

Revolutionising Peru's energy distribution: pioneering flexibility, dynamism and demand-driven management



On behalf of German international cooperation for development in a project implemented by GIZ, NIRAS has been working closely with three utility companies to support the elaboration of smart-grid roadmaps, forward-thinking business plans, and the execution of innovative pilot projects.

A growing population inevitably results in greater energy demands, and Peru is no exception. With fossil fuels as the primary source of energy (+70%), in recent years the Peruvian Government has been seeking ways to reduce dependence on oil and gas and transition to renewable energy (RE).

With varying degrees of success, Peru's 23 electricity distribution companies (EDCs) – a mix of public and private enterprises of varying sizes and operating in diverse areas of the country – have been implementing a small number of pilot projects for technological innovation and energy efficiency (EE). These EDCs have also launched initiatives to implement smart metering systems and automate operational equipment in the primary distribution network to improve the quality of supply. However, while progress has been made, the EDCs' lack of vision for a smart-electricity grid and the procedures or recommended practices that would enable an orderly transition to digitalisation of the grid has raised concerns.

Launched in 2019, the Power Supply 4.0 project is funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) and implemented by GIZ, in partnership with selected state-owned EDCs, the Ministry of Energy and Mines (MINEM), the regulatory authority OSINERGMIN (Organismo Supervisor de la Inversión en Energía y Minería) and the state-owned umbrella company FONAFE (Fondo Nacional de Financiamiento de la Actividad Empresarial del Estado). With the original overall goal of providing the regulatory, institutional and technical foundations for Peruvian public utilities to increase EE and integrate renewables in the energy mix, Power Supply 4.0 advises three EDCs in the north, south and east of Peru (Hindrandina, SEAL and ELOR).



A smart grid is an electricity network enabling a two-way flow of electricity and data with digital communications technology enabling to detect, react and pro-act to changes in usage and multiple issues. Smart grids have self-healing capabilities and enable electricity customers to become active participants.

Power Supply 4.0 is comprised of four components. NIRAS was contracted to carry out two that focused on preparing and implementing pilot projects in selected utilities as part of their current investment plans and improving conditions for including RE and EE measures in the development of said EDCs' strategies and new business models.

Roadmaps, practical pilot projects and innovative business models MINEM has been leading the process to modernize Peru's electricity sector. In the case of distribution, it has been developing reform proposals to improve transparency of the distributor's functions as a network operator and allow for the deployment of smart-grid technologies, among others.

In addition to the current electrical infrastructure, smart grids bring the technological potential of electronics, communication and computing to establish a two-way flow between the equipment installed in the user's network area and the companies providing the electricity service. Smart grids are characterised by the extensive use of information and communication technologies throughout the value chain of the electricity sector. This translates into a digitally transformed new network that is more decentralised, observable, manageable, intelligent, secure and reliable, with less environmental impact.

Achieving the goals of the Power Supply 4.0 project implies that EDC management makes a paradigm shift in operations and moves to a more flexible, dynamic and demand-driven approach in a timely manner while tapping into new business models that will strengthen the quality of the power supply service, reduce costs, boost customer confidence and improve Peruvian citizens' quality of life.

The project empowers this shift by providing technical assistance to selected EDCs in the preparation of their smart grid roadmaps, which are based on the smart grid maturity model (SGMM). SGMM is a management tool that allows a company in the electricity sector (and countries) to plan services, quantifiably measure their development and prioritize strategies on their way to implementing smart grids. It seeks to cover all dimensions of the company, including business, strategic, technological, operational, asset management, customer, value chain integration and society and environment dimensions.

In helping the EDCs – Hindrandina, SEAL and ELOR – NIRAS collaborated with METRUM, a Colombian company that delivers innovative system solutions for power quality measurement and analysis, empowering customers to optimise energy use and reduce costs while minimising environmental impact. NIRAS and METRUM Soluciones Inteligentes jointly enhanced the capabilities of the three EDCs in implementing pilot smart grid technology projects and co-developed strategies to foster emerging business models in the evolving transformation and modernisation of Peru's electricity sector.

One practical example of a business model that was developed was a plan for SEAL to enable the implementation of distributed generation in selected schools and other educational institutions with the installation photovoltaic (PV) solar generation systems.

Under this model, the PV generation system would belong to SEAL, which would be in charge of the financing, design, construction, operation and maintenance of the plant's assets. The schools whose property was used to generate electricity would receive a rental payment from the EDC or renewable energy at a competitive price. The project team assessed the viability of the model from the perspective of the user and the EDC.

Building skills and networks for long-term, sustainable change. As part of the assignment, the NIRAS team enhanced the strategic investment planning and innovative business model development capacities of staff at the three EDCs. Building these skills has enabled the EDCs to meet the technical requirements for integrating RE and improving EE within their operations.

Projects and business models in the 3 EDCs

- Pilot projects: Smart meters; Amorphous transformers***
- Pilot proposals: Automation of the primary distribution network; Public lighting remote management; Substation status monitoring systems***
- Upscaling proposals: Implementation of ground fault detectors; Implementation of reclosers; Public lighting remote management***
- Business model proposals: Photovoltaic solar plants (distributed generation); Demonstrative or promotional pilot; Electromobility***



As an integral component of the efforts to build capacity in the power supply project, it has been crucial to impart international insights and best practices in implementing smart grid technologies. This included exposing EDCs to successful regional examples of digital transformation, advanced metering infrastructure and distributed generation.

In December 2021, we organised a Technology Roadshow in Brazil, where EDC representatives gained valuable insights from Brazilian universities, research centres, technological suppliers and energy companies involved in smart grid development in cities such as Campinas and São Paulo.

In May 2023, a delegation from public Peruvian EDCs visited Colombia to acquire invaluable knowledge and experiences. During this visit, the group toured an electric bus-charging infrastructure operator and engaged with “Colombia Inteligente,” a public-private initiative dedicated to facilitating the country’s transition to smart grids. Here, they had the opportunity to learn from Colombia’s best practices in green energy distribution.

As a result of the visit with “Colombia Inteligente”, a dedicated group was formed comprising representatives from the EDCs. Their goal? To replicate the successful Colombian experience in Peru and eventually give rise to the formation of “Peru Inteligente”. This endeavour will make it possible for the nation to integrate smart networks into its electricity infrastructure, enhancing its reliability, resilience and sustainability, all with the goal of benefitting society as a whole, says Carlos Cervantes, a technical adviser and NIRAS’s long-time expert.

Moreover, incorporating actions outlined in Roadmaps into the Institutional Strategic Plans of the EDCs ensures the ongoing digital transformation of these entities, allowing financial resources for execution and the establishment of compliance goals to be secured.

“The impact generated by the project Power Supply 4.0 project must be understood in two dimensions,” says Rolf Sielfeld, the Team Leader for Components 2 and 3. “First, through the intervention in three companies, we were able to extend the interest of the rest of the companies in accelerating the transformation and modernisation of the companies and their grids. ‘Peru Inteligente’ is the result of this effort. The second dimension refers to the potential that this successful experience could have in encouraging other countries in the region such as Argentina, Ecuador or Bolivia.”

Demand for renewable energy is steadily increasing around the globe, thanks to the collective recognition that our planet sorely needs a shift to a greener future. It is through projects like Power Supply 4.0 that we can reach this future, one where sustainability and careful regard for our world are at the forefront.

The Power Supply 4.0 project is made up of four components:

- **Improving the legal framework and energy planning for the integration of RE and increasing EE in the power supply sector are available;**
- **Preparing and implementing pilot projects in selected utilities, as part of their current investment plans;**
- **Improving conditions in selected utilities for including RE and EE measures in the development of their strategies and business models;**
- **Strengthening knowledge management between the players in the electricity supply.**