# Meaning of smart grid

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The smart grid is an enhancement of the 20th century electrical grid, using two-way communications and distributed so-called intelligent devices. Two-way flows of electricity and information could improve the...

The smart grid is a planned nationwide network that uses information technology to deliver electricity efficiently, reliably, and securely. It"s been called "electricity with a brain," "the energy internet," and...

A smart grid is an electricity network that uses digital and other advanced technologies to monitor and manage the transport of electricity from all generation sources to meet the varying electricity demands of end users. Smart grids co-ordinate the needs and capabilities of all generators, grid operators, end users and electricity market stakeholders to operate all parts of the system as efficiently as possible, minimising costs and environmental impacts while maximising system reliability, resilience, flexibility and stability. Most of the technologies involved have already reached maturity, and so tracking investments provides insights on levels of deployment.

Investment in smart grids need to more than double through to 2030 to get on track with the Net Zero Emissions by 2050 (NZE) Scenario, especially in emerging market and developing economies (EMDEs).

Countries and regions making notable progress in deploying smart grids include:

With around 80 million km of transmission and distribution lines in place world wide today, electricity networks are the backbone of secure and reliable power systems. Over the coming decade, transmission and distribution grids are expected to capture a rising share of total power sector investment in the NZE Scenario, in recognition of their critical role in supporting modern power systems and clean energy transitions.

Building electricity networks, especially high-voltage interconnections, is very complex, both in terms of permitting and construction. Line route plans and reports have to be drawn up covering the entire length of the network, conditions and specifications have to be assessed, and stakeholders must be engaged. This results in long lead times for these projects.

Meanwhile, deployment of variable renewables and electrification of other sectors is moving fast, leading to strains and pressures in power systems. Real-time knowledge of system health through the use of smart grid technologies allows for fuller utilisation of existing resources, enables networks to operate closer to their true limits without sacrificing reliability, and makes it easier to contain system failures into smaller areas and prevent cascading power outages.

While the transmission grid is already well-digitised, digitalisation of the distribution grid is still lagging in

many countries, limiting the availability of real-time information. Despite the deployment of residential smart meters having advanced in recent years and even having reached 100% in some economies, such as China, the share is still very low in many countries.

Innovative digital infrastructure is gaining prominence in electricity grids, both in distribution and transmission, with around 7% growth in investment in 2022 compared to 2021.

The distribution sector accounts for around 75% of all investment in grid-related digital infrastructure, through the rollout of smart meters and the automation of substations, feeders, lines and transformers via the deployment of sensors and monitoring devices.

Investment in digitalisation in distribution also includes specific digital tools, such as Distributed Energy Management Systems (DERMS). These are able to exploit the potential of the increasing volumes of flexibility resources such as small-scale renewables plants, EV charging points and battery energy storage systems to solve local network issues for short-term grid needs, such as voltage regulation and congestion management. In addition, such tools can help distribution system operators (DSOs) to optimise their long-term investments, considering the flexibility potential of Distributed Energy Resources (DER) as an alternative to network reinforcement, including in grid-planning activities.