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Lower grid costs through Smarter Regulation:

Benefit-based incentives, cost-efficiency, and innovative grid technology

A CurrENT Position Paper on the Regulation as regards future-proofing electricity bills in the Union, through reducing system costs and fostering electrification and digitalisation

CURRENT
Enabling Network Technology throughout Europe

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Executive Summary

Europe's transition to a decarbonised, electrified economy is driving an unprecedented wave of investment in electricity networks. The European Commission estimates that €1.2 trillion will be required in electricity network investment by 2040, split between €730 billion for distribution and €477 billion for transmission infrastructure.

A substantial share of this investment will be recovered through network tariffs and passed on to consumers, at a time when network costs already account for a significant and rising proportion of household electricity bills. Eurostat recorded an 8.9% rise in EU network costs in 2024 alone, and ACER projects that network costs could rise by 50-100% by 2050 depending on the investment pathway.

Not all of this cost is unavoidable, but a significant share of grid expansion costs can be reduced through greater use of grid-enhancing technologies, including both innovative wire and non-wire technologies. Many of these solutions can be deployed within months or years, rather than the decade or more typically required for conventional infrastructure, and can materially reduce curtailment, congestion, and connection delays.

However, current regulatory frameworks continue to reward system operators primarily for big capital expenditure on physical assets, rather than for the efficiency gains that innovative technologies deliver. This bias discourages system operators from adopting lower-cost solutions, even where these would clearly benefit consumers.

This position paper sets out evidence for this structural problem and proposes four recommendations for the Regulation to future-proof electricity bills:

1. Benefit-based incentives for cost efficiency and optimisation;
2. A common set of performance indicators for efficiency comparison;
3. Reinforcement of smart grid indicators and Union-level progress reporting;
4. Broaden the adoption of TOTEX-based regulation.

Introduction: Electrification and the Investment Imperative

Europe's energy transition is built on the twin pillars of decarbonisation and electrification. As transport, heating, and industrial processes shift away from fossil fuels, and as indigenous renewable generation continues to scale, the electricity grid must expand and adapt at pace and scale unlike any historical precedent.

This structural shift is placing the electricity grid at the centre of the EU's energy and industrial strategy, with grids now becoming the binding constraint to the pace of the energy transition. Delays and inefficiencies in grid development pose direct threats to the achievement of the EU's 2050 climate targets, competitiveness agenda, and energy security.

Against this backdrop, the Regulation to future-proof electricity bills provides a critical opportunity to ensure that the massive sums of capital about to be mobilised for grid development are spent as efficiently as possible, and that the resulting costs are fairly and sustainably distributed to consumers.

The Rising Costs of Grids

Network costs are already a substantial component of household electricity bills. Between 2020 and 2023, network costs accounted for around 24-29% of the average EU household electricity bill.[1] This share is expected to increase further as investment accelerates.

The European Commission estimates that €1.2 trillion of investment in electricity networks will be needed by 2040, including €730 billion for distribution networks and €477 billion for transmission infrastructure.[2] The large majority of this expenditure will ultimately be recovered through network tariffs and borne by end consumers.

[1] ACER, 2024 Market Monitoring Report, September 2024 (p. 43), https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER-CEER_2024_MMR_Retail.pdf
[2] https://energy.ec.europa.eu/news/eu-guidance-ensuring-electricity-grids-are-fit-future-2025-06-02_en

Evidence that network costs are already increasing has begun to emerge. Eurostat reported that network costs rose by 8.9% across the EU in 2024, with increases recorded in 18 Member States.[3] This reflects the scale of investment genuinely required to develop Europe's grids, and this upward trajectory is expected to continue as that investment accelerates.

Looking further ahead, ACER estimates that network costs could increase by 50% by 2050, and by as much as 100% under a high-investment scenario.[4] Given the scale of this investment, it is essential that regulatory frameworks are designed to ensure it is delivered as cost-efficiently as possible, so that the benefits of an improved grid are not undermined by unnecessarily high costs to consumers.

Given the scale of investment, the central policy challenge is to ensure that the grid is used as efficiently as possible in parallel with conventional expansion. Innovative grid technologies can deliver this, and their deployment must become a core part of system operators' toolkits, thereby allowing Europe to meet its future energy needs.

The Case for Urgency: The Cost of Delay

The average implementation time for conventional transmission infrastructure exceeds 10 years, of which permitting alone accounts for more than 5 years.[5] Innovative non-wire solutions, by contrast, can typically be deployed within months, enabling a rapid response to existing and emerging congestion and connection bottlenecks. Reconductoring with innovative, high-capacity wire solutions can also be done much faster than conventional expansion.

[3] https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20250506-2
[4] ACER, ACER report on network tariff practices, March 2025 (p. 4), https://www.acer.europa.eu/sites/default/files/documents/Publications/2025-ACER-Electricity-Network-Tariff-Practices.pdf
[5] ACER, 2024 Monitoring Report, December 2024 (p. 18), https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_Monitoring_Electricity_Infrastructure.pdf

This slow pace of grid expansion imposes direct costs on consumers and the wider electricity system. Delays, which are common, will result in structurally higher electricity prices and undermine Europe's energy security, competitiveness, and decarbonisation ambitions.

Evidence from transmission service operators in the United States indicates that each $1 billion of delayed investment can result in approximately $150-370 million in annual lost consumer benefits due to higher congestion, increased generation costs, and foregone efficiency gains.[6]

In Europe, grid congestion already costs around €4 billion each year and,[7] without action, the cost of managing congestion could rise dramatically over the coming decades. Estimates suggest that annual redispatch costs could reach around €34 billion by 2040 even under a high grid expansion scenario, while a business-as-usual trajectory could see these costs increase to more than €100 billion.[8] At the same time, more than 800 GW of renewable energy capacity remains stalled in grid connection queues across the continent.[9] [10] This growing backlog reflects increasingly constrained electricity networks, contributing to higher levels of renewable curtailment, undermining investor confidence, and creating wider system inefficiencies, the costs of which are ultimately borne by consumers through higher electricity bills.

If innovative, rapidly deployable, and cost-efficient technologies remain underused relative to slower conventional expansion, this will constitute a direct and avoidable transfer of cost and risk onto consumers and governments.

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[6] WIRES Group, Delaying Transmission Increases Costs and Reduces Benefits for Consumers, November 2025, https://wiresgroup. com/delaying-transmission-increases-costs-and-reduces-benefits-for-consumers/

[7] ACER, 2025 Monitoring Report, September 2025 (p. 4), https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER-Monitoring-Report-2025-crosszonal-electricity-trade-capacities.pdf

[8] https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/more-coordination-needed-renewable-deployment-prevent-grid-congestion-2024-05-27_en

[9] AURORA, The State of European Power Grids: A Meta-Analysis, December 2025, https://auroraer.com/resources/aurora-insights/articles/the-state-of-european-power-grids-a-meta-analysis

[10] Solar and wind projects requesting grid access in the UK, France, Italy, Spain, and the Netherlands

The Regulatory Barrier: A Structural Bias Towards Costly Capital Expenditure

Despite the clear cost and speed advantages of innovative grid technologies, their uptake across the EU remains limited.[11] This persistent underutilisation of innovative technologies is heavily driven by regulatory regimes that were designed for the energy system of the past.

Traditionally, European transmission and distribution system operators have been regulated using a rate-of-return or cost-plus methodology.[12] Under this framework, new infrastructure investments are approved by regulators and added to the system operator's "regulatory asset base", or RAB. The system operator then recovers these costs through allowed revenues, comprising asset depreciation (return of capital) and a regulated return calculated as a percentage of the outstanding RAB (return on capital). This framework creates a strong financial incentive to select conventional, capital-heavy solutions over cheaper, innovative solutions that can deliver equivalent results faster.

Even when a low-cost solution is more cost-effective, a system operator will typically favour the capital-intensive asset because it expands the RAB and generates a guaranteed financial return. This is due to operational solution costs being typically classified as operating expenditure (OPEX). Under traditional regulation, OPEX is generally recoverable through tariffs but does not earn a regulated return on capital, unlike CAPEX. As a result, system operators have weaker financial incentives to adopt operational solutions, creating a strong bias toward capital-intensive investments. This is what ACER itself calls the "CAPEX bias".[13]

Another regulatory model is revenue-cap (or price-cap) regulation. Under this approach, the regulator sets an allowed revenue for a multi-year regulatory period based on forecast costs. If the company beats its cost forecast,

[11] https://www.currenteurope.eu/technologies/grid-compass/dynamic-line-rating-adoption/
[12] https://www.acer.europa.eu/sites/default/files/documents/Publications/2024_Report_Benefit_based_remuneration_infrastructure_investments.pdf
[13] https://www.acer.europa.eu/sites/default/files/documents/Official_documents/Position_Papers/Position%20papers/Position%20Paper%20on%20infrastructure%20efficiency.pdf

it keeps the difference until the next reset; if it overspends, it absorbs the loss. However, like the rate-of-return or cost-plus regulation, this system too suffers from a “CAPEX bias”.

To remove this distortion, some regulators have moved to a total expenditure (TOTEX) approach, which treats CAPEX and OPEX symmetrically.[14] In its proper implementation, the TOTEX approach predefines a fixed ratio between "fast money" (revenues allowed to cover OPEX) and "slow money" (revenues allowed to cover CAPEX, over multiple years). This is known as the Fixed OPEX-CAPEX Share (FOCS) approach. Because the regulator applies a single capitalisation rate to all expenditures, the system operator’s profit margin remains unchanged regardless of whether it selects an asset-based or an operational solution.

TOTEX regimes only partially fix the underlying structural issue. While a TOTEX framework addresses the CAPEX bias within a single regulatory period, it does not provide a long-term incentive for system operators to deploy breakthrough, cost-efficient technologies. If an innovative solution reduces a project's cost by 80%, the regulator will typically adjust the system operator's allowed revenues downward at the next price review, leaving the operator with lower absolute revenues and no long-term reward for taking technological risks. In effect, this simply reintroduces the bias every price review period. System operators, understanding these cycles, will take this into account at every investment decision stage.

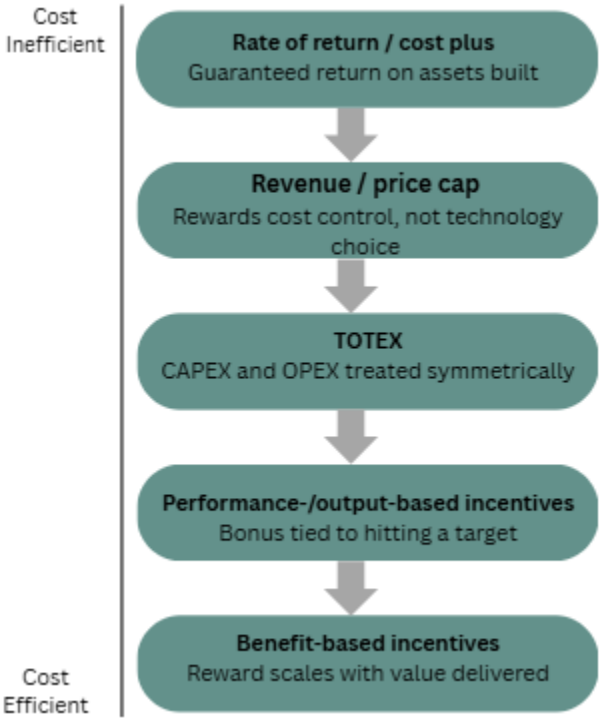
14 https://www.acer.europa.eu/sites/default/files/documents/Publications/2024_Report_Benefit_based_remuneration_infrastructure_investments.pdf

Incentive Regulation

Smart regulation requires that system operators are incentivised to deploy cost-efficient solutions. In this regard, there are two broad camps of incentive schemes worth discussing.

The first is called performance-based, or output-based, regulation. The regulator sets specific targets or indicators, linking these to a portion of allowed revenue for a system operator.[15] For example, renumeration could be tied to an increase in extra cross-border capacity. Such an approach stands as an important evolution in the renumeration model of system operators, potentially representing a genuine incentive to improve the deployment of cost-efficient solutions.

The second, and more powerful, scheme is called benefit-based regulation, as proposed in a recent report by Florence School of Regulation and the Robert Schuman Centre, compiled for ACER.[16]



Most Member States sit in the top two boxes for CAPEX.

Italy layers benefit and performance based on top of a cost plus / rate of return base.

A benefit-based scheme requires four essential building blocks:

1. Identification of the system need. The regulator identifies the specific problem to be solved. The system operator may propose needs, but the regulator confirms them.
2. A defined conventional benchmark. The regulator defines the cost of a "traditional standard solution" to that need.

[15] https://www.acer.europa.eu/sites/default/files/documents/Publications/2024_Report_Benefit_based_remuneration_infrastructure_investments.pdf
[16] Ibid

3. A system operator-proposed alternative. The system operator brings forward a more efficient or innovative solution.
4. A sharing mechanism. The system operator is rewarded with a defined share of the resulting saving, calculated as the difference between the conventional benchmark and the innovative alternative. The sharing mechanism is a percentage of the saving which the operator retains as an incentive payment, with the remainder passed through to consumers via lower network charges

The key advantage of benefit-based mechanisms is that reward is based on the value that a system operator creates, as compared to the cost of a conventional approach. As such, this scheme can effectively overcome the CAPEX bias and bring about cost-efficient solutions.

Very few European countries use performance-based or benefit-based incentive schemes today. A review of 30 European jurisdictions found that most still regulate the bulk of their network investment on a cost-recovery basis, with only a handful of countries, including Italy, Portugal, Austria, Belgium, Ireland, Slovakia and Slovenia, using any form of performance or benefit-based incentive at all.[17] Where these schemes exist, they are sometimes small, experimental, and time-limited, rather than a standard part of how network costs are regulated.

However, schemes following the logic of benefit-based mechanisms are already showing positive results. In Italy, the grid operator was able to deliver 10 low-cost projects, which were deployed in 1-2 years, unlocking 3GW+ of capacity, at 93% less cost than the counterfactual scenario.[18]

17 https://www.acer.europa.eu/sites/default/files/documents/Publications/2024_Report_Benefit_based_remuneration_infrastructure_investments.pdf

18 Based on author's calculations of data from ARERA. Full report forthcoming.

Recommendations

Recommendation 1: Benefit-based incentives for cost efficiency and optimisation

Regulators should be required to offer system operators a benefit-based remuneration route as a standard part of tariff-setting, alongside existing frameworks, such as TOTEX, rather than as an optional or experimental add-on. Under this approach, the system operator's reward is calculated by reference to the value it delivers relative to a conventional benchmark, not by reference to how much it spends.

Under a benefit-based scheme, cost reduction, achieved for example by the deployment of innovative grid technology, becomes the direct source of the operator's reward, calculated against the cost of conventional technology. This removes the perverse incentive against cost-efficiency, faced by system operators.

Recommendation 2: A common set of performance indicators for efficiency comparison

Without comparable metrics, it is not possible to accurately compare the efficiency of different system operators. As the proposed regulation requires ACER to assess the efficiency of TSOs and national regulatory authorities to assess DSOs, it is important that these assessments are based on a common set of performance indicators. Regulators should therefore be required, when setting performance indicators for the efficient operation and development of networks, to include ACER's recommended smart grid indicators. This would help ensure greater consistency and comparability across efficiency assessments.

Recommendation 3: Reinforcement of smart grid indicators and Union-level progress reporting

Regular, standardised EU-level reporting, focused on innovation, cost-efficiency and optimisation, would create much-needed visibility into how far Member States are actually deploying innovative, cost-efficient technologies.

Recommendation 4: Broaden the adoption of TOTEX-based regulation

Regulators that have not yet done so should move toward a TOTEX-based approach, treating capital and operating expenditure symmetrically rather than rewarding one over the other. This is a natural first step alongside Recommendation 1, as it removes the more basic distortion between CAPEX and OPEX, creating a fairer starting point before benefit-based incentives are layered on top to reward genuine innovation.