Advancing Europe's grid performance: why Europe must digitalise its grids

> *"Europe accounts for 27% of global cleantech patents[1], showing our leadership in the grid-enhancing and clean energy technologies that will define a competitive net-zero economy. But innovation leadership will only matter if we can deploy these solutions at scale. With 40% of Europe's grids over 40 years old, grid productivity is now a competitiveness imperative: by digitalising the network, we can unlock more capacity, flexibility and resilience from the infrastructure we already have."*
>
> ***Cecilia Bonefeld-Dahl, Director-General, DIGITALEUROPE***

> *"Digitisation is essential to unlocking the full performance of Europe's electricity grids. The priority now is to accelerate deployment at scale and build the smart grids Europe urgently needs by addressing remaining regulatory bottlenecks and providing incentives for grid digitisation. Moving to a TOTEX approach will be essential to enable more efficient investment and incentivise digital innovation in grid management."*
> ***Peter Weckesser, Chief Digital Officer at Schneider Electric and President of DIGITALEUROPE***

> *"Europe doesn't just need more grid – it needs a smarter one, and it needs it now. This white paper shows how digitalisation can unlock grid capacity through increased grid productivity and why better aligned performance indicators, incentives and rules are key for Europe's competitiveness. By smartening the electricity grid, we can deliver on affordability, sustainability and resilience."*
> ***Sabine Erlinghagen, CEO of Siemens Grid Software***

> *"For Europe, the digitalisation of grids is not just a technology upgrade — it is a strategic imperative for the energy transition. By harnessing data, intelligence, and predictive capabilities, Europe can build grids that are not only more resilient, efficient, and flexible, but also capable of integrating the complexity of a decarbonised energy system. As data becomes the operating system of the grid, digitalisation will be central to securing Europe's competitiveness, sovereignty, and sustainable growth."*
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> **Juha Pankakoski, Executive Vice President, Global Functions, Siemens Energy**

The Challenge: Europe's grid problem is performance, besides expansion

At a time of renewed geopolitical tensions in the Middle East and continued energy price volatility, Europe's energy security, sustainability and competitiveness increasingly depend on strengthening its homegrown and electrified energy system.

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[1] European Patent Office, "Energy generation technologies". Available at: https://www.epo.org/en/about-us/observatory-patents-and-technology/technologies/energy-generation-technologies

Three problems stand out:

First, rising electricity demand is putting growing pressure on grids that rely on conservative ratings and security standards designed for rare peak scenarios. As a result, **grids run at 50% load** on average, leaving an estimated **30–40% of existing capacity unused**.[2]

Second, integrating clean energy has arguably become harder than generating it. Grid connection queues are growing rapidly. Around **1.7 TW of renewable capacity is currently waiting for grid access** across Europe. This is three times what is needed to meet the 2030 national energy and climate plan targets.[3]

Third, congestion-management costs in Europe, meaning the costs of keeping electricity networks balanced and avoiding grid overloads, are soaring due to weak visibility and limited flexibility. These costs reached **€8.9 billion in 2024** and could exceed €26 billion by 2030.[4]

The Opportunity: Digitalisation can unlock today's capacity while grids catch up

The good news is that many of these challenges can already be addressed with existing technology that can help Europe's grids carry more electricity while new grid capacity is built.

Grid-enhancing technologies can increase transmission line capacity from existing grids 5by 20% to 40%.[6] Smart demand management and technologies like batteries can also reduce pressure during peak hours.

Digital tools also strengthen resilience. They enable utilities detect faults in minutes instead of hours, reducing outages and preventing blackouts. Flexibility solutions are often proving both quick and cost-effective: **over 50% of microgrid investment projects recover their investments in 5 to 10 years**[7], while some solutions can optimise hardware investment needs by up to 45%.

How Europe can unlock grid performance

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[2] Schneider Electric Research Institute; *Grid Relief from Smart Buildings;* April 2026. Available at: https://www.se.com/ww/en/insights/sustainability/sustainability-research-institute/us-electricity-2030-work-harder-smarter/. See also Compass Lexecon, "From legacy to leadership: Europe's Digital Grid Transformation". Available at: https://tdeurope.eu/wp-content/uploads/TD-Europe_From-Legacy-to-Leadership_Europes-Digital-Grid-Transformation.pdf

[3] Beyond Fossil Fuels, EMBER et al., *How Europe's grid operators are preparing for the energy transition;* May 2025. Available at: https://beyondfossilfuels.org/wp-content/uploads/2025/05/REPORT_FINAL.pdf

[4] Aurora Energy Research, *The State of European Power Grids: A Meta-Analysis,* December 2025. Available at: https://cms-production.auroraer.com/wp-content/uploads/2025/12/The-State-of-European-Power-Grids%E2%80%94A-Meta-Analysis-.pdf

[6] ACER, "Electricity infrastructure development to support a competitive and sustainable energy system – 2024 Monitoring Report", December 2024. Available at: https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_Monitoring_Electricity_Infrastructure.pdf

[6] ACER, "Electricity infrastructure development to support a competitive and sustainable energy system – 2024 Monitoring Report", December 2024. Available at: https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_Monitoring_Electricity_Infrastructure.pdf

[7] Schneider Electric Research Institute, op.cit.

If these technologies already exist, why is deployment still too slow? The problem is that Europe's grid rules and investment incentives are still not aligned with the needs for a more digital, flexible and electrified energy system. In many EU countries, grid network tariffs continue to favour traditional infrastructure spending over digital and flexibility solutions, even when these are most cost-effective.

DIGITALEUROPE's white paper identifies four priority actions policymakers should take now.

1. Measure and reward grid performance: What gets measured, gets optimised. EU countries should introduce performance-based incentives that reward energy efficiency, congestion reduction, flexibility integration and better use of existing grids. Common European indicators are needed to ensure coordination and consistency. DIGITALEUROPE proposes six: grid observability and controllability, energy efficiency, resilience, clean energy integration, flexibility management, and reducing connection delays through digital tools and GETs (i.e. grid-enhancing technologies).

2. Implement the TOTEX regulatory approach in network tariffs: Grid operators are still mainly rewarded for building physical infrastructure such as cables and substations. This creates a bias towards hardware-heavy investments, even when digital solutions could be faster and cheaper. A TOTEX approach would treat operational spending, such as software, flexibility services, storage and batteries, on equal footing with capital spending, allowing operators to choose the most efficient solution. EU electricity rules already mandate TOTEX[8], but more than two-thirds of Member States still have not implemented it.[9]

3. Embed digitalisation into distribution networks' lifecycle: Distribution grids account for around 60% of grid investment needs by 2040 and require stronger investment in people, skills and digital tools. Policymakers should support workforce training, cloud and data management best practices, and dedicated EU funding to improve grid operations, support expansion and use flexibility more effectively.

4. Ensure data access and grid-level interoperability: While 63% of DSOs share data with TSOs[10], interoperable and standardised rules for voluntary data-sharing remain limited. Europe needs clearer, standardised and harmonised rules for data access and grid communication protocols. Better coordination across transmission and distribution systems is essential to improve grid visibility, flexibility and overall system productivity.

[8] Art. 18 of Electricity Market Design Regulation (Regulation (EU) 2024/1747)
[9] European Commission, *DSO Observatory 2024 - Unlocking Flexibility in Europe*. Available at: https://publications.jrc.ec.europa.eu/repository/handle/JRC141953
[10] European Commission, *DSO Observatory 2024 - Unlocking Flexibility in Europe, op.cit*.