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

ANNUAL REPORT 2020



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ANNUAL **20** REPORT **20**

This report summarizes the activities of the
**Partnership to Advance Clean Energy
Deployment 2.0 (PACE-D 2.0 RE)**
program from June 2019 to September 2020.

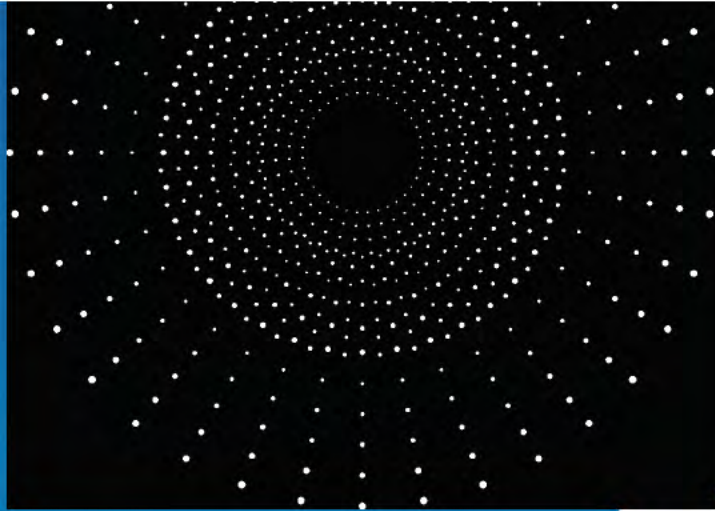


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EXECUTIVE SUMMARY

India's power sector has transformed itself during the last decade, doubling power generation capacity from 132.33 gigawatts (GW) in 2007 to 370 GW 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.

As part of the U.S.-India Strategic Energy Partnership and the Asia EDGE initiative of the U.S. Indo-Pacific Vision, the U.S. Agency for International Development (USAID) is committed to helping India meet its goal of adding 175 GW of renewable energy and 40 GW of rooftop solar energy by 2022.

USAID's Partnership to Advance Clean Energy—Deployment 2.0 Renewable Energy (PACE-D 2.0 RE) program works 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.

PACE-D 2.0 RE partners with the states of Assam, Gujarat, and Jharkhand, Indian Railways, Solar Energy Corporation of India, Confederation of Indian Industry (CII)—Green Business Council, etc., to improve strategic energy planning, scale grid-connected distributed renewable energy, and adopt innovative renewable energy procurement models. PACE-D 2.0 RE's work 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.

Between June 2019 and September 2020, MNRE–USAID PACE-D 2.0 RE:

- ◆ Supported 95 megawatts (MW) of clean energy generation capacity;
- ◆ Leveraged \$60 million in investment for renewable energy;
- ◆ Reduced greenhouse gas emissions by 1,027,593 tCO₂e;
- ◆ Supported Gujarat Electricity Regulatory Commission (GERC) in implementation of two regulations on tariffs for promotion of use of RE;
- ◆ Developed two software tools (demand forecasting and resource mapping) for improving resource planning in RE-rich environments and one software tool to implement solar rooftop for low-paying customers;
- ◆ Developed the Super RESCO business model for promoting solar rooftops; and
- ◆ Engaged more than 100 institutions and trained nearly 630 policymakers, utility employees, regulators, developers, and financial and academic institutions.

In 2020, PACE-D 2.0 RE quickly pivoted to navigate a world transformed by a global pandemic. COVID-19 led to a national lockdown, travel restrictions, and a new normal that required people to stay at home and socially distance. During this time, the program focused on interventions that maximized impact and minimized risk.

MNRE–USAID PACE-D 2.0 RE worked with national and state-level partners to develop and adopt 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. Despite moving online, the program continued to progress. The value of solar analysis for the states of Gujarat and Jharkhand was completed and shared with stakeholders. Similarly, PACE-D 2.0 RE continued working with GERC on behind-the-meter storage regulations and time-variant demand charges. Assam is expected to adopt green tariffs to balance energy supply with demand, and Jharkhand is implementing a distributed photovoltaic (DPV) rooftop solar pilot for low-paying consumers.

PACE-D 2.0 RE developed the DISCOM Renewable Procurement Optimization and Smart Estimation (DISCOM-REPOSE) software tool to accurately estimate consumers' electricity needs, match demand with a power portfolio that integrates renewable energy, and maximize cost-effective renewable energy procurements.



Capacity-building efforts intensified with virtual webinars and professional trainings. The program scaled its successful approach across the region, launching an [online certification program on strategic energy planning](#). The first cohort of 42 South Asian professionals graduated in 2020, and the second will start in 2021.





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Strategic Resource Planning

PACE-D 2.0 RE has worked under this component on four interconnected but independent activities: 1) publication of a white paper; 2) development of a software tool for resource planning by DISCOMs in RE-rich environments; 3) creation of a model regulatory framework to help regulators adopt best practices in resource planning; and 4) capacity-building of power sector professionals on resource planning.

The cost of purchasing power accounts for 60 to 70 percent of DISCOMs' total costs. Better—more strategic—resource planning can reduce this cost by 5 to 7 percent. This savings can be passed to consumers through reduced tariffs.

Strategic resource planning helps predict consumers' electricity needs more accurately, makes renewable energy procurement more cost effective, and matches electricity demand with renewable energy at minimum system integration cost.

WHITE PAPER

PACE-D 2.0 RE and MNRE 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 (such as resource planning software, the regulatory framework, and better planning capacity in utilities). **It highlights the importance of resource planning in a renewable energy-rich scenario, covering international best practices compared to local practice.**



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SOFTWARE TOOL

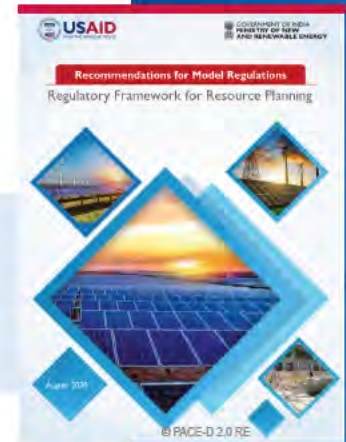
The PACE-D 2.0 RE team is developing a software tool for DISCOMs to conduct resource planning in RE-rich environments and incorporate new technological advancements such as demand response, electric vehicles, energy efficiency, etc. The tool consists of three modules: demand forecasting, resource mapping, and power procurement. The first two modules have been developed and deployed in Assam Power Distribution Company Limited (APDCL) and Jharkhand Bijli Vitran Nigam Limited (JBVNL). The third module is under development.



The complete DISCOM-REPOSE tool is expected to be released in April 2021. The deployment of the tool in Assam and Jharkhand is expected to reduce their power purchase costs by 5 to 10 percent (\$35 million annually for each) and increase the share of electricity from renewable energy by 10 to 15 percent.

REGULATORY FRAMEWORK

PACE-D 2.0 RE worked with national agencies and the state electricity regulatory commissions to develop model regulations for medium- and long-term load forecasting, resource planning, and power procurement.



The PACE-D 2.0 RE team has approached the regulatory commissions in 12 states about implementing this framework. The team also approached the Forum of Indian Regulators and several DISCOMs concerning adoption of the framework.

CAPACITY BUILDING

In 2020, PACE-D 2.0 RE laid the foundation to replicate its resource planning strategies throughout the region.

It launched a six-week online certification program to help young professionals in South Asia use the REPOSE tool to develop resource plans for their utilities. Forty-three participants from utilities, academic institutions, and regulatory bodies in Bangladesh, Bhutan, India, Maldives, Nepal, and Sri Lanka participated in the program. Because demand was so high, PACE-D 2.0 RE will host a second cohort in a "train-the-trainers" program across South Asia in 2021.



Utility Resource Planning Online Certification Program

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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.



Scaling Grid-Connected DPV

PACE-D 2.0 RE is working 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.

Grid-connected 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, so achieving the balance of the target in the next two years will be a challenge.

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 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.

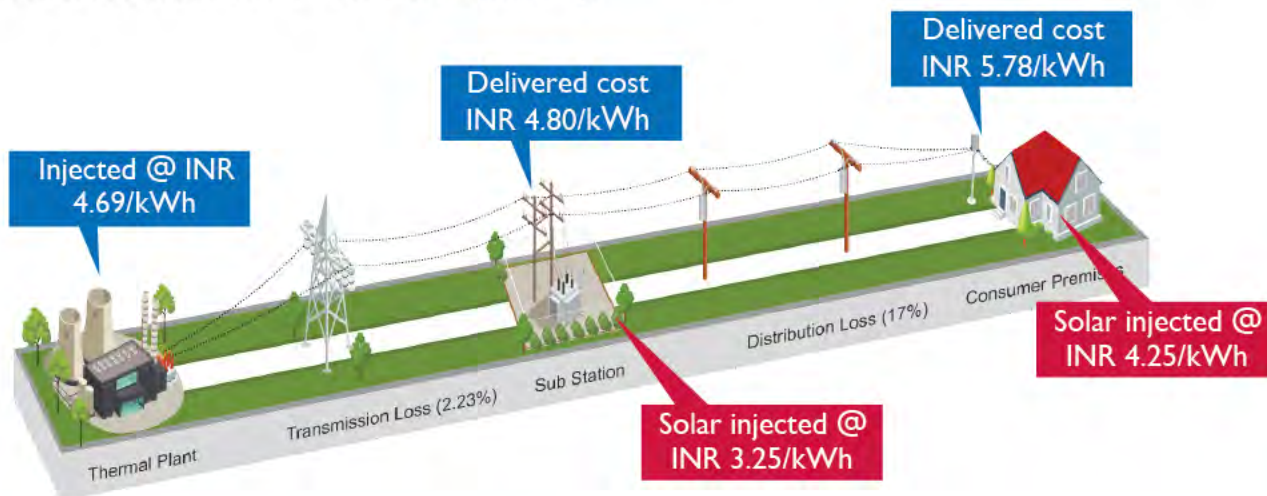
To increase participation in the residential rooftop solar program, PACE-D 2.0 RE developed the Super Renewable Energy Company (Super RESCO), a new business model for solar PV systems that will benefit low-paying consumers and DISCOMs.

To increase participation in the residential rooftop solar program, PACE-D 2.0 RE developed the Super Renewable Energy Company (Super RESCO), a new business model for solar PV systems that will benefit low-paying consumers and DISCOMs. In this new public-private partnership, DISCOMs act 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-D 2.0 RE's financial and economic analysis, the deployment of 250 megawatts peak (MWp) of solar rooftop in Assam will result in an investment of \$130 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.

Similarly in Jharkhand, replacement of 15 percent of residential consumption by solar rooftop will result in systemic gains of \$100 million and creation of over 4,000 jobs. The Super RESCO model reduces aggregate technical and commercial losses which lowers the cost of supply. Savings are also achieved through subsidies as the tariff for most of these residential consumers is subsidized.



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. Assam and Jharkhand have appreciated the Super RESCO model.

In Assam, APDCL may test it in an area with high aggregate technical and commercial losses; in Jharkhand, PACE-D 2.0 RE has designed a pilot and helped JBVNL develop a tender for 10 MW of rooftop solar PV installation. In 2021, PACE-D 2.0 RE will support JBVNL to evaluate bids, award the contract, and deploy rooftop solar systems. The program plans to release a national white paper examining how the Super RESCO model can be rolled out nationally.



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. The complexity of the installation makes it difficult for consumers with limited technical knowledge to evaluate vendors' work.

Furthermore, while policymakers and regulators have set standards for solar PV projects, the next step is monitoring on-the-ground compliance with these standards. The PACE-D 2.0 RE team suggested a mechanism for implementing the policies and standards for quality and safety in India.

Based on active stakeholder engagement, interviews, and other research, PACE-D 2.0 RE 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.

A key recommendation for ensuring the quality and safety of installations was development of a 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 plans to work with the Confederation of Indian Industry (CII) to develop a complementary online resource for rooftop solar consumers, investors, and developers that would monitor, evaluate, and rate vendors' work.



Before the national launch of the vendor rating framework, PACE-D 2.0 RE is working with the CII and the Gujarat Energy Research and Management Institute to pilot the VRF with 50 installations from 10 rooftop solar vendors responsible for the design, procurement, and installation of solar PV rooftops or distributed PV systems.

The vendor rating framework will help consumers evaluate solar rooftop vendors across the nation based on uniform benchmarks for quality and safety. The rating will incentivize vendors to participate and continually improve the quality of their installation services (which will also increase the generation efficiency of installations).

The VRF developed under PACE-D 2.0 RE will improve the **quality and safety of solar PV installations**, supporting efforts by the **Government of India** and several state governments to aggressively promote this technology.

ENABLING DISTRIBUTED PV PLUS STORAGE

Pairing behind-the-meter energy storage systems with DPV—creating a system that can act as both generation and load—is a potentially unique and disruptive power sector technology capable of providing a range of important services to customers, utilities, and India's entire power system. 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 causes demand to shift 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.

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 energy goals. 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 or reliability of their electricity, reduce their bills, or take advantage of new DISCOM offerings.

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 highlights the Government of India's goal to reduce the cost of batteries to \$60/kWh by 2030 by promoting battery manufacturing plants.

PACE-D 2.0 RE and NREL are working with the GERC to amend its net-metering regulations to include behind-the-meter DPV-plus-storage that will benefit consumers.

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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 see 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.

PACE-D 2.0 RE with NREL conducted a [value of solar 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 two states' electricity regulatory commissions this year and developed a simplified model to help Jharkhand determine the optimal solar tariff. The main analysis, performed using a PLEXOS model, 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.





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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 (CEA) 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 target 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 Solar Energy Corporation of India (SECI), India has tried models 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 conducted six workshops and webinars on this topic to encourage system-friendly

RE procurement with DISCOMs, Central Electricity Regulatory Commission, State Electricity Regulatory Commissions, the Solar Energy Corporation of India (SECI), MNRE, and developers, financiers, and institutions in Ahmedabad, Delhi, Guwahati, and Ranchi.

The PACE-D 2.0 RE team published "System-Friendly Competitive Procurement for Renewable Energy in India," a white paper released at a workshop on November 1, 2019, in Delhi.



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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 MNRE has issued guidelines on using this model for renewable energy procurement throughout India.

System-friendly procurement minimizes both generation and system integration costs by incorporating renewable energy considerations and 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.

SECI used the round-the-clock model in two separate renewable energy procurements of 1,200 MW and 400 MW each. After their success, SECI launched a bid for 5 GW of round-the-clock power in March 2020, marking a major transition toward system-friendly renewable energy procurement in India that will reduce generation and integration costs. **The SECI tenders incorporated lessons and global best practices recommended by PACE-D 2.0 RE.**

Indian Railways (IR), the largest consumer of electricity in India, is accelerating its efforts to procure more renewable energy to reduce its carbon footprint and power costs. After its successful collaboration with SECI,



*Mr. S.K. Mishra
Director, Solar Energy
Corporation of India*

“

USAID workshop and presentations on ‘System Friendly RE Procurement benefited SECI in the design of two tenders of 1.6 GW capacity for procurement of round the clock RE power.

”

PACE-D 2.0 RE is now working with Railway Energy Management Company Limited, the subsidiary company of IR responsible for procurement of electricity for IR, to develop a round-the-clock power tender to run

trains on renewable energy. The program is supporting analysis, tender design, stakeholder consultation, bid management, and contract award.

PACE-D 2.0 RE analyzed Indian Railway's traction load (electric load to run trains) for [Haryana](#) and Madhya Pradesh and found that IR can use renewable energy power 50 percent of the time. The round-the-clock model could also lower power purchase costs. The analysis was presented to the Railway Board, which is considering conducting a pilot with round-the-clock and/or other models of system-friendly RE procurement suggested by the PACE-D 2.0 RE program.

TARIFF MECHANISM TO ENHANCE UTILIZATION OF LARGE-SCALE SOLAR GENERATION

As India moves toward achieving its 100 GW solar target by 2022, it requires strategies to fully utilize the power generated by the solar projects. The intermittent excess supply in the day should lead to lower tariffs since the cost of solar generation is low. 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 evening (or other times when supply is lower).

PACE-D 2.0 RE conducted a [webinar on green tariff](#) design and deployment 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. APDCL may include the recommendations in its FY 2021–2022 Annual Revenue Filing to the Assam Electricity Regulatory Commission. PACE-D 2.0 RE plans to support two additional states with green tariff analysis.

The program also developed “Optimal Market-Based Utilization of Electricity Supply Resources of Assam,” a report focused on the state with the second lowest per capita energy consumption in India.

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.



Mr. Anand Kumar
Chairperson, Gujarat Electricity
Regulatory Commission

“

We endeavor for a win-win situation for all stakeholders so that power sector growth is sustainable and financially stable. To achieve this we feel that new and innovative measures like ToD based Green Tariff will play a critical role in streamlining deployment of clean energy technologies and enhancing energy security.

”

PACE-D 2.0 RE PERFORMANCE METRICS (2019-2020)

CAPACITY-BUILDING HIGHLIGHTS



102

Institutions Engaged



628

Participants Trained
(544 Men and 84 Women)



3 Tools/Methodologies Developed

- Demand forecasting module of REPOSE tool developed, adopted, and deployed in partner states
- Resource mapping module deployed
- DPV low-paying customers pilot launched in Jharkhand



2 Laws, Policies, Regulations, or Standards Adopted

- Regulatory framework for medium- and long-term resource planning
- Regulation on green time-of-day tariffs for the Gujarat Electricity Regulatory Commission



One Business Model Developed

- Super RESCO for promoting solar rooftop



95 MW Clean Energy Capacity Supported



\$60 Million in Investment Leveraged from Non-USAID Sources



1,027,593 tCO₂e GHG Emissions Reduced

PACE-D 2.0 RE PARTNER STATES

Gujarat



Delhi



Assam



Jharkhand



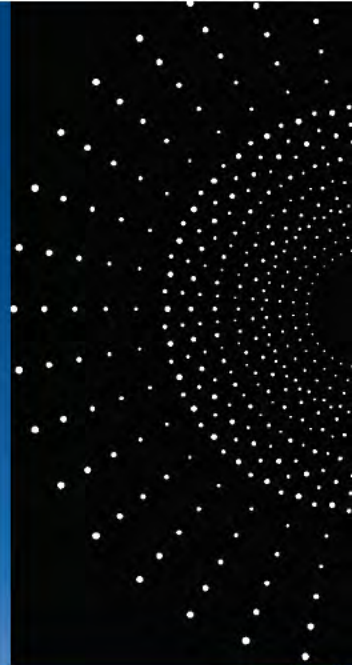


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