

Digitalization of grids

3-3 | EU4 | DMA EU (former EU7)

507.7 TWh

ELECTRICITY TRANSPORTED ON THE GROUP'S DISTRIBUTION GRID

510.6 TWh in 2021 **-0.6%**

231 min

SAIDI

243 min in 2021 **-5.2%**

0.7 million beneficiaries

NEW CONNECTIONS IN RURAL AND SUBURBAN AREAS

0,8 million in 2021 **-12.5%**

Electricity distribution grids by country and region



| | High voltage | Medium voltage | Low voltage |
|--------------------------|------------------|----------------|----------------|
| km | 2,024,038 | 40,566 | 717,992 |
| | 2% | 35% | 63% |
| Europe and North America | 5% | 27% | 68% |
| Iberia | 6% | 36% | 58% |
| Italy | – (1) | 31% | 69% |
| Latin America | 4% | 50% | 46% |

(1) In Italy there are almost 20 km of high-voltage grid.

The grid is not an infrastructure for its own sake, but enables the interconnection of the different players in the energy market. Supply electricity is reliable only if it is guaranteed by a grid that, through innovation and digitalization, is capable of ensuring the completion of the energy transition through the electrification of uses.

Aware of its strategic role, we now have one of the most innovative and digitalized electricity infrastructures in the world. We also launched an action plan called **Grid Futurability®**, a comprehensive, customer-oriented industrial approach aimed at renewing, strengthening and expanding the Enel Group's grids in the coming years. Our aim is to provide a more resilient, participative and sustainable grid, one which can anticipate, through an investment roadmap, the needs of stakeholders and harness innovative technological developments to meet them.

The grid is key to achieving decarbonization targets. In 2022, we presented the **Net-Zero strategy** for grid activity to counter direct emissions inherent in the infrastructure, acting on digitization, remote operations, the use of electric vehicles for work, measures to protect biodiversity and reducing technical grid losses. In addition, we are engaging suppliers, equipment manufacturers and construction companies in our supply chain to reduce indirect emissions and implement more sustainable processes and network components, such as SF₆-free switchgear, vegetable oils for transformers and environmentally friendly or standard cables for sustainable construction sites.

Over the past year, we have entirely rethought the value chain by applying the concept of **Sustainable by Design**, redesigning the production and end-of-life management processes of grid assets with the aim of decreasing raw material consumption, maximizing economic value and reducing environmental impacts, including greenhouse gas (GHG) emissions.

A **Sustainable Reference Model** tool has been developed which, integrated into our digitalized systems, makes it possible to monitor the number and type of solutions implemented at all active or opening sites and to measure their impacts, along four lines: decarbonization, social, environmental and circularity. The score associated with each solution makes it possible both to identify the most virtuous sites (*ex post* evaluation) and to carry out simulations (*ex ante* evaluation) to facilitate the choice of solutions to be implemented.

In order to make the value chain circular, we also defined **Grid Mining & Zero Waste** strategies, to review the end-of-life management processes of grid assets in a more sustainable way and identify New Life Cycle practices (recycling and reuse of materials at the end of their life). In this regard, in order to ensure complete tracking of the materials contained in grid assets, we have developed the "Digital Product Passport" in our systems, which enables us to monitor any materials considered critical, for which it might be useful to evaluate an alternative, but also to define *ex ante* the end-of-life reuse scenarios. Having an integrated and digitalized tracking system along the entire value chain is the driving force toward the ambition to open our "mine" (grid mining) to the outside world as well,

making it available to other companies or different sectors in order to involve their respective production chains and feed new markets for raw and secondary materials, promoting the development of the area and the saving of virgin materials, and creating new job opportunities related to waste material recovery initiatives while minimizing environmental impacts. More details can be found in the chapter "[Circular economy](#)" in this document.

Achieving such ambitious goals necessarily requires joint multi-stakeholder action, involving suppliers, partners, competitors, industry grids, etc. In the spirit of Open Power, we have:

- founded the **Open Power Grids Association**, which aims to share and develop grid-related technologies and methodologies with industry stakeholders in order to accelerate the adoption of safer, more efficient and sustainable solutions for faster achievement of the requirements towards the zero-emission ambition;
- launched specific challenges on the crowd sourcing platform [openinnovability.com](#), covering, among other aspects:
 - a new concept for the design of the primary and secondary substations, as well as for the smart meter installed in end user' homes, whose development and large-scale adoption will lead to a significant reduction in environmental impacts;
 - the identification of low-emission gensets to be used for emergency management or in all cases where they are needed for the operation and maintenance of the grid;
 - alternative technologies for the construction phase of traditionally concrete assets such as 3D printing.

In addition, tests were conducted on a new design of distribution infrastructure supports using alternative mate-

rials to traditional cement with a high clinker content with a high impact in terms of avoided emissions of up to 80%. Meanwhile, by way of application of the grid mining strategy, experiments continue on the reuse of composite material from wind turbines for the production of certain grid components and on the identification of solutions for the reuse of wood waste from logging near overhead lines.

In 2021 **Gridspertise** was established, a new industrial and commercial entity that offers innovative, flexible, sustainable and integrated solutions to electricity and distribution operators (DSOs), presenting itself to the market as a reliable partner to boost the digital transformation of power grids across the industry ecosystem as part of the energy transition. The priority areas for action are:

- **meter and grid edge digitalization**, focused on increasing customer engagement and stakeholder participation through smart meters and grid edge technologies that also enable engagement in electricity prosumer markets;
- **digitalization of grid infrastructure**, aimed at increasing the intelligence and flexibility of power grids to accelerate full-scale digitalization, increasing efficiency, reliability and service quality and supporting DSOs to manage the challenges facing network operations;
- **digitalization of field operations**, to increase operational efficiency thanks to innovative solutions for planning and operational processes and, at the same time, to increase the safety of internal and external operators in the field.

In October 2022, an agreement was signed for the sale of 50% of Gridspertise Srl to the international private equity fund CVC Capital Partners Fund VIII (CVC).

Record distributed renewable generation capacity with 5.6 GW connected to its grids in 2022

By 2022, we will have connected to our grids a record nearly 5.6 GW⁽¹⁾ of distributed renewable generation capacity equivalent to more than 400 thousand producers and prosumers worldwide, including more than 300 thousand in Europe and the rest in Latin America.⁽²⁾

This gives us a global cumulative capacity of 65.7 GW,⁽³⁾ equivalent to approximately 1.4 million producers and prosumers. These results were achieved thanks to the increasing capacity to accommodate distributed renewable generation (hosting capacity) and the high level of digitalization of the distribution networks operated by Enel.

For further details, see section "[Renewable energies](#)" in this chapter.

(1) Including about 300 MW corresponding to Enel Goiás in Brazil, sold at the end of December 2022.

(2) Including about 35,000 producers and prosumers added by Enel Goiás in Brazil, sold at the end of December 2022.

(3) Including about 700 MW corresponding to Enel Goiás in Brazil, sold at the end of December 2022.