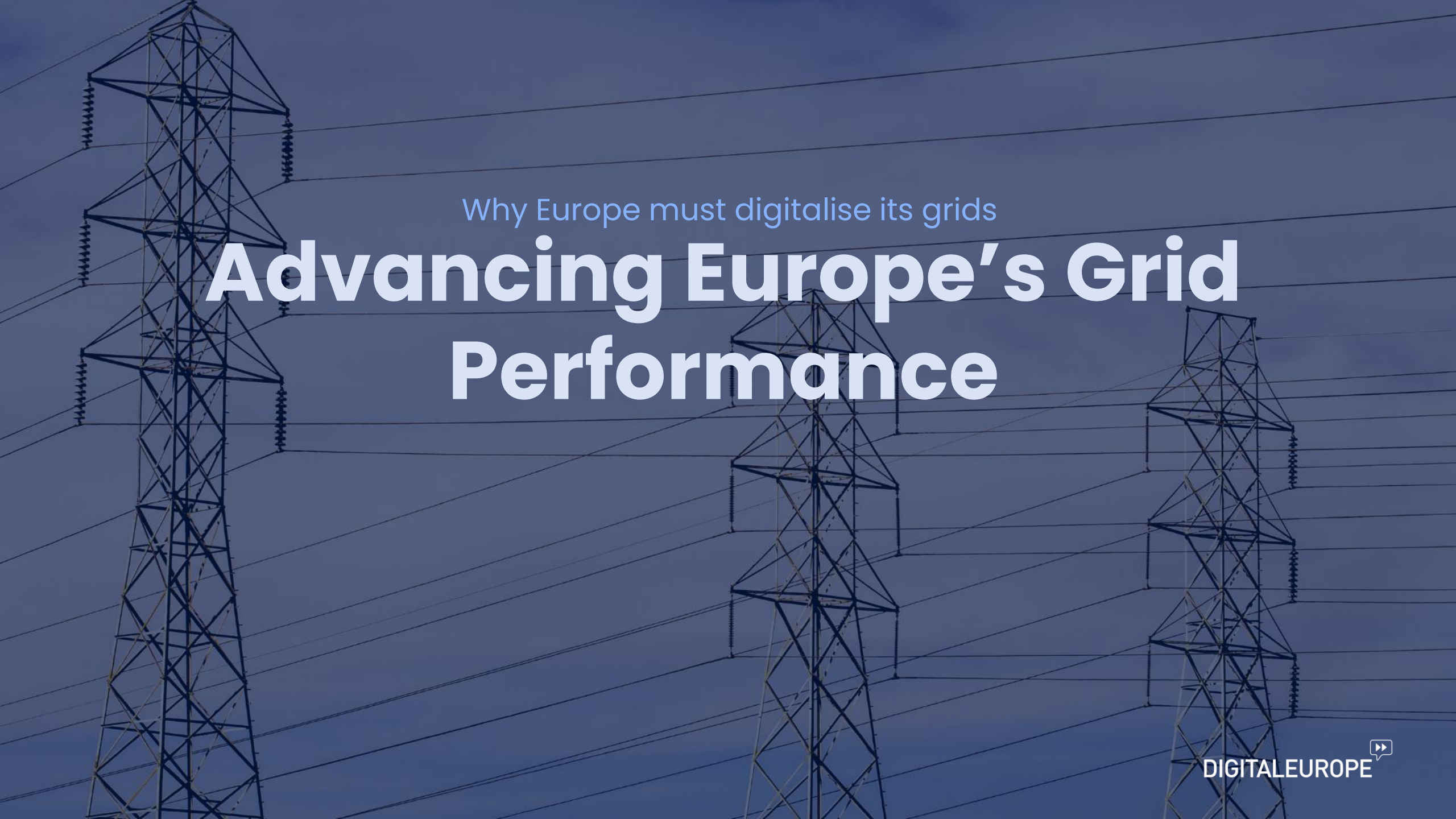

Why Europe must digitalise its grids

# Advancing Europe's Grid Performance

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# Outline

1. The challenge
2. The opportunity
3. Priority bottlenecks
4. The asks
5. Best practices from Europe and globally

THE CHALLENGE

# Europe’s grid problem is performance, besides expansion

**Europe’s grid challenge is not only about expansion. It's also about the grid's ability to adapt to new generation and demand profiles. The technology to do that already exists.**

## Key challenges

- **Untapped grid potential:** Current rules require grid operators to follow conservative ratings, security standards and assumptions designed for rare peak or worst-case scenarios. But existing grid assets often have far more usable capacity.
- **Increasing connection queues:** Queues now include renewables and large new loads such as data centres, delaying electrification and industrial growth
- **Rising congestion costs:** Grid operators are paying more for remedial actions because usage visibility, in particular at distribution level, remain too weak.

### Interview insights

> *“Europe’s biggest blind spot is distribution. Most new demand and distributed generation connect there, but grids still lack the visibility, control standards and investment incentives to use capacity more productively.”*

> *“Europe is failing the most basic purpose of its energy system to supply the demand.”*

## The evidence

**30–40%**
European grid capacity is underused because systems are planned around rare peaks and operate at **50%** load [1]

**€8.9bn**
congestion-management costs incurred by Europe in 2024, expected to reach more than **€26 bn** by 2030[2]

**1.7 TW**
renewable generation capacity now sitting in European grid connection queues[3]

**€67 bn**
Annual investments required until 2050 for a grid that delivers on the energy transition[4]

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# Digitalisation can unlock today's capacity while grids catch up

**Grid digitalisation does more with less. The Commission's legal proposal on network charges is a timely opportunity to scale grid-enhancing technologies and make electricity more attractive for the industry.**

## Reduced peak demand

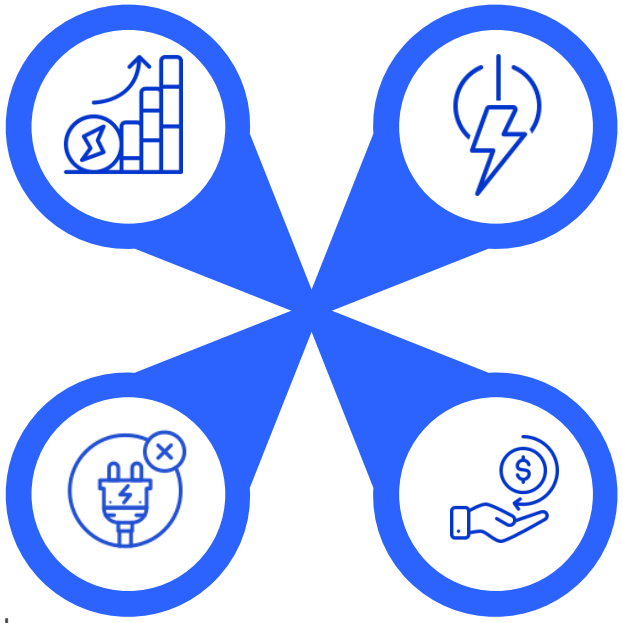
*Digital flexibility helps grids serve more load without additional infrastructure*

- **20–40%** average peak reduction via digital demand management and integration of distributed energy resources (i.e. batteries, solar panels, EVs)[5]

## Improved reliability

*Digitalisation reduces outages and maintenance costs*

- AI cuts grid fault detection **from hours to minutes**, preventing major blackouts
- **Up to 30%** reduction in outage duration reported by European utilities using digital monitoring and predictive maintenance[6]



## Unlocked spare capacity

*Real-time visibility lets grids run closer to actual limits*

- AI & digitalisation enable to carry up to **20-30%** on the same grid[7]

## Faster recovery & lower system costs

*Digitalisation improves investment recovery*

- **~70%** of demand-side flexibility projects have paybacks under 10 years, more attractive than large-scale buildout[5]
- **Up to 45%** hardware investment optimisation through flexibility solutions (e.g. RomeFlex for Italian DSO)[7]

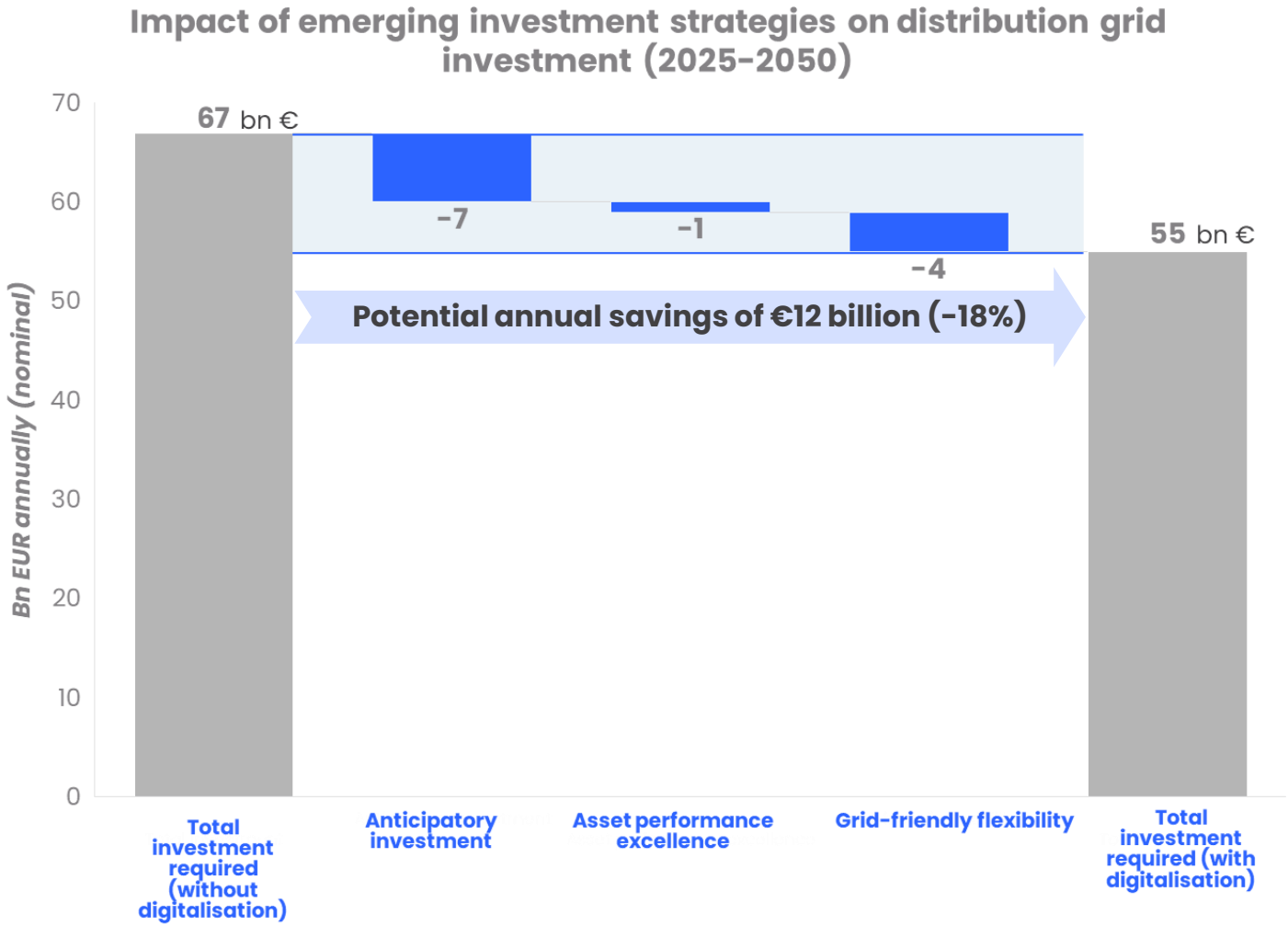
## The bottom line

Grids are run under conservative rules, leaving much capacity unused. Digital tools and DERs can flatten demand, cut peaks by up to **60%** & boost grid performance[5]

Smarter grids can cut investment needs by **~18%** — saving **€12bn / year** until 2050[8], equivalent to **14x** the entire EU's CEF energy budget

# Digitalisation can make grid investments go further

## Digitalisation can save €12bn annually in distribution grid investment through 2050




- Distribution grids need **~€67bn investment per year** through 2050 to enable electrification, energy security and decarbonisation.
- Smart investment strategies can cut grid investments needs by **18%**, reducing annual investment needs to **~€55bn**.
- The biggest savings come from **anticipatory investment** and **asset performance optimisation** through real-time data & AI, avoiding costly demand- and generation-driven physical reinforcements.
- **Flexibility and digitalisation** shift the system from reactive expansion to efficient use of existing infrastructure.

Table source: Eurelectric, *Grids for Speed*, 2024. Available at: Link

KEY BOTTLENECKS

# Europe's grid rules & incentives are not in sync with its energy future

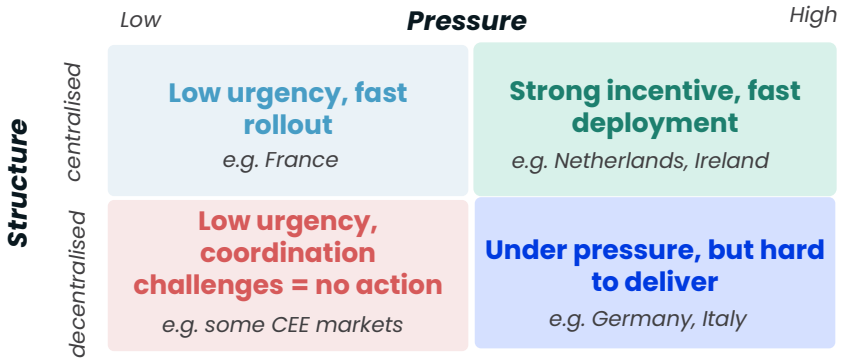
**A CAPEX investment bias and lack of regulatory incentives constrain grid performance. EU rules often already exist, but the problem is their national implementation and some loopholes.**

## Obstacles

| Lack of data governance and EU-harmonised interoperability | Scarce incentives (i.e. CAPEX bias in tariffs, no risk-sharing mechanism, no recognition of batteries as non-wire solution) | Weak flexibility uptake |
|---|---|---|
| **63%** of DSOs share data with TSOs, but interoperable, standardised rules for voluntary data-sharing are limited. [9] | **32%** of Member States apply the TOTEX approach to tariff design (i.e. AT, DK, DE, IT, NL, PT)[9], despite EU rules requiring it[10] | **15%** of Member States have flexibility incentives (i.e. Ireland, Finland, Sweden & Hungary)[9] |

## Digital drivers

Digitalisation is driven by national utility structure and urgency (e.g. congestion, high vs flat electricity demand)—not just ambition




## Where gaps are most acute

**Distribution grids:** Uneven digitalisation (i.e. smart meter rollout, dedicated measurement devices) limit DSOs' ability to-efficiently integrate and coordinate DERs in real time

**Data exchange with TSOs & DSOs**: Lack of standardisation & harmonised grid communication protocols and interfaces.

**Demand side:** Less than **30%** of EU buildings are equipped with digital controls, leaving flexibility and energy savings untapped.[11]



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THE ASKS

# Four priority policies to future-proof Europe's grids

## 1 Measure & reward grid performance

What gets measured, gets optimised. Shift from input- and asset-based indicators towards outcome-based grid performance incentives.

*Proposed possible high-level indicators:*

1. Grid observability & grid controllability
2. Energy efficiency
3. Energy resilience
4. Integration of clean energy
5. Flexibility management
6. Reducing grid connection delays via digital tools or GETs

## 2 Implement TOTEX regulatory approach

Ensure operators are rewarded equally for OPEX (digital, software, flexibility, storage) and CAPEX (traditional grid investments), with upfront, risk-free rules for operators. This is key alongside grid reinforcement.

*68% of Member States still have not applied the TOTEX approach*

## 3 Ensure data access and grid-level interoperability

Set clearer, standardised and harmonised rules for data access and harmonise grid communication protocols. Ensure coherent implementation across system layers and stakeholders to maximise productivity gains.

## 4 Embed digitalisation into distribution networks' lifecycle

Develop workforce training policies and best practices in cloud and data management as part of a broader digital approach to improve operations, support grid expansion, and use flexibility more effectively, backed by large-scale EU funding under the Multiannual Financial Framework.

Distribution grid makes up 60% of grid investment needs by 2040[12].

**Europe will not unlock grid performance at scale without regulatory frameworks to optimise capacity, deploy digital solutions, and integrate flexibility through market-based incentives.**

# Regulation can change operator behaviour

## Virginia

### Transparency on grid capacity utilisation

As the world's data centre capital, the state aims to lower its energy bills by becoming the first nation to mandate utilities to gather and report detailed data on their grid utilisation, through a bill underway.

**Impact:** *The State expects to reduce grid waste & lower energy bills through grid inefficiencies transparency*

## Italy

### Rewards for using digital solutions

Italy's energy regulator (ARERA) has introduced financial rewards for utilities that improve service quality and reduce congestion. This incentivises the use of digital tools, not just new grid infrastructure buildout.

**Impact:** *Lower costs, faster congestion management and reduced need for expensive grid upgrades.*

## Sweden

### Clear productivity metrics

The Swedish NRA (Ei) has developed grid productivity indicators to assess and monitor smart grid development in Sweden. These include: supply continuity, grid losses, voltage variation, load factor, PGFs connected to the grid, etc. [13]

**Impact:** *Enabling DSO benchmarking and targeted incentives for digitalisation and efficiency*

## Australia

### Flexibility & demand-led energy transition

Australia has shifted towards software-enabled flexibility, supported by more storage (i.e. grid-forming batteries) and infrastructure connectivity via harmonised grid communication protocols with grid operators.

**Impact:** *Reduced peak load in pilots in some states (e.g., NSW) essential grid stability services at up to 6% of the cost of traditional solutions.*

**Bottom line: Europe does not need to invent a model from scratch; it needs to scale the regulatory choices that already work**

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