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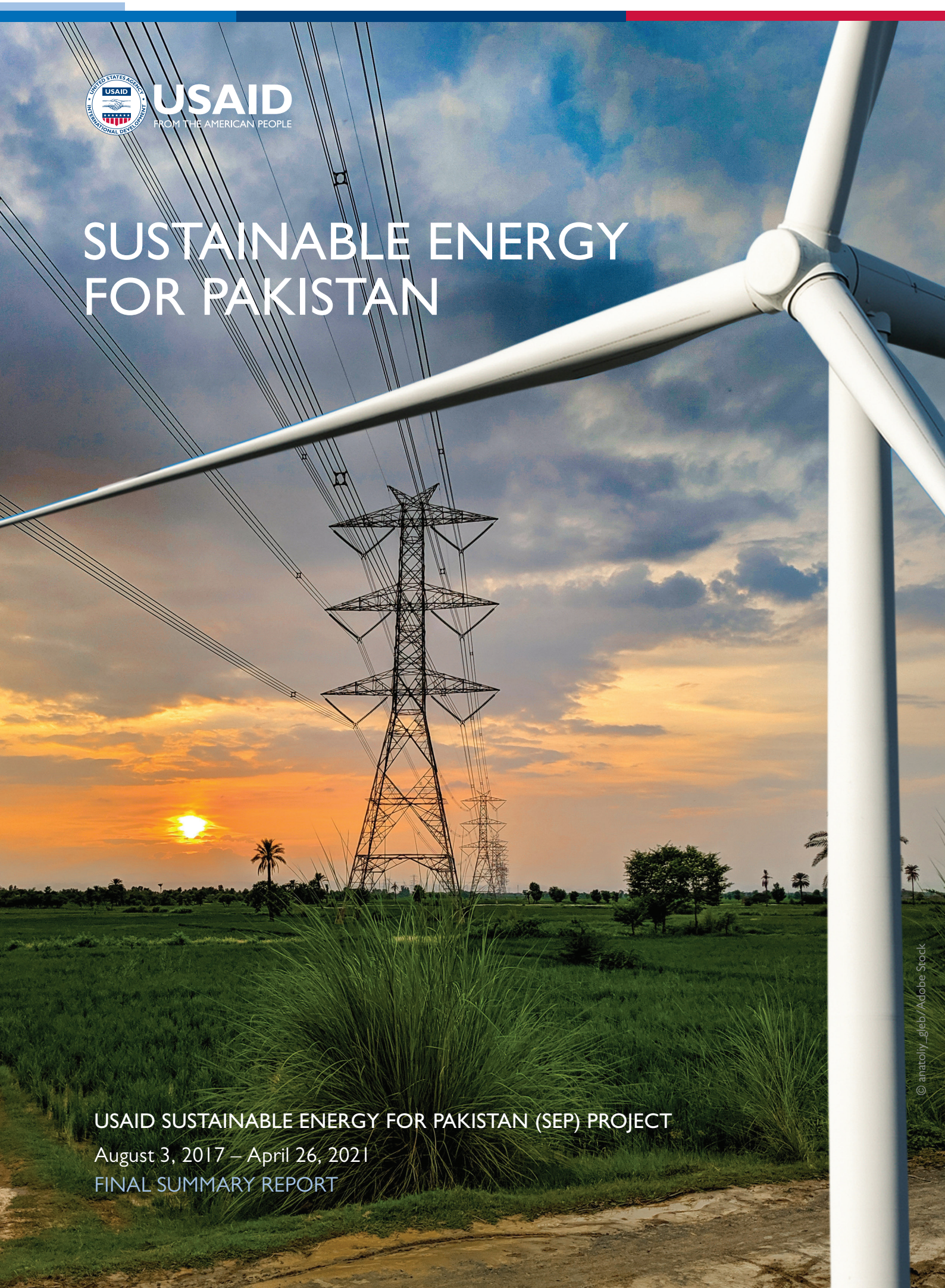
SUSTAINABLE ENERGY FOR PAKISTAN



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USAID SUSTAINABLE ENERGY FOR PAKISTAN (SEP) PROJECT

August 3, 2017 – April 26, 2021

FINAL SUMMARY REPORT

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For more than 60 years, the U.S. Government has been a proud partner of the Government of Pakistan in the energy sector. Since 2010, USAID has worked closely with our counterparts to strengthen and modernize the entire energy value chain. Sustainable Energy for Pakistan (SEP) was one of USAID's flagship projects, advancing energy services that support economic and social development.

SEP introduced new standards and technologies, built capacity of energy departments, improved transmission and distribution operations, increased the share of renewables, and supported creation of an attractive business environment for private investment.

I thank our partners in the Government of Pakistan and the SEP team for their hard work. I am confident that our joint efforts will go a long way in taking Pakistan into a future where sufficient, affordable, clean energy will be available to all.

Donald McCubbin
Director, USAID Energy Office

U.S. Ambassador Paul Jones visits the smart grid lab established by SEP. Photo by SEP.

SUSTAINABLE ENERGY FOR PAKISTAN

PROJECT OVERVIEW

Although Pakistan's electricity sector is developing, it continues to face significant challenges. For many years, the primary issues facing the population were electricity shortfalls and load shedding. To respond to these challenges, the Government of Pakistan accelerated the rate of addition of new capacity: the country's installed capacity surged from 23,337 megawatts (MW) in 2014 to 38,700 MW by June 2020—a growth rate of 60 percent in six years. However, this new capacity came with its own new challenges, including high distribution losses and a mounting circular debt inhibiting investment in system upgrades and expansion. Despite projected electricity surpluses, constraints remain to energy sector growth, discouraging private sector engagement and the development of a sustainable, clean energy future for Pakistan.

Through the Sustainable Energy for Pakistan (SEP) project, the U.S. Agency for International Development (USAID) supported the Government of Pakistan's efforts to increase the financially sustainable delivery of energy services for economic and social development through:

- **Increased private investment** in clean energy projects.
- **Improved capacity** of the transmission system and energy markets to support increased private investment in the provision of energy services.
- **Enhanced commercial viability** of the electricity distribution subsector.
- **Improved sector governance through policy reforms** that facilitate investment and privatization of energy services.

Results

Supported the financial close of 12 wind power projects and four solar power projects that will provide 860 MW of renewable energy for Pakistan's national power grid.

Assisted the Government of Pakistan with design of a competitive procurement process for renewable energy generation, which will serve as the foundation for renewable energy auctions.

Leveraged and mobilized $922.6 million of public and private sector investment in clean energy projects.

Modernized and digitalized power transmission and distribution systems:

- Installed 7,961 smart meters at distribution companies, mobilizing $2.34 million in public sector investment.
- Installed 100 secured smart meters (SMS) onto Pakistan's national grid, enabling the market operator to perform automated billing and settlements and paving the way for a competitive wholesale electricity market. SMS provided an integrated technology solution, allowing the country to automate and digitize collection of data for the first time and help mobilize $17 million of public sector investment. These meters, which monitor the entire country's power flow, will provide data to facilitate transactions of nearly $10 billion.
- Established a model subdivision at Peshawar Electric Supply Company (PESCO) by installing 412 smart meters, 150 kilometers of aerial bundled cable, and 334 asset performance management system units that monitor distribution transformers in real time, enabling an expected aggregate technical and commercial loss reduction of 20 percent, $2 million in annual savings, and $18 million in public sector investment.

Enhanced the technical capacity of 1,472 individuals (11% women) across the power sector, including those representing the national transmission system operator, market operator, distribution utilities, and government ministries.

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INCREASING PRIVATE SECTOR INVESTMENT IN CLEAN ENERGY

Overview

While Pakistan has made significant progress in opening the energy sector to private investment and decreasing power supply deficits, project developers, investors, and financiers continue to face challenges in clean energy investment. Credit risks perceived, complexity of the decision-making process, energy sector circular debt, inadequate transmission and distribution infrastructure, as well as a nascent policy and regulatory environment for clean energy supply and services are barriers to investment in clean energy projects.

USAID addressed the challenges facing clean energy investment in Pakistan by providing targeted support to public and private sector energy stakeholders with the aim of increasing private investments in such projects and expediting their development cycles.

USAID and partners at the financial closing ceremonies of 12 wind (left) and 4 solar (right) projects in November 2019 and February 2020, respectively. Photo by SEP.

Results

Facilitated financial closure of 12 wind power projects and four solar power projects (860 MW) through legal and transaction support to the Alternative Energy Development Board (AEDB). USAID mobilized $922.6 million from the private and public sectors to support the Government of Pakistan in achieving its renewable energy generation target of 30 percent by 2030.

Equipped the National Transmission and Despatch Company's (NTDC's) Planning Department with industry-leading digital tools, including energy portfolio management software (PSR) and an energy market simulation platform (PLEXOS). These tools will help NTDC plan for grid expansion and integration of private sector-led variable renewable energy projects.

12
Wind Power Projects

4
Solar Projects

860 MW
Generation Capacity

$922.6 M
Mobilized

The SEP project has catalyzed renewable energy development in Pakistan. The program has raised awareness and capacity of the sector in accelerating the transition towards renewable energy and increased investments in the sector.

— Sheeraz Anwar Khan
Director (Wind), AEDB

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DIGITALIZING ENERGY SYSTEMS

Engineers oversee production of arial bundled cable at the Fast Cable Factory in Lahore. Photo by Timeless Media.

Smart meters being tested prior to installation. Photo by Timeless Media.

Overview

Modernizing Pakistan's electricity sector is vital to providing reliable service to consumers. The country's outdated network infrastructure, lack of adequate system planning, high technical and commercial losses, and financial accounting inefficiency across the value chain pose significant challenges to sector performance. Boosting performance and reliability through technology-driven interventions and digitalizing is a critical step toward achieving the country's ambitious energy goals.

USAID improved efficiency, accuracy, and transparency in Pakistan's energy sector through targeted investments in digital infrastructure, building local capacity in the use of advanced analytical tools and techniques and bolstering the sector's commercial viability.

> *Successful demonstration of the newly designed AMI solution in the IT lab has provided necessary confidence to the managements of DISCOs, which will help expedite transformation of distribution business to digitization.*
>
> — **Imtiaz Ahmed**, Chief Executive Officer, Power Information Technology Company

With USAID support, Pakistan has, for the first time, been able to automate and digitize the collection of data on all the energy that transits the country, delivered by more than 38,700 MW of installed capacity.

Results

Procured and installed 7,961 AMI smart meters for PESCO and Multan Electric Power Company (MEPCO).

Designed and established an integrated advanced metering infrastructure (AMI) platform that enables DISCOs to purchase smart meters from multiple vendors (breaking an existing monopoly) and accelerate deployment of digital AMI systems to reduce losses, improve revenue collection, and conduct effective load management.

Procured and installed 100 high-accuracy smart meters and related communications equipment at NTDC and the market operator (CPPA-G), marking Pakistan's transition from manual to digital electricity data, enabling real-time power flow monitoring, and advancing the creation of a wholesale electricity market.

Developed a model subdivision at PESCO by replacing existing meters with digital smart meters, removing illegal taps, upgrading 150 km of arial bundle conductor cables, and installing 334 asset performance management system units at distribution transformers to protect the system from overload.

Established a smart grid integration and testing lab at WAPDA House Lahore, empowering testing and certification and integration compliance of smart grid devices.

Equipped CPPA-G with PLEXOS to enable modern planning and verification.

Established a Planning & Engineering Department at TESCO, equipped with the latest planning software for load flow studies and asset mapping, and trained staff to use these tools to develop loss mitigation strategies and expand service capacity in line with future demand growth, near load centers.

Participants in USAID's Energy Sector Women's Fellowship Program in Peshawar. Photo by SEP.

To build capacity in the use of advanced analytical tools and techniques, SEP trained:

- **101 participants**—one-third of whom were women—from NTDC and DISCOs on PSS/E
- **39 participants** on basic PSR suite (SDDP, OPTGen, & NCP) software and 6 individuals on the advanced course
- **21 participants** from CPPA-G on PSR SDDP (hydro-thermal dispatch modeling software)
- **19 participants** from Tribal Electric Supply Company (TESCO) on planning software (ArcGIS and Synergi)
- **13 participants** from MEPCO and PESCO on Multivendor Compliant AMI Landscape System Administration

PROMOTING COMPETITIVE PROCUREMENT OF CLEAN POWER AND CRITICAL INFRASTRUCTURE

A worker installs a smart meter at MEPCO in Multan. Photo by Mercury Transformations.

Overview

Despite Pakistan's significant progress in developing its renewable energy industry, a major shortcoming of the country's power sector reform program has been the absence of competition in solicitation. Globally, competitive bidding processes almost always result in lower prices as compared to negotiated or feed-in tariffs—as long as international best practices are used. Knowledge of competitive bidding methods, auction design, and evaluation procedures are some of the necessary components of creating a successful and transparent energy market.

Objective

USAID assisted Government of Pakistan counterparts and stakeholders in transitioning to a transparent, competitive, and financially sustainable energy market that is open for full private sector participation, including for renewable energy investors.

Results

Provided legal and transaction advice to AEDB for the competitive bidding framework (pre-qualification), bidding documents, security package, and bid evaluation criteria for Category 3 projects (those with a letter of intent, in development prior to tariff determination). SEP convened the first-ever working group for competitive bidding and two consultative sessions with Government of Pakistan stakeholders to incorporate feedback and develop the competitive bidding documents.

Trained NTDC staff on PSR suite and PLEXOS software to support an Indicative Generation Capacity Expansion Plan to identify the gap in supply and demand that can be filled with wind and solar energy through auctions.

By supporting an open-architecture-based, multi-vendor AMI enterprise landscape and integrating smart meters into the national grid, USAID enhanced Pakistan's competitive procurement framework for energy infrastructure. DISCOs can now purchase and install smart meters from multiple manufacturers, creating a more cost-competitive environment and enabling the development of a robust wholesale electricity market. As a result of these initiatives, the Government of Pakistan issued two letters of intent to competitively procure 31,000 smart meters—a $2.34 million investment.

The introduction of competitive procurement of electric power will bring two major benefits to Pakistan. It will lower the average cost of power for consumers in the long run and it will make the power procurement process more transparent. We highly appreciate USAID for supporting the Government of Pakistan in this initiative.

— **Syed Aqeel Hussain Jafri**
Director (Policy/International Cooperation)/Secretary, AEDB

Participants at the consultative workshop for competitive bidding of Category 3 projects on November 27, 2019. Photo by SEP.

IMPROVING ENERGY SECTOR GOVERNANCE

Stakeholders discuss proposed amendments to the Exploration and Production Rules 2013 with the Directorate General of Petroleum Concessions. Photo by SEP.

Overview

Pakistan's energy sector reform process—which has aimed at improving efficiency, performance, and private sector participation since the 1990s—has had limited success. Challenges include load-shedding and power outages that hinder economic and educational activity, overreliance on government subsidies, unaccounted-for energy losses, and inconsistent performance monitoring and enforcement by regulators. To maximize the impact of the Government of Pakistan's energy efficiency and conservation activities over the past several decades, regulatory and policy frameworks for energy efficiency must be strengthened.

USAID established a policy environment for scaling up renewable energy based on global best practice that fosters private investments in new generation capacity; supported the institutionalization of the integrated energy planning process within key government, academic, and private organizations; and strengthened the Government of Pakistan's procurement and contracting processes for renewable energy and transmission infrastructure through improved risk allocation.

The proposed integrated energy planning framework should be able to respond effectively to the analytical needs of the Cabinet Committee on Energy and other high-level decision-making government entities in making policy decisions.

— **Makhdoom Khusro Bakhtyar**
Minister for Planning, Development and Reform, Government of Pakistan

Results

Enhanced governance of Pakistan's energy sector by supporting the development, adoption, and implementation of policies aimed at facilitating investment and privatization of energy services.

Established long-term, sector-wide planning capabilities in coordination with the Department of Energy by establishing an integrated energy planning unit within Pakistan's national Planning Commission.

Improved regulation and governance in the gas sector leading to more streamlined performance of regulatory functions. Regulator-expedited approvals lead to greater confidence among oil and gas companies and more leveraging of investments in Pakistan's upstream oil and gas sector.

Proposed amendments enhanced the regulatory framework and improved the confidence of private investors, leading to more investments in the exploration and production of domestic gas resources.

PLEXOS licenses are handed over to NTDC in Lahore on October 21, 2019. Photo by SEP.

SEP policy and regulatory reform support:

- Completed a **model gas sales and purchase agreement** for use by producers and Government of Pakistan-nominated gas buyers
- Completed **Standard Operational Procedures** for the Directorate General of Petroleum Concessions
- Developed a **draft model gas pricing agreement** for the Directorate General of Gas
- Developed the standard **Smart Meter Test Protocol**
- Drafted an **Electric Vehicle Penetration and Energy Supply Chain Impact Analysis Model**
- Drafted the **Developing the Net Metering Market in Pakistan** policy
- Drafted the **Open Access (Wheeling) Regulation** policy
- Drafted the policy brief on **electric vehicle base, target, and reference case** impact assessment
- Informed the concept paper for **Single Buyer Plus Arrangement (Wheeling) Regulation** policy
- Proposed recommendations to the **Alternative and Renewable Energy Policy 2019**
- Reviewed **Exploration and Production Rules 2013** to evaluate proposed amendments, incorporate improvements, define new rules, and provide support to the approval process
- Supported the **Commercial Code for Single Buyer Plus Regulation** policy

SEP's modeling and analysis of electric vehicle penetration and impacts in Pakistan is a very useful and timely input to the development of a comprehensive national electric vehicle policy framework.

— **Nadeem Babar**, Chairman, Prime Minister's Task Force on Energy Reforms

Workers installing smart meters at PESCO in Peshawar.
Photo by Mercury Transformations.

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USAID TASK ORDER AID-OAA-I-13-00028 AID-391-TO-16-00005
This publication was produced for review by the United States Agency for International Development. It was prepared by the Sustainable Energy for Pakistan (SEP) project (Tetra Tech ES, Inc., prime contractor).

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