

Digitisation and Decarbonisation of Power Distribution Networks in Pakistan

Powering Pakistan's renewable energy transition

The Challenge

Pakistan's Nationally Determined Contribution (NDC) 3.0 commits the country to unconditionally reduce greenhouse gas emissions by 17 percent, compared to 2015 levels. In the energy sector, this requires increasing the share of on-grid renewable energy from around 30 percent today (including hydropower) to 60 percent by 2030. Achieving this transition places significant demands on the national power system.

Transmission and distribution operators must plan network expansions, manage system operations, and ensure that new renewable energy projects can connect to the grid without compromising its stability or causing widespread outages. This requires improved forecasting of renewable energy (RE) generation and transmission infrastructure across different regions, as well as the effective integration of RE into the grid network, particularly at the distribution level.

Pakistan also faces high technical and commercial losses in its distribution system. These losses contribute to the growing circular debt and higher emissions by requiring more electricity generation through inefficient means. With the recent solar rush, a phenomenal uptick in grid-fed rooftop PV energy quantum causes turbulent power quality in the distribution grids, exacerbating the losses. Grid operators lack visibility over their networks, preventing them from taking active steps to remedy the situation. Addressing these challenges calls for modern digital solutions that enable real-time monitoring and more efficient management and control of distribution networks.

Our Approach

The project supports Pakistan in advancing its energy transition by strengthening the foundations needed for a low-carbon,

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climate-resilient power sector. It works with key public institutions and power sector operators to improve planning processes, enhance technical capabilities and introduce innovative digital solutions that reduce losses and emissions, and support grid stability. By combining strategic guidance with practical measures, the project contributes to creating an enabling environment for a sustainable and future-oriented energy transition.

The project supports the Government of Pakistan through the following measures:

- Enhancing regulatory and planning frameworks for effective integration of renewable energy into the grid.
- Strengthening the capacities of distribution network operators to manage a higher share of variable renewable energy and improve operational performance.
- Assessing and demonstrating scalable automation and digitalisation concepts that can reduce losses and increase efficiency in distribution networks.
- Promoting transnational knowledge sharing and policy dialogue to inform decision making and improve coordination among key energy sector players.



Pg. 1, Left: Signing of the Project Implementation Agreement with the Ministry of Energy (MoE).

Right: International consultant shares insights at the workshop on proposed Distribution Code revisions.

Contact person	Photo: © GIZ Pakistan
Jens Brinkmann jens.brinkmann@giz.de	<p>Pg. 2, Left: Trainer assisting a participant during the National Workshop on the TIMES Model training.</p> <p>Right: Installation of monitoring and metering devices at PESCO.</p>

Expected Results

Regulatory Framework for Renewable Energy Grid Integration

The project is supporting government institutions and grid operators in shaping a more coherent and forward-looking regulatory framework for the renewable energy integration. Long-term energy scenarios, including a net-zero pathway, are being developed with national partners to guide strategic, integrated planning of the energy sector. Work is underway to develop load forecasting techniques using modelling tools to improve electricity procurement processes in the distribution companies and support the development of Power Acquisition Plan (PAP) methodology.

Capacities for Renewable Energy Grid Integration

Specialists from distribution companies are currently receiving targeted training, technical coaching and participating in simulation exercises using digital tools that strengthen their ability to integrate higher share of renewable energy safely and efficiently. A methodology for renewable energy generation forecasting is being developed, alongside grid-stability studies and technical guides for grid operators. The project follows train-the-trainer (TtT) approach to preserve the knowledge base and ensure its further dissemination while advancing gender-responsive capacity development by enabling greater participation of women and preparing selected female professionals to serve as future master trainers.

Technical and Financial Feasibility of Automation and Digitalisation for Distribution Grids

Digital solutions, aimed at reducing grid losses and emissions, are being piloted with two distribution companies. Feasibility assessments, baseline loss calculations and technical support are guiding the development of holistic digitalisation concepts. The project is providing selected digital tools and grid monitoring equipment to support implementation, while continuous coaching helps strengthen network operators' skills to manage and sustain these newly digitalised grid areas.

Knowledge Management and Policy Dialogue

National dialogue formats, including workshops and seminars, contribute to building technical capacity of energy sector players, bringing global experience to tackle local challenges, and, thus, aligning the policies with international best practices. Transnational knowledge exchange is being facilitated among the international grid operators and Pakistani distribution companies. Topics include, for example, Net-metered Distributed Generation, Role of Smart Inverters, Advanced Metering Infrastructure, Battery Energy Storage Systems and Ancillary Service Markets.



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