock" (RTC) power tenders, the MNRE announced its intention to only use RE auctions for RTC power and RE hybrid projects (*e.g.*, those combining wind and solar power to generate electricity during the day and night). This move is expected to make clean power more competitive against traditional thermal power plants. These new procurement approaches, recommended by USAID, address RE challenges such as variability, limited hours of supply, and low-capacity utilization of transmission infrastructure.

PACE-D 2.0 is helping decarbonize the transportation sector in India. Currently, Indian Railways uses electricity or high-speed diesel to power trains (traction load). PACE-D 2.0 RE partnered with Indian Railways to develop a round-the-clock power tender of 150 MW to run trains on renewable energy, complemented with energy storage systems. This will help Indian Railways meet its goal of using 100 percent green power by 2030. PACE-D 2.0 RE also supported the Kolkatta Metro to develop battery specifications for tunnel ventilation.

Innovative RE Procurement to Increase RE Use at Reduced Cost

New Approaches

Benefits Round-the-Clock power	More dispatchable RE for supply-demand match	More firm RE power (on-site or different locations)	Demand-based supply managed by seller

Green Time-of-Day Tariff

As India moves toward achieving its 100 GW solar target by 2022, it requires strategies to fully utilize the power generated by the projects while thermal power plants continue to operate at their economic minimum. The intermittent excess supply in the day should lead to lower tariffs since the cost of solar generation is low and thermal power is available only at variable cost. Lower tariffs, in turn, should lead to increased demand, resulting in a more active economy and better quality of life.

One important tool to promote solar energy use is tariffs. A time-based green tariff can balance supply with demand by lowering the price during the day (or peak production season) when supply is high and increasing it in the evening (or other times) when supply is lower.

PACE-D 2.0 RE conducted a webinar on green tariff design and deployment in August 2020 for more than 100 participants from DISCOMs, state electricity regulatory commissions, private developers, and other experts. The webinar suggested the need to change the design of retail tariffs to accommodate the emerging supply-demand situation at different times of the day. Another recommendation was to educate consumers to take advantage of the reduced tariffs by shifting their demand.

PACE-D 2.0 RE analyzed how green tariff measures for JBVNL and APDCL can help pass the benefits of lower-cost solar generation to consumers. The program worked with the DISCOMs of Assam and Jharkhand and studied practices adopted by DISCOMs of other states to promote consumption. The program also developed a report focused on the state with the second lowest per capita energy consumption in India, "Optimal Market-Based Utilization of Electricity Supply Resources of Assam." PACE-D 2.0 RE found that a green tariff rebate of $0.01/kWh will increase the energy sales of APDCL by 6.6 percent and revenues by at least $4 million annually.

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USAID PACE-D 2.0 RE released a white paper , proposing a green time-of-day tariff as a demand-side solution for cost-effectively absorbing the higher RE penetration. The paper presents the case studies of Assam and Jharkhand, highlighting the analysis to determine the green ToD tariff and its implementation. The program also developed an Excel-based tool, available on the PACE-D 2.0 RE website, to design green ToD tariffs.

PACE-D 2.0 RE introduced and designed a time-based green tariff model, which balances supply with demand by lowering the price during the day (or peak RE production period) when supply is high. PACE-D 2.0 RE a conducted study for Assam and found that by reducing the green ToD by 1 Rs/kWh, there is a 6 percent increase in demand that will benefit APDCL annually by INR 297 million.

Bio Urja

The PACE-D 2.O RE program worked closely with MNRE and supported the following two activities:

1. Update of the Bio Urja portal of MNRE, and
2. Creation of procurement guidelines for waste-to-energy projects.

The integrated Bio Urja portal will help project Developers submit online applications for bioenergy projects, and MNRE can provides their approval on the portal, reduing the decision-making time and improving transparency. The portal also includes State Nodal Agencies for Renewable Energy (SNA) for providing their recommendations online.

Municipal solid waste generation in India is expected to reach 0.45 million tonnes per day by 2031. To deal with the growing amount of waste, conversion of waste to energy is a sustainable solution. However, the waste-to-energy projects are marred with a high failure rate due to the sheer technological complexity involved in setting up and operating such a facility and cooperation by multiple stakeholders.

The program also worked with MNRE to develop guidelines for waste-to-energy projects. The guidelines will help states with faster procurement and bring uniformity of approach to all the states in India.The guidelines will be placed on the MNRE website after public consultation.

Collaborations

The PACE-D 2.0 RE program built partnerships with Assam, Jharkhand, and Gujarat at the state level and with SECI and Indian Railways at the central level at the start of the program to develop innovative concepts for higher deployment of renewable energy in a cost-effective manner. As the program progressed, USAID developed long-term partnerships with CII, IIT-Kanpur, and IIT-Roorkee to amplify the program learnings. CII is the largest conglomerate of Indian industries, while IIT-K and IIT-R are highly respected technology institutes in India. These organizations will continue to apply best practices and lessons learned from PACE-D 2.0 RE, even after the program concludes.

CONFEDERATION OF INDIAN INDUSTRIES-GREEN BUSINESS COUNCIL (CII-GBC)

The program engaged CII-GBC to adopt and implement the VRF developed in the program to improve quality and safety of the SPVRT in India after PACE-D 2.0 RE closeout. The process started in 2019, and the program conducted several meetings with CII-GBC to involve and sensitize them about the importance of the VRF, including the business case. In late 2020, CII-GBC convened a special task force to review the VRF and business plan developed by the program. CII-GBC is now

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on board and launched the VRF on May 20, 2021, announcing that the rating of the vendors will start on September 1, 2021, after necessary preparations to develop the assessors and complete the software are complete.

INDIAN INSTITUTE OF TECHNOLOGY KANPUR (IITK)

The program started involving IITK while developing a white paper on rethinking the RE-rich environment and continued their involvement to finalize the system requirement specifications for REPOSE and design and deliver the capacity-building program on integrated resource planning using REPOSE. The IITK has shown interest in utilizing training materials developed on resource planning and uploaded it on the portal of the Centre of Energy Regulations (CER), managed by IITK. The draft memorandum of association for a long-term relationship between IITK and USAID is under review.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE (IITR)

The program conducted two capacity-building programs with IITR—a two-day program on solar rooftops for low-paying customers using the Super RESCO model and a one-day program on green ToD tariffs. Both programs were attended by more than 100 participants. Encouraged by the response, IITR has written to USAID, requesting to repeat those programs after six months and expressing interest in collaborating on other topics as well.

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Capacity-Building

Improving human and institutional capacities was at the core of the program. PACE-D 2.0 RE trained professionals on several aspects of RE but specifically built capacity on four new innovations that came out of the program and attracted the attention of several stakeholders:

1. Long-term and medium-term planning in the RE environment;
2. Super RESCO model for deployment of solar rooftops with low-paying customers;
3. Design and implementation of the green ToD tariff; and
4. Innovative RE procurement

PACE-D 2.0 RE engaged over 200 institutions and educated and trained over a thousand policymakers, utility employees, regulators, developers, and financial and academic institutions through several training programs. Special emphasis was given to promoting women's participation in the energy sector.

PACE-D 2.0 RE Program Indicators (2019-2021)

118.5 MW

Clean Energy Capacity Supported

Target: 59 MW

1112

People Trained (935 men; 177 women)

Target: 390

223

Institutions Trained

Target: 28

$76.18 M

Investment Leverage

Target: $57.21

5 Tools Developed **Target:** 5

1,302,350 tCO2 GHG emission reduced

Target: 664,585 tonnes of CO2

4 Policies Proposed **Target**: 4

5 Tools Developed

- Demand forecasting tool
- Resource mapping tool
- Power procurement optimization tool
- DPV Low Paying Pilot –Jharkhand
- Green ToD model with Assam

4 Laws, Policies, Regulations, or Standards Adopted

- Regulatory Framework for Demand Forecasting, Resource Mapping, and Power Procurement
- Time-Variant Demand Charge for GERC
- Framework of Quality and Safety Standards for Solar Rooftop Vendors
- Amendment to Net-Metering Regulations of GERC for Inclusion of Behind-the-Meter Storage.

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Program Partners: