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Subject:	COMMISSION STAFF WORKING DOCUMENT Accompanying the document Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/943, as regards future-proofing electricity bills in the Union, through reducing system costs and fostering electrification and digitalisation

Delegations will find attached document SWD(2026) 600 final.

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COMMISSION STAFF WORKING DOCUMENT

Accompanying the document

Proposal for a Regulation of the European Parliament and of the Council

amending Regulation (EU) 2019/943, as regards future-proofing electricity bills in the Union, through reducing system costs and fostering electrification and digitalisation

{COM(2026) 600 final}

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TABLE OF CONTENTS

1. INTRODUCTION

The European electricity network is a cornerstone of the EU' economy and energy security. As the world's most interconnected electricity grid, it already allows renewables to be integrated and delivers electricity across borders. Yet the challenge facing the EU is no longer simply to maintain this system, but to transform it so that it can support a more electrified economy and efficiently integrate the widespread deployment of renewables. This calls for significant investments into electricity grids of approximately EUR 600 billion by 2030 and approximately EUR 1.2 trillion by 2040 are needed.

Considering that these investments will have to be reflected, by way of network charges, in the bills of European consumers, the EU must ensure that the electricity grid is operated at maximum efficiency, while incentivising system users to adopt system-friendly behaviours to reduce costs as much as possible. This will in turn bring down energy costs for consumers, especially for those consumers who make the smartest use of the electricity grid.

Recent geopolitical and economic developments have made it even more urgent to develop an efficient, smart and flexible grid. The continuing war of aggression in Ukraine, tensions in the Middle East and disruptions to global energy supply chains have highlighted the vulnerability of the EU to fossil-fuel price shocks and import dependency.

In light of the conflict situation in the Middle East, President Von Der Leyen stated ahead of the European Council of 19 March 2026 that: '*we need to* ***make the best use of existing grid infrastructure****. While grid charges are essential to cover much needed investments, we should also* ***ensure that grid users receive the right incentives to make optimal use of existing grid infrastructure, as this will avoid unnecessary and costly grid expansions****. Grid operators too can do more to* ***improve the productivity of grid infrastructure, making full use of innovative technologies****. The Commission will present a* ***legal proposal to achieve those goals****, while allowing Member States to reduce grid charges for energy-intensive industries'* (emphasis added) ([1]).

The European Council, in its conclusions called: '*on the Commission, in the light of the recent letter by its President, including regarding the intention to increase the market stability reserve, to urgently present* ***targeted measures – across all components of electricity prices – for concrete actions to lower electricity prices*** *[...]'* ([2]).

Against this backdrop, the European Commission ('Commission') put forward a coordinated set of measures to boost security and affordability by reducing the EU's reliance on imported fossil fuels. AccelerateEU ([3]), published on 22 April 2026, establishes a plan for an energy union that delivers energy security and clean, abundant, affordable, homegrown energy to EU consumers and businesses. It highlights the importance of decarbonisation, the need to protect consumers and industry from price peaks and the need to invest in and modernise our infrastructure.

This proposal builds on previous Commission measures to answer the call to improve the efficiency of the electricity system, while making full use of innovative technologies, ultimately reducing overall energy bills.

([1]) https://ec.europa.eu/commission/presscorner/detail/en/STATEMENT_26_663.
([2]) en-20260319-european-council-conclusions.pdf.
([3]) https://energy.ec.europa.eu/strategy/accelerateeu-strengthen-eu-energy-resilience_en.

It does so by directly addressing two components of those bills, namely network charges and taxes through specific measures on network charges, smart electricity grid indicators, smart meters, and taxation, as well as the related question of timely grid access to enable electrification, by proposing measures enabling non-discriminatory and transparent prioritisation of grid connection requests and their maturity.

The proposal seeks to improve the design of network charges so that both system operators and system users are incentivised to use the electricity system more efficiently, reduce peaks, make use of flexibility and limit avoidable grid costs. To support this, it introduces targeted measures to make those incentives effective in practice: a minimum smart meter trajectory, common smart grid indicators, more effective electricity grid data exchange, and a voluntary EU-level framework for secure reuse of electricity grid data to develop and test innovative digital tools to operate and optimise the grid.

At the same time, the proposal will play a crucial role in speeding up electrification of the EU's energy system, through appropriate tariff design, efficient technologies and flexibility. Smart meters and smart grids, supported by secure and interoperable data exchange between system operators, market participants and final customers, are key enablers of such flexibility, as they allow electricity consumption, generation and storage to respond more efficiently to system needs and price signals. However, the transition to electrification is hampered where national taxation frameworks continue to favour fossil fuels over electricity, thereby disincentivising the shift to lower-cost, renewable and low-carbon energy solutions.

To lower electricity bills effectively and support the EU's energy and climate objectives, the Commission's proposal takes a dual approach by both making electricity networks more efficient and aligning taxation principles. The measures on taxation do not harmonise tax rates or levels but ensure that electricity is not subject to a higher tax burden than gas.

2. NETWORK CHARGES

2.1. Policy context

2.1.1. Role of network charges in the electricity system

The main element of the proposal relates to network charges, which constitute one of the four elements of energy bills.

Network charges finance the physical upgrade of grids and the operation of the electricity system. Put simply, network charges are what all system users connected to the electricity system pay for the service of having the possibility to have electricity transported from the point of production to where the electricity is used. Tariffs ([4]) allow for the cost recovery of investments into transmission and distribution grid assets, smart meters, the cost of maintenance and repairs of the existing network, running system services on a daily basis as well as the costs of transmission system operators ('TSOs') and distribution system operators ('DSOs'). Costs that can be recovered by network tariffs include capital expenditure related to infrastructure investments ('CapEx'); operational expenditure related to the daily management of the system ('OpEx'); remuneration of system operators; the cost of network losses; costs of system balancing and ancillary services; costs of congestion management; and others.

Network charges are complex in their design, as they have to balance different system needs while encouraging cost-effective multi-annual network investment decisions and strong incentives to keep overall operational system costs in check.

Network charges are set for regulatory periods (typically of 4-5 years), during which the national regulatory authorities ('NRAs') determine the level of tariff remuneration (i.e. allowed revenues for system operators) and tariff methodologies, which determine the incentives for system operators and how the total costs will be distributed among system users in the form of network charges. This regulatory cycle provides stability, although there are often mid-period adjustments or annual revisions to ensure that the levels of allowed system operator revenue and network charges are consistent with the actions system operators need to take to manage any change in circumstances.

2.1.2. Existing EU legislative framework

2.1.2.1. Independent NRAs competence to fix or approve tariffs

Under EU legislation, ultimate responsibility for network tariff design lies with the independent NRAs ([5]). According to Article 59(1)(a) of Directive (EU) 2019/944 (the 'Electricity Directive') ([6]), NRAs have '*the duty to fix or approve, in accordance with transparent criteria, transmission or distribution tariffs or their methodologies, or both'*.

([4]) Tariffs and network charges are used interchangeably, both in the staff working document and the legislative proposal accompanying it.

([5]) In ACER's report tariff setting is described as a three-step process: first, the allowed or target revenues of the system operators (including the remuneration method for TSO or DSO costs) are determined; second, the tariff structure is defined; third, the costs/revenues are allocated to each of the tariff structure's items (i.e. charges paid by network users). See the ACER tariff report 2025, pp. 71-72, available here: 2025-ACER-Electricity-Network-Tariff-Practices.pdf).

([6]) Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast), as amended by Directive (EU) 2024/1711 of the European Parliament and of the Council of 13 June 2024, OJ L, 2024/1711, 26.6.2024 (http://data.europa.eu/eli/dir/2024/1711/oj).

Member States are obliged to guarantee the NRA's independence and ensure that it exercises its powers to fix or approve tariffs impartially and transparently.

For that purpose, NRAs must be legally distinct and functionally independent from other public or private entities, act independently from any market interest and take autonomous decisions, independently from any political body ([7]). That requirement has no bearing on close cooperation with other relevant national authorities or to general policy guidelines issued by the government not related to the regulatory powers and duties under Article 59 of the Electricity Directive. NRAs' independence from national governments and parliaments in relation to the exercise of their competence in tariffs has been put forward and upheld by the Court of Justice of the European Union ('the CJEU').

The Court has consistently found that NRAs must make their own decisions autonomously and solely in the public interest, to ensure compliance with the objectives pursued by Regulation (EU) 2019/943 (the 'Electricity Regulation') ([8]) and the Electricity Directive, without being subject to external instructions from other public or private entities.

To this end, the Electricity Directive requires Member States to ensure that their NRA has '*all the necessary human and financial resources it needs*' ([9]) to perform its tariff-setting tasks well, and in accordance with EU legislation.

2.1.2.2. Current tariff design principles

As outlined above, the NRA has the responsibility to fix or approve tariff methodologies. The scope of this responsibility can only be defined and amended by EU legislation. The principles for developing tariffs are set out in the Electricity Regulation, including subsequent amendments in the latest reform of 2024 (the 'Electricity Market Design Reform Package') ([10]). In addition, governments can issue general policy guidelines in accordance with Articles 57 and 59 of Directive (EU) 2019/944.

A basic principle enshrined in Article 18 of the Electricity Regulation is that network charges should be cost-reflective and encourage efficient use of the existing grid by providing price signals for network users to adapt their behaviour. According to the Electricity Regulation, network charges must be '*cost-reflective, transparent, take into account the need for network security and flexibility and reflect actual costs incurred…*'. In addition, the tariff regime should support '*overall system efficiency*', provide '*price signals to consumers and producers*', '*locational signals at Union level and take into account the amount of network losses and congestion caused, and investment costs for infrastructure*' ([11]).

Traditionally, electricity tariff regimes were split between CapEx and OpEx under regulatory prices controls, with a strong bias towards CapEx investment in infrastructure which is typically regulated via a certain expected rate-of-return on investments. However, this approach had to be updated to adjust to the overarching policy of decarbonisation and increased electrification, along with the decentralisation of energy production. In the

([7]) Article 57 of the Electricity Directive.

([8]) Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast), as amended by Regulation (EU) 2024/1747 of the European Parliament and of the Council of 13 June 2024, OJ L, 2024/1747, 26.6.2024, ELI: http://data.europa.eu/eli/reg/2024/1747/oj. See also relevant CJEU judgments: judgment of 2 September 2021, *European Commission v Federal Republic of Germany*, Case C-718-18; judgment of 3 December 2020, *European Commission v Belgium*, Case C-767/19; judgment of 11 June 2020, *Prezident Slovenskej republik*y, Case 378/19.

([9]) Article 57(5)(b) of the Electricity Directive.

([10]) Regulation (EU) 2024/1747 of the European Parliament and of the Council of 13 June 2024 and Directive (EU) 2024/1711 of the European Parliament and of the Council of 13 June 2024.

([11]) Article 18 paragraphs 1 to 3of the Electricity Regulation.

context of the Electricity Market Design Reform Package, Article 18 of the Electricity Regulation was amended to reflect this. The legislation now requires a total expenditure ('TotEx') approach in that tariffs should '*reflect the fixed costs of transmission system operators and distribution system operators and shall consider both capital and operational expenditure to provide appropriate incentives to transmission system operators and distribution system operators over both the short and long term including anticipatory investment, in order to increase efficiencies including energy efficiency*.' In this way, tariff methodologies should encourage holistic thinking about system needs and the most efficient solutions to meet these needs ([12]). This approach can allow NRAs to incentivise TSOs, DSOs and market participants to invest in cost-effective systems that allow for flexibility and optimal use of the grid rather than a more traditional approach of only building out the grid. ([13]) A recent survey by the Commission's Joint Research Centre focusing on major DSOs found that, in only 32% of the 26 participating EU countries in which the surveyed DSOs operate, NRAs apply a TotEx approach. In the remaining 68% of countries, NRAs apply a non-TOTEX approach. ([14])

Additional principles for tariff design further demonstrate co-legislators' acknowledgement of the increasing need for incentives to be provided to system users to develop system-friendly behaviour to increase the flexibility of the grid. For example, Article 18(2) of the Electricity Regulation requires incentives to be provided to system operators over both the short and long-term including anticipatory investments to foster the integration of renewables, flexibility, demand response and optimisation solutions for existing grids.

Moreover, to acknowledge the changing role that distribution systems are playing – most new renewables projects are connected at the distribution level – Article 18 of the Electricity Regulation sets out that network charges should not discriminate between production connected at the distribution level and production connected at the transmission level.

Finally, to support NRAs in designing the national tariff regime and to mitigate the risks of market fragmentation, the Agency for the Cooperation of Energy Regulators ('ACER') produces a report every two years on transmission and distribution tariff methodologies. The most recent report, published on 26 March 2025 ([15]), highlights best practices and contains recommendations for NRAs. NRAs should take account of these reports in their work while also considering national specificities. In addition, ACER published a report into DSO revenue setting in April 2026([16]), which provides recommendations and supports NRAs further in their work.

2.1.3. Problem Definition

The Electricity Regulation and Electricity Directive already contain a comprehensive set of rules on network charges design, covering both the cost coverage of system operators and the principles of how this cost is distributed between different user categories to provide the right incentives for system-friendly behaviour. These rules largely stem from

([12]) In order to promote innovation and move away from CapEx bias in grid investment, RAP advocates allowing for revenue-capped cost recovery based on total expenditure and rewarding system operators for specific performance outputs that promote the energy transition to incentivise network innovation. Incentivising Network Innovation – RAP Blueprint.

([13]) Action 12 in ACER, Unlocking flexibility: No-regret actions to remove barriers to demand response).

([14]) See JRC, 'DSO Observatory 2024 – Unlocking Flexibility in Europe' (2025), pp. 52-55, available at: https://publications.jrc.ec.europa.eu/repository/handle/JRC141953.

([15]) Available here: 2025-ACER-Electricity-Network-Tariff-Practices.pdf.

([16]) https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER-2026-DSO-revenue-setting-report.pdf.

the 2019 Clean Energy Package and were written with integration of renewables and flexibility in mind. They were recently amended and updated as part of the Electricity Market Design Reform Package.

Meanwhile, European energy systems are undergoing a paradigm shift. In the past, large, centralised dispatchable generation covered the demand of predictable loads. However, the power system now features a larger proportion of decentralised and intermittent renewable electricity. At the same time, electricity demand is expected to increase ([17]) as we decarbonise and electrify new sectors of the economy. The electricity grid is also experiencing changes in patterns of electricity flows due to a high concentration of renewable power in certain areas of the grid and increased distributed generation at household level (for example, rooftop solar). Within this context, the role of the electricity network and underlying charges is also evolving. Network charges can have an influence on steering investments and on the behaviour of system users already connected to the grid. Equally, network charges can encourage or discourage the flexibility needed to minimise system costs.

Therefore, while cost recovery is a key purpose of network tariffs, there is substantial room to amend the current tariff design principles to provide stronger incentives to encourage system-friendly behaviour by system users and more efficient grid operation by TSOs and DSOs, which would ultimately drive down the costs of grid investment and system operation ([18]). Moreover, while the principle of tariff transparency is already set out in Article 18 of the Electricity Regulation, there is substantial room to introduce measures to improve transparency in tariff-setting methodologies.

Finally, on 2 July 2025, the Commission published a notice with guidelines on future proof network charges for reduced system costs (the 'Commission guidance') ([19]). In that notice the Commission proposes a design of tariff methodologies for network charges to incentivise the use of flexibility and investments to optimise the use of existing grid, deliver grid expansion at least cost and ensure a fair and cost-reflective allocation of grid charges while encouraging European competitiveness, deeper electrification and decarbonisation. However, to achieve these objectives, it is of utmost importance that the relevant design principles are implemented in all Member States. This can only be achieved through legally binding instruments, such as the measures in this proposal, which are consistent with the Commission guidance.

2.2. Objectives of the proposal

First, the proposal aims to clarify the current rules for network charge design and introduce additional rules to provide **stronger incentives** to encourage system users to adopt a **system-friendly behaviour** and system operators to manage the **grid more efficiently**. A key overarching principle set out in the proposal is that of **incentive-based regulation**. The overall cost and efficient use of the grid is heavily dependent on the performance of system operators and how their compensation is calculated. Regulatory incentives that promote a neutral approach to operational and capital expenditure can be transformative

([17]) Electricity consumption in the EU is expected to increase by around 60% by 2030 (EU Action Plan to accelerate the roll-out of electricity grids for Grids, 2023).
([18]) This is in line with the findings of the recent Commission guidelines on network charges, C(2025)4010 final.
([19]) https://energy.ec.europa.eu/publications/communication-future-proof-network-charges-reduced-energy-system-costs_en.

and induce network operators to seek solutions at the most efficient total cost right from the planning stage.

The following examples are illustrative of the types of design principles that are proposed for inclusion in Article 18(2) of the Electricity Regulation.

The proposal also introduces certain restructuring amendments to the existing Article 18 of the Electricity Regulation. In particular, certain elements currently in paragraphs (3) to (8) of Article 18 are moved to paragraph (2) as design principles, because they qualify as such. One example relates to providing **appropriate incentives for system operators** to operate the network in a cost-efficient way. The requirement that tariffs should provide appropriate incentives to system operators is currently included in Article 18(8). However, given that this is a principle according to which tariffs should be designed, it has been placed as point (c) in the second paragraph of the proposed Article 18. Furthermore, this should be a principle applicable not only to DSOs, but also to TSOs. Another new element that the proposal includes in Article 18(2) (c) is that those incentives should span across all voltage levels. The rationale behind this addition relates to **improving cooperation between system operators**. Better cooperation between TSOs and DSOs is an important objective because it can make grid planning and operation more efficient, reduce unnecessary costs and interventions, improve stability and reliability, and allow the electricity system to be managed in a smarter, more flexible way.

The proposal introduces a design principle in Article 18(2), according to which tariff methodologies should provide appropriate incentives for system users to **reduce peak load consumption**. This proposal is in line with the Commission guidance ([20]). Indeed, one key area where network tariffs can play an invaluable role is in lowering peak demand. In a system with growing flexibility needs, the principle of cost-reflectivity must reflect this to ensure that network costs are fairly allocated among system users according to how much they cost or support the system. Otherwise, NRAs risk not taking actual costs that users generate for the grid into account correctly, leading to those network costs being charged to others. Electricity grids are generally dimensioned to cover peak demand and any incentives through network charges for energy consumers to reduce the peak leads to a reduction in energy system investments to cover it. The proposal indicates that one way for tariffs to incentivise system users to reduce peak demand is by adding a **capacity element** to the tariff structure, i.e., elements based on system users' **peak electrical demand** (measured in kilowatts, kW) rather than just the total amount of energy they consume (kilowatt-hours, kWh). While the notion of capacity elements in tariffs is included in the current text of Article 18(7) of the Electricity Regulation, it only relates to distribution tariffs. The proposal clarifies that this should apply to distribution and transmission tariffs alike.

Linked to the above, the proposal includes in the amended Article 18(2) of the Electricity Regulation that tariff methodologies should contain **time-of-use elements**, i.e., elements based on system users' time at which they consume energy**.** This proposal is in line with the Commission guidance ([21]). Adding time-of-use elements to volumetric energy charges increases cost-reflectivity as it incentivises system users to produce or consume electricity

([20]) See footnote 19; Commission guidance p. 13.

([21]) See footnote 19; Commission guidance p. 13.

in a way that reduces system peaks and utilises the full potential of renewable energy when abundant. Traditionally, network charges were either static with the same price for each hour or contained a basic temporal difference with higher charges for day rates and lower charges for night rates. Today, with the deployment of smart meters, the introduction of time-of-use elements in network charge design can be far more sophisticated and reflect real-time use of the grid. Moving users away from peaks reduces investment needs across the entire network since usage at peak times is often a cost driver for new investments. In addition, grid tariffs should also stimulate consumption during peak renewable production times when demand is flexible, such as filling battery storage or charging electric vehicles, for example. While the notion of 'time-differentiated network tariffs' already exists in Article 18(7) of the Electricity Regulation as an element for NRAs to consider when fixing or approving tariffs, the proposal includes it among the elements that tariffs should contain.

Second, the proposal aims to improve **transparency** in the way in which tariffs are structured.

It does so:

- Through proposing the addition of Article 18(5) and (6) to the Electricity Regulation which require (i) publication of the costs that are to be recovered by TSOs and DSOs through network charges; (ii) publication of details underlying tariff methodologies and (iii) NRAs to publicly consult relevant stakeholders before fixing or approving tariff methodologies;

- Through proposing the addition of Article 18(7) to the Electricity Regulation which requires ACER and NRAs to carry out efficiency comparisons of TSOs ad DSOs respectively;

- Through proposing an empowerment on the Commission to adopt one or more Delegated Acts setting out; (i) a common structure and harmonised methodology on tariffs; (ii) detailed conditions under which regulatory authorities may introduce separate network charge regimes for specific categories of system users; and (iii) harmonised rules on the procedural and substantive requirements for the public consultations that need to be carried out for the relevant draft tariff methodologies.

The proposed transparency measures will allow system users to better understand the tariffs set for both transmission and distribution network services, as well as how such tariffs have changed, are set and may change in the future. Additionally, network users should be able to understand the costs underlying transmission and distribution tariffs and to anticipate their level to a reasonable extent.

Last but not least, the additional measures on transparency included in the proposal will also help NRAs in their task of setting or approving 'smarter' tariffs that ensure the electricity grid is managed more efficiently, by providing further targeted incentives for system users and system operators.

Third, the proposal clarifies that two possibilities are available:

- A possibility for NRAs to adjust the tariff regimes to reflect the different consumption patterns of specific categories of system users, such as energy intensive users, data centres and others. NRAs could calibrate and set lower tariffs for data centres and energy intensive users, insofar as this is justified and in line with the principle of cost reflectivity, as set out in the proposal for Article 18(3), and without any entitlement to State aid compensation. This was part of the Commission's recommendation in the Commission guidance on future-proof network charges for reduced energy system costs ([22]).

An increasing number of system users may adjust their electricity consumption profiles thanks to demonstrating flexibility using storage or demand response. For example, zinc producers already adjust their consumption profile at short time frames to electricity prices as part of their operations. Aluminium producers can also add flexibility in their consumption profile in the form of short-term interruptible load. For the iron and steel sector, there are a number of opportunities to adjust their electricity demand profiles in both electric arc furnaces and blast furnaces, as well as in the use of electrolysers ([23]) . Data centres can provide grid flexibility by adjusting both their physical assets and IT operations ([24]). On the physical side, they can temporarily curtail cooling loads using thermal inertia, leverage on-site battery storage, or run backup generators to shed grid load during peak periods. On the software side, they can perform temporal workload shifting, delaying non-urgent tasks like AI model training to off-peak hours. Hyperscalers can also geographically redistribute computational workloads to regions with abundant, cleaner, or lower-cost renewable energy. In addition, recharging pools ([25]) can also provide flexibility to the grid. For example, they can react to price signals by adjusting the charging speed of the assets that are connected to them.

- A possibility for Member States to allocate funding to the electricity network from their general budget for the purpose of supporting large investments to accelerate decarbonisation, electrification of production processes and market integration. Such State injections should be subject to specific safeguards, as set out in the proposal for Article 18(4). In this context, any public support should be targeted and temporary. Member States should fully assess the budgetary implications prior to introducing such measures, to ensure compliance with the EU fiscal rules in line with the objectives of the Stability and Growth Pact ([26]).

  Member States maintain their right to notify under applicable State aid rules measures aimed to reduce energy costs, including network charges for specific categories of system users, while preserving incentives provided to system users to choose their location and adjust their consumption to lower the overall costs of the transmission and distribution systems.

([22]) Commission notice on Guidelines on future proof network charges for reduced energy system costs, (C/2026/126), p. 13.

([23]) JRC Publications - Flexibility options in a decarbonising iron and steel industry (2024).

([24]) CERRE (2025) Flexibility in the energy sector.

([25]) See Article 2, point (51) of Regulation (EU) 2023/1804 of the European Parliament and of the Council of 13 September 2023 on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU, (OJ L 234, 22.9.2023, pp. 1–47, ELI: http://data.europa.eu/eli/reg/2023/1804/oj).

([26]) See link: Stability and Growth Pact - Economy and Finance - European Commission.

2.3. Expected benefits and impacts

2.3.1. Benefits to the network and system users

As the European power system changes, so should the design of network tariffs. As mentioned above, today's power system features a growing proportion of decentralised and intermittent renewable energy, as well as changes in patterns of electricity flows due to a high concentration of renewable energy in certain parts of the grid and increased distributed generation such as small-scale batteries and rooftop solar. Aligning the network tariff design with these changes can significantly benefit the system as a whole. Tariff designs already tend to vary both across and between EU households and industries. Indeed, according to the European Central Bank, network costs accounted for an average of 27% of household bills and 12% for those of energy-intensive industries in 2024 indicating that network charges constitute a higher proportion of the bill for households ([27]).

One of the drivers of network costs is the need for new investments and the modernisation of the existing grid. To build a decarbonised EU energy system, investments of an unprecedented magnitude of approximately EUR 1.3 trillion will be needed in the transmissions and distribution grids ([28]). More specifically, electricity distribution dominates, accounting for nearly half of the total investment needs (€730 billion) over the period 2024-2040 driven by the shift to renewable energy and electrification, which require extensive modernisation and expansion of networks. Transmission infrastructure also attracts considerable investment, with over €472 billion of investment needs in the respective years, largely due to investments in national transmission infrastructure which constitute more than 70% of the investment needs.

Designing network charges to reduce peak load through **capacity charges** can play a crucial role in reducing the overall need for grid reinforcements. For example, according to a 2025 report published by the Dutch government, estimated total investment needs until 2040 for the electricity grid in the Netherlands is EUR 195 billion but, importantly, analysis also shows that making better use of the network could reduce the cumulative investment by up to EUR 22.5 billion for the Netherlands alone ([29]). Similar effects have been demonstrated in other Member States, where more cost-reflective network charges have significantly reduced peak load consumption and hence the necessary build-out of the electricity grid. This was the case in Belgium ([30]), where capacity-based charges were introduced to provide clear price signals to minimise the synchronous peak, thus avoiding the need for further grid investment. Evidence shows that the industrial synchronous peak decreased by 4% between 2019 and 2024 despite the actual volume of withdrawals increasing by 10%. This approach can therefore enable more capacity on the grid and support electrification.

Adding a **dynamic time-of-use element** to the charges for system users is a significant tool to drive more grid-friendly behaviour. Currently, 14 Member States distinguish

([27]) See link: https://www.ecb.europa.eu/press/economic-bulletin/focus/2026/html/ecb.ebbox202601_02~a552b71378.en.html.

([28]) Investment needs of European energy infrastructure to enable a decarbonised economy (2025), available here: Investment needs of European energy infrastructure to enable a decarbonised economy - Publications Office of the EU.

([29]) https://open.overheid.nl/documenten/e914cc94-ffcd-42dd-9989-bf7c3fdd44f9/file.

([30]) https://energy.ec.europa.eu/document/download/8789f345-a6ae-46b6-97d2-a7366e516cdc_en?filename=C_2025_4010_1_EN_annexe_acte_autonome_cp_part1_v4.pdf.

between seasons ([31]), for example. This could be built on further to incentivise users to produce or consume electricity when prices are lower and renewable energy is abundant, and limit, to the extent possible, the more expensive times for using electricity. This goes hand-in-hand with the deployment of smart meters, and with the expected high additional deployment rates of distributed generation and demand (e.g. electric vehicles and electric heating), time-of-use incentives can have a significant impact.

The central role of dynamic time-of-use tariffs was analysed by Agora Energiewende in a study focused on the potential for flexibility at household level in Germany ([32]). It found that applying dynamic time-of-use grid tariffs can reduce grid expansion costs at the low voltage level by around 50% compared to having no price signals at grid level and flexibility only reacting to the market price signal. Furthermore, it found that households with dynamic tariffs could save EUR 600 per year in the long term. These significant financial savings also imply lower electricity costs for all consumers if dynamic time-of-use tariffs are widely used.

In Spain ([33]), the tariff structure applies energy and capacity-based charges (75% of the tariff is capacity-based at the transmission level and is 84.6% at the distribution level). Additional charges are levied for excess power withdrawal above the contracted capacity, and the time-of-use element is divided into six periods, depending on the season, day of the week and time of day. The purpose of this pricing structure is to incentivise efficient behaviour, allowing for increased consumption outside of system peaks and therefore reducing the requirement for investment in electricity networks. The evidence suggests that this tariff methodology reduced transmission and distribution charges by 5.6% between 2019 and 2020. While the biggest savings are available to customers better able to adapt to price signals, even consumers who did not adjust their consumption at the low voltage level experienced a 0.6% reduction in charges.

In Slovenia ([34]), the design of capacity and energy-based time-of-use tariffs allows end-users to increase electricity consumption (such as for heating and transport) without substantially increasing their network charges, by utilising flexibility and managing their peak demand. This supports electrification and facilitates the integration of distributed renewable energy. The updated tariff methodology substantially increased the share of power-based charges, improving cost-reflectiveness. This is supported by widespread smart metering and a national data hub with access to 15-minute real-time data. The design helps to prevent speculative under-contracting, while transitional exemptions protect small users (< 43kW) during the tariff methodology shift. Within three months of implementation, the system observed over 50MW in load relief (which corresponds to about 2.4% of the national peak in January) and new demand response business models also emerged.

([31]) https://op.europa.eu/en/publication-detail/-/publication/08843617-9cf8-11f0-97c8-01aa75ed71a1/language-en.

([32]) Agora Energiewende and Forschungsstelle für Energiewirtschaft e. V. (2023): The benefits of energy flexibility at home https://www.agora-energiewende.org/fileadmin/Projekte/2023/2023-14_DE_Flex_heben/AEW_326_energy_flexibility_at_home_WEB.pdf.

([33]) 50 ACER (2025) Best Practice Report.

([34]) https://op.europa.eu/en/publication-detail/-/publication/08843617-9cf8-11f0-97c8-01aa75ed71a1/language-en?.

Analysis from ACER ([35]) has found that more advanced differentiation in time and location through fully dynamic tariffs could further increase the cost-reflectivity of tariffs and incentivise efficient network behaviour. It is therefore an important principle when designing network charges. However, NRAs need to balance this with complexity of design, the level of smart meter rollout in a given country and interplay with dynamic retail pricing.

In relation to **locational charges**, increased decentralised generation from renewable and other sources has implications for overall system costs especially at distribution level ([36]). Therefore, smarter design of network tariffs, through a diversified connection charging regime, can help to direct investments in generation closer to demand (and vice-versa). In cases where grid capacity already exists (for example in places where fossil fuel power plants are being decommissioned or there was previously high industrial demand), such charges ensure grid-friendly network usage. Over time, this helps to reduce costly network congestion, reduce overall investment needs and minimise network costs for all users. It can also help to direct investments to non-fossil flexibilities, such as storage and demand response, and to steer these flexibilities towards certain areas, for example, near areas characterised by significant variable renewable generation. This is particularly relevant in Member States which suffer from significant internal network congestion. Although not directly covered by the proposal, differentiated connection charges could be further complemented by locational charges for injecting into the grid as a way to reduce or time-shift peak supply in certain areas where the grid is particularly congested.

Denmark, for example, has included several design elements in the network charges to enable locational incentives ([37]). It considers differentiated connection charges based on the geographical location of the network user (based on generation surplus areas versus demand surplus areas). Use-of-network charges are also calculated by applying a locational factor, whereby producers in areas with high demand surplus pay lower charges, thereby reducing bottlenecks. From 2023, injection charges apply for distribution costs (previously only for transmission costs) and new legislation in 2023 also expanded the possibilities for industrial-scale co-located production and consumption through one connection point to the grid, with the aim of encouraging co-location of renewables and consumption.

As mentioned above, the proposal aims to ensure that tariffs provide the necessary incentives for a neutral approach to operational and capital expenditure. The impact of creating more balanced incentives that encourage a move away from a focus on capital expenditure and that incentivises optimal choices can be significant. According to a 2026 study ([38]), if inefficient TSOs moved closer to the performance level of more efficient TSOs today, they could already achieve savings of up to 3%. This does not include future performance improvements expected with increased flexibility.

([35]) https://www.acer.europa.eu/sites/default/files/documents/Publications/2025-ACER-Electricity-Network-Tariff-Practices.pdf.

([36]) Between 60-90% of new connections are at distribution level (Clean Energy Package Impact Assessment, 2016).

([37]) ACER report on network tariff practices (2025) https://www.acer.europa.eu/sites/default/files/documents/Reports/2025-ACER-Electricity-Network-TariffPractices.pdf.

([38]) Guidehouse (2026) Study on tariff structures, incentives for flexibility and efficient investments.

Indeed, at national level, some NRAs are already looking into what can be achieved in the longer term. For example, in France, the NRA expects ([39]) that appropriately reflecting flexibility solutions as an input to grid capacity sizing should bring significant savings for the power system; savings for the TSO alone are estimated to be nearly EUR 7 billion over 15 years. Furthermore, the French DSO ENEDIS is testing the use of flexibilities (overlapping between consumption and production and between sectors, balancing, local flexibility) to optimise the sizing of its grid in a project expected to bring EUR 250 million savings by 2035 ([40]). Furthermore, studies show that deploying more innovative grid technologies could increase overall existing network capacity between 20% to 40% by 2040 ([41]), thereby reducing the need for grid expansion and its related costs.

Without solid incentive-based regulation to ensure the best outcomes for consumers, there is a risk that these benefits may not be realised. Indeed, system operators should be encouraged to innovate and look to existing examples deployed globally. In Australia ([42]), for example, which 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, the impact has been significant. There is a reduced peak load in pilots in some states (such as in New South Wales), and essential grid stability services are less expensive than the cost of traditional solutions.

In addition, a 2026 study identified **stronger cooperation between TSOs and DSOs** as a key driver of efficiency ([43]) which should be incentivised at national level due to its multiple benefits. Integrated planning between TSOs and DSOs can lead to more efficient grid development by aligning their investment plans and strategies, avoiding redundant infrastructure investments, and ensuring that grid expansions are made where they are most needed. Establishing joint operational procedures for managing grid stability and reliability can improve the overall efficiency of the grid by ensuring coordinated actions during peak demand periods, emergency situations, and maintenance activities. Encouraging the use of flexibility services provided by DSOs can help manage local grid constraints and reduce the need for TSO interventions, balancing supply and demand at local level and reducing the strain on the transmission network. Developing regulatory frameworks that support TSO-DSO coordination is therefore essential, including creating incentives for both TSOs and DSOs to collaborate and share resources and addressing issues related to cost allocation and revenue sharing to ensure fair compensation for their contributions to grid efficiency. Integrating advanced technologies is key to enabling this cooperation to allow for real-time monitoring and control of the grid and therefore more responsive and adaptive grid management.

Such cooperation is also essential given the highly diverse landscape of DSOs in Europe. According to a 2026 ACER report ([44]), there are 2 674 DSOs across 28 countries serving

([39]) CRE (2023) “Report on the performance of system operators in the development of a smart electricity grid” https://www.cre.fr/fileadmin/Documents/Rapports_et_etudes/2023/2024-02_Rapport_indicateurs_eng.pdf.

([40]) Agora Energiewende (2024) “Boosting flexibility in distribution grids” https://www.agoraenergiewende.org/fileadmin/Projekte/2023/2023-23_EU_boosting_flexibility/24-0184_Rev.2_DNV_Report_Agora_Energiewende_-_Boosting_flexibility_in_distribution_grids.pdf.

([41]) https://www.currenteurope.eu/wp-content/uploads/2024/06/CL-CurrENT-BE-Prospects-for-Innovative-Grid-Technologies-final-report-20240617-2.pdf.

([42]) https://cdn.digitaleurope.org/uploads/2026/06/Study-White-paper_grid-performance.pdf.

([43]) Guidehouse (2026) Study on tariff structures, incentives for flexibility and efficient investments.

([44]) https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER-2026-DSO-revenue-setting-report.pdf.

a wide range of customer bases, from as few as one customer to nearly 40 million. Therefore, integrated planning and grid operation across voltage levels is crucial to drive efficiencies.

The proposed measures on network charges could help mitigate energy cost pressures for EU companies, particularly in sectors facing intense global competition and high exposure to volatile energy markets.

2.3.2. Administrative costs

To provide stronger incentives for efficient use of European grids, the proposed measures introduce transparency rules in Article 18(5) and (6) as well as an obligation on ACER and NRAs to carry out efficiency comparisons of TSOs and DSOs respectively in Article 18(7). These provisions may result in additional administrative costs for NRAs and system operators, as explained below. For the additional costs for ACER, the Legal and Financial Statement accompanying the proposal suggests additional staff for ACER. The proposal is not expected to result in any administrative costs on small and medium-sized enterprises (SMEs).

Transparency rules

The newly introduced transparency rules in Article 18(5) and (6) may lead to an increased administrative burden and higher compliance costs for NRAs and system operators, as regards the additional elements they will need to make publicly available. However, these costs are not expected to be significant because the publication requirements are kept to a minimum and are in line with those transparency elements that have been flagged by ACER in its latest best practices report, published on 26 March 2025 ([45]). The fact that these elements have been included in ACER's 2025 report also means that they have already been discussed between ACER and the NRAs. Moreover, any administrative costs for NRAs and system operators are proportionate, because they are necessary to achieve the objectives of increasing the comparability of tariff-setting, improving system users' understanding of the tariffs they have to pay, and ultimately allowing system operators to manage the network more efficiently. By improving transparency, system users will be able to develop system-friendly behaviour, ultimately leading to lower bills and reducing costs for the electricity system.

Moreover, the proposed requirement for NRAs to conduct public consultations on their draft tariff methodologies may also lead to increased administrative costs. However, given the regulatory frequency of new tariff methodologies, any administrative costs are expected to be low to moderate and in any event necessary to achieve the objectives of (i) improving system users' understanding of the tariffs they have to pay, and (ii) giving them the opportunity to submit comments or communicate concerns to the NRAs when the latter are setting or fixing the final tariff methodologies.

Efficiency comparisons by NRAs

The proposal introduces a requirement on NRAs to perform efficiency analyses of their DSOs, insofar as the Member State in question has more than one DSO. Considering that it is proposed that such analyses be carried out every four years, the resulting

([45]) 2025-ACER-Electricity-Network-Tariff-Practices.pdf.

administrative costs should remain moderate and, in any event, necessary to achieve the overarching objective of ensuring the efficient management and operation of the network.

Finally, the proposal includes an obligation for NRAs to set performance indicators as regards the efficient operation and development of the network, including smart electricity grid indicators. This obligation is not expected to significantly increase administrative costs for NRAs, because, as per Article 59(1)(l) of the Electricity Directive, NRAs are already responsible for assessing '*the performance of transmission system operators and distribution system operators in relation to the development of a smart grid that promotes energy efficiency and the integration of the energy from renewable sources, based on a limited set of indicators, and publish a national report every two years, including recommendations'*. The proposal adds two elements to the existing legal framework. First, it requires that the indicators be broader, relating to the efficient operation and development of the network, and second, it establishes a link between those indicators and their role in setting tariff methodologies. Hence, any additional administrative costs stemming from the proposal are expected to be insignificant.

2.3.3. Environmental impact

Applying the design principles for tariff methodologies set out in the proposal is expected to result in the existing grid capacity being used more efficiently, which in turn is expected to result in reductions in greenhouse gas emissions by integrating renewable energy into the network in a more cost-effective way. In addition, the tariffs set on the basis of the design principles in the proposal will provide more accurate price signals to system users, untapping the potential for non-fossil flexibility and demand response.

3. SMART GRIDS AND INNOVATION

3.1. Non-wire, smart and digital solutions for grids and related smart grid indicators

3.1.1. Policy context

Digitalising and making the energy sector and electricity grids smarter has been a policy priority of the Commission for the last few years. Electricity grids, in particular distribution grids, must become smarter to deliver electricity efficiently and reliably during the transition towards a low-carbon energy system ([46]). Examples of non-wire, smart and digital solutions for grids include dynamic line rating, power-flow control devices, advanced sensors, smart meters, real-time monitoring and automation systems, and other digital tools that help system operators observe, manage and optimise grid use more efficiently.

EU energy policy has therefore been geared towards smart grids from an early stage. Smart grids are a broad concept that often combines the efficient use of network assets and the resources connected to them with environmental sustainability, uptake of renewable energy sources and energy efficiency. To this end, the first TEN-E Regulation (347/2013) already included a separate category for smart electricity grids ([47]), to accelerate their

([46]) According to ACER, annual electricity distribution grid investments in Europe increased from around EUR 23.5 billion in 2021 to EUR 35.3 billion in 2024 and are projected to reach EUR 46.7 billion by 2027, underlining the scale of the investment challenge and the need to ensure that these investments are complemented by smart-grid, digital and flexibility solutions - ACER, Managing the ramp-up of electricity distribution investments to better serve grid users – ACER report on distribution system operator (DSO) revenue setting practices, 14 April 2026, p. 19. https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER-2026-DSO-revenue-setting-report.pdf.

([47]) A definition of smart electricity grids is foreseen in article 2.9 of the TEN-E regulation.

adoption across the EU, and further broadened the category with the 2022 revision (2022/869). In this regard, CEF Energy already allocated 445 million EUR to smart grid projects. ([48])

Smart grid indicators (SGIs) can be used to analyse the situation of electricity grids and identify whether and how the operators of those grids are reacting to the network users' changing needs and to the opportunities provided by technological developments, in particular in digital technologies. The Clean Energy Package, in particular the revision of the Electricity Directive, proposed by the European Commission in November 2016 and finalized in 2019, gave NRAs a role in promoting this via Article 59(1)(l) of the Electricity Directive, which lays down that NRAs must, among their duties, "*monitor[...] and assess[...] the performance of transmission system operators and distribution system operators in relation to the development of a smart grid that promotes energy efficiency and the integration of the energy from renewable sources, based on a limited set of indicators, and publish a national report every two years, including recommendations*."

The 2022 Digitalising the Energy System – EU Action Plan ([49]) then turned that legal requirement into a practical EU energy policy workstream: it announced that the Commission would support ACER and national regulators in defining common smart grid indicators, so that regulators could monitor smart and digital investments in the grid and measure progress towards a more intelligent, digitalised electricity system, including the future digital twin of the grid.

An EU Action Plan for Grids, adopted in 2023 ([50]) proposed to further strengthen implementation of smart grid projects via a dedicated workstream on Technopedia to share best practices in the TSO, DSO and regulatory community, as well as via ACER work on addressing CapEx-bias including via benefit-sharing.

Successive meetings of the Copenhagen Forum on Energy Infrastructure have focused on the need to promote the development of a limited set of common indicators for smart grids and have invited ACER, CEER, ENTSO-E and the EU DSO Entity to work together in this area. In particular, the 11th Energy Infrastructure Forum called upon "*CEER and ACER in cooperation with ENTSO-E, EU DSO Entity and the relevant stakeholders to deliver the respective reports, in a coordinated manner, on the common indicators for smart grids at all voltage levels, including both output and input indicators, by the next Forum*" ([51]). ACER and CEER published two reports in January 2026 focusing respectively on SGIs for transmission and distribution networks ([52]).

Under the European Grids Package ([53]), the proposed revision of the TEN-E Regulation ([54]) introduces an obligation for non-wire solutions ([55]) to be considered as a priority in network planning on both EU-wide and national transmission level. A new

([48]) https://cinea.ec.europa.eu/cef-energy-connecting-europe-affordable-secure-and-green-future_en.
([49]) COM(2022) 552 final.
([50]) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52023DC0757.
([51]) Copenhagen Infrastructure Forum – Conclusions 3 June 2025, available at: https://energy.ec.europa.eu/events/11th-energy-infrastructure-forum-2025-06-02_en.
([52]) ACER, 'Output performance indicators to monitor the application of electricity transmission grid-enhancing technologies – Position Paper' (ACER, 2026), and CEER, 'Electricity "Smart Grid" Performance Indicators" (CEER, 2026).
([53]) https://ec.europa.eu/commission/presscorner/detail/en/ip_25_2945.
([54]) Proposal for a Regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure, amending Regulations (EU) 2019/942, (EU) 2019/943 and (EU) 2024/1789 and repealing Regulation (EU) 2022/869, Brussels, 10.12.2025, COM(2025) 1006 final.
([55]) Examples of non-wire solutions include demand response, storage, smart charging and vehicle-to-grid, as well as grid-enhancing and digital solutions such as dynamic line rating, power-flow control devices, network reconfiguration, advanced voltage control and digital congestion-management tools.

category of Projects of Common Interest (PCIs) to support broader deployment of non-wire solutions on existing high voltage network infrastructure that contribute to increases in net transfer capacity was also proposed.

3.1.2. Problem definition

Despite the long-term EU focus on smart electricity grids, the use of innovative and digital solutions in operating and planning electricity grids in the EU varies across Member States and between the transmission and distribution levels and overall is not satisfactory. While the control of transmission grids is fully digitalised and most modern switchyards in such grids are controlled by digital relays, this is not always the case at the distribution level, despite the fact that most of the challenges related to the penetration of renewable-based generation and of decentralised flexibility resources are emerging and will continue to emerge in distribution systems. The current situation regarding the use of alternatives to network development like grid-enhancing technologies is also mixed, also due to the different regulatory approaches adopted by NRAs vis-à-vis TSOs and DSOs ([56]).

Europe's grid challenge cannot be addressed only by expanding grids. It needs to be complemented by using existing infrastructure more efficiently for affordability. Changes proposed under the revision of the TEN-E Regulation as part of the European Grids Package, are focusing mostly on cross-border electricity infrastructure, in line with the TEN-E scope. However, to ensure that the cost-efficiency principle is followed at all electricity infrastructure levels, and notably distribution grid level, deployment of non-wire, smart and digital solutions should be promoted whenever they provide a more efficient but effective alternative to grid expansion, both at transmission and distribution level.

Specifically, smart grid indicators serve to assess the development of smart electricity grids and capture the related increases in grid performance and efficiency. While ACER and CEER reports ([57]) were adopted early 2026, recent evidence also pointed to rather limited adoption of indicators on transmission and distribution levels. At the distribution level, national legal or regulatory requirements to monitor utilisation of the grid were present in 12 out of 26 countries in 2026. Only around a third of EU countries adopted measures to combat CapEx-bias ([58]) A.t the level of the transmission system, the ACER report ([59]) points to a significantly different scope of indicators being used, while the development of (smart) transmission grids is directly relevant for the internal electricity market, enabling cross-borders flows. There is thus currently no common practice regarding SGIs and their use at European level. Some EU Member States have developed and monitor a series of smart grid indicators ([60]). Some of them also publish the results of this monitoring exercise,

([56]) See for instance the latest ACER report on Increasing cross-zonal capacity and system flexibility in Southeast Europe, noting the deployment of dynamic line rating in this region is not satisfactory: https://www.acer.europa.eu/monitoring/MMR/crosszonal-electricity-trade-capacities-2026, or CurrEnt DLR adoption map: https://www.currenteurope.eu/technologies/grid-compass/dynamic-line-rating-adoption/#.

([57]) https://www.ceer.eu/wp-content/uploads/2026/01/Electricity-smart-grid-performance-indicators-combined-2.pdf
Fourteen output indicators corresponding to six dimensions of a smart grid are presented in the paper: integration of renewable energy generation; integration of increased electrification of energy uses; continuity of supply and resilience to extreme events; other quality of supply objectives; energy efficiency; and data made available to market participants.

([58]) https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER-2026-DSO-revenue-setting-report.pdf.

([59]) https://www.acer.europa.eu/sites/default/files/documents/Position%20Papers/ACER-Position-Paper-Smart-grid-output-KPIs-for-electricity-transmission-2025.pdf
In its paper, ACER proposes three KPIs to measure the performance of smart grid solutions applied by the TSOs: performance of existing transmission assets in real-time system operations; performance of operational security; and grid expansion performance.

([60]) CEER collected 343 indicators in use across CEER member countries and classified them according to nine smart grid dimensions. See CEER, 'Electricity "Smart Grid" Performance Indicators" (CEER, 2026), p. 16. A brief presentation of some national practices with regard to SGIs is available in ACER, 'Output performance indicators to monitor the application of electricity transmission grid-enhancing technologies – Position Paper' (ACER, 2026).

either as a standalone report or as part of the NRA annual report. However, Member States may monitor different dimensions of smart grids and, even when they focus on the same dimensions, they may use similar but slightly different indicators and metrics that make any comparison across countries more difficult ([61]).

Broader adoption of non-wire technologies, smart and digital solutions has strong support among stakeholders, as evidenced by the open public consultation carried out while preparing the European Grids Package. Some 62% of respondents agreed that more EU-level action is needed to improve the visibility and quantified benefits of digital, innovative, and grid-enhancing technologies, with 14% reporting neutrality. A larger majority, 76% of respondents argued that further measures are needed to increase the efficiency of the existing grid ([62]).

3.1.3. Objectives of the proposal

Provisions under paragraph 1 of the proposed Article 18a of the Electricity Regulation aim to ensure that non-wire, smart and digital solutions are effectively promoted whenever they provide a cost-efficient way to improve the usable capacity, flexibility and reliability of electricity networks. In this way, the proposal seeks to improve grid productivity, by making use of innovative tools. Improving grid productivity means making better use of existing electricity network infrastructure so that the grid can connect and transport more renewable generation, electrified demand and flexibility resources, with fewer losses, less congestion and lower system costs, rather than relying only on conventional grid expansion.

Provisions under paragraphs 2 and 3 of the proposed Article 18a, as well as under the proposed amendment in Article 61(5) aim to tackle information asymmetry between system operators and regulatory authorities in system performance by equipping them with a unified set of smart grid indicators to measure progress and uptake of smart electricity grid solutions, and to facilitate coordination between national approaches and exchange of best practices. It also aims to ensure existing CapEx-bias in two-thirds of EU countries is addressed by linking such indicators to regulatory incentives.

As explained in the previous section, there is currently no common practice about SGIs and their use at EU level. A provision on smart grid indicators is therefore needed because **the current voluntary framework does not**:

- provide tools to facilitate coordination between national approaches and exchange good practices.
- adequately link such indicators to tariff-setting and regulatory incentives.

The **proposal creates a more coherent EU approach** by asking ACER to structure the work through a recommendation and regular progress reporting, while requiring regulatory authorities to set performance indicators for network operation and development, including smart grid indicators. This provides a consistent basis for measuring the uptake of smart solutions, identifying best practices and, where needed, enabling further harmonisation through implementing acts.

([61]) CEER, ‘Electricity “Smart Grid” Performance Indicators” (CEER, 2026).
([62]) European Commission, ‘COMMISSION STAFF WORKING DOCUMENT {SWD (2025) 2000 final}, IMPACT ASSESSMENT REPORT [European Grids Package]’ Annex 2 Stakeholder consultation synopsis report (2025), p.70.

3.1.4. *Expected benefits and impacts*

The main **benefit** is the prospect of **avoiding or deferring conventional grid reinforcement costs**, because smart, digital and grid-enhancing solutions can achieve network benefits quicker and, in some cases, cheaper than classical investments.

Energy system benefits - When appropriately defined and monitored, SGIs can help generate energy system benefits in two ways. On the one hand, the uptake of smart grid technologies can be demonstrated and mobilised. On the other hand, the performance and achievement of smart grid solutions can be emphasised. Both approaches are expected to have a positive and complementary effect on the performance and efficiency of transmission and distribution grids. SGIs can therefore be an important regulatory tool to evaluate and promote smart grid solutions that deliver, among other things, additional grid capacity faster and at lower cost than conventional reinforcements. In the current context of Europe's energy transition, not taking SGIs into account carries a risk of increased grid tariffs, curtailing renewables and delays in connecting new grid users.

In terms of quantifying the benefits:

- The Impact Assessment Report of the European Grids Package highlights that grid-enhancing technologies, if prioritised,"*could expand network capacity by 20-40% by 2040 and save up to 35% in conventional grid expansion costs.*" (63) More specifically, "*the deployment of dynamic line rating […] on most congested network elements could bring net benefits of EUR 2.67 billion over a period of 20 years through additional 27 GW of available transmission capacity.*"(64)
- Digital flexibility helps grids serve more load without additional infrastructure – the average peak is reduced by 20–40% through digital demand management and integrating distributed energy resources (i.e. batteries, solar panels, EVs) (65);
- Digitalisation reduces outages and maintenance costs – Artificial Intelligence (AI) cuts grid fault detection from hours to minutes, preventing major blackouts. European utilities using digital monitoring and predictive maintenance report that outage duration is reduced by up to 30% (66);
- Real-time visibility lets grids run closer to actual limits, enabling more cross-border exchanges and hence better ability to harness the benefits of internal market integration - AI and digitalisation allow up to 20-30% more load on the same grid (67)

(63) European Commission, 'COMMISSION STAFF WORKING DOCUMENT {SWD (2025) 2000 final}, IMPACT ASSESSMENT REPORT [European Grids Package]' (2025), p. 34.

(64) Commission analysis for the Impact Assessment Report of the European Grids Package. The analysis is based on ACER data and considers DLR deployment on the 143 most congested critical network elements used for capacity calculation in the CORE region. More details can be found in Annex 4 of European Commission, 'COMMISSION STAFF WORKING DOCUMENT {SWD (2025) 2000 final}, IMPACT ASSESSMENT REPORT [European Grids Package]' (2025), p. 86.

(65) Schneider Electric Research Institute; Grid Relief from Smart Buildings; April 2026.

(66) DIGITALEUROPE; Powering Europe's future: How AI and digital grids can secure Europe's climate and industrial leadership, November 2025. Available at: https://cdn.digitaleurope.org/uploads/2026/01/DIGITALEUROPE_position-paper_Roadmap-for-digitalisation-and-AI-in-energy-1-1.pdf.

(67) DIGITALEUROPE; Advancing Europe's Grid Performance Why Europe must digitalise its grids, May 2025.

In addition, experiences of those national regulators which have already adopted measures to promote smart and digital solutions show that significant benefits can be delivered to grid users and, therefore, electricity consumers ([68]).

Digitalisation and innovation - Monitoring the uptake and efficiency of smart grid technologies through SGIs is expected to have a positive impact on the deployment of flexible, digital and data-driven solutions by TSOs and DSOs. The development of these solutions will also positively contribute to innovation, by providing clear investment signals for such technologies. Mutual learning between national regulatory authorities and system operators, which will partly be driven by the reporting of best practices and recommendations by ACER, is further expected to reinforce these effects.

Competitiveness and strategic autonomy - The energy system benefits described above are likely to reduce the energy costs of European companies (especially in energy-intensive industries) and improve their competitiveness on international markets. Furthermore, as smart grid indicators are expected to promote the uptake of innovative grid solutions, they might positively expand the market for providers of these solutions, including non-wire, smart and digital solutions. By making indicator-based assessment a more systematic part of regulatory oversight, the measure should improve the visibility of issues that matter for competitiveness and market entry, including connection times, hosting capacity, losses, and access to consumption/injection data.

This is also relevant from an industrial policy perspective. The EU already hosts competitive manufacturers in several smart grid technology segments, while European research and innovation actors are at the forefront of work on smart grids, digitalisation and AI for energy, notably through the Strategic Energy Technology Plan ([69]) and Smart Networks for Energy Transition (SNET) of the European Technology & Innovation Platforms (ETIPs) ([70]). By strengthening the regulatory visibility and uptake of smart-grid solutions, the proposal can therefore also support European industrial leadership in this strategic market. The Strategic Roadmap for Digitalisation and AI in the Energy Sector provides measures to assist smaller DSOs that may need targeted assistance to build the necessary capabilities. It puts forward that the 2026 LIFE Clean Energy Transition sub-programme includes a EUR 10 million action on smart grids to strengthen DSOs in-house digital and AI skills , alongside broader support through the Pact for Skills, Erasmus+ and the European Institute of Innovation & Technology ([71]).

The main direct **cost** of the proposed provisions is the implementation and assessment effort for national regulators and network operators, including integrating these solutions into planning, regulatory review and monitoring. Nonetheless, several regulatory authorities have already adopted performance-based regulation and are considering non-wire, digital and smart solutions as alternatives in network planning, as required by the existing Articles 32 and 51 of the Electricity Directive. The measure is therefore likely to create low to moderate administrative costs, but potentially much larger system-cost benefits where it changes investment choices at project level. At the same time, it must be noted that the expected costs will primarily impact ACER – which would receive additional resources as per the Legislative and Financial Statement -, which is tasked with issuing recommendations on smart grid solutions and the efficient use of electricity

([68]) A summary of other relevant NRA practices in Belgium, France, Finland, Germany, Portugal, Slovenia and Sweden can be found in ACER, 'Output performance indicators to monitor the application of electricity transmission grid-enhancing technologies – Position Paper' Annex A (2026), as from p. 27.

([69]) https://energy.ec.europa.eu/topics/research-and-technology/strategic-energy-technology-plan_en.

([70]) https://smart-networks-energy-transition.ec.europa.eu/.

([71]) COM(2026) 501.

infrastructure. If further implementing acts on SGIs are to be developed, additional costs for the European Commission might also apply.

Some administrative costs for system operators might be generated by the proposed provisions on SGIs, as they require system operators to provide the data necessary for that purpose to the national regulatory authorities and to ACER. The costs of measurement infrastructure and reporting obligations are expected to be marginal compared to the expected savings in grid efficiency. However, some system operators might be disproportionally affected, especially smaller DSOs.

No direct administrative or compliance costs of the proposal on smart grid indicators on non-regulated energy companies, including SMEs, were identified. More transparent and comparable indicators on connection and data access can reduce information asymmetries for smaller suppliers, aggregators and technology providers.

Consumer costs and empowerment - The energy system benefits that could be generated, at least indirectly, by smart grid indicators are expected to result in lower electricity bills for end consumers, in the form of avoided grid tariff increases and potential lower energy costs. It is, however, not possible to credibly quantify the magnitude of these savings, which might also differ between Member States ([72]). Making the electricity grid smarter might also empower end consumers (for example, by facilitating the provision of flexibility) and bring additional opportunities for consumers to take an active role in the energy transition.

Skills and employment - No direct impact of the proposal on smart grid indicators on skills and employment was identified.

System security and cybersecurity - As smart grid indicators generally lead to improved grid observability and performance, a positive impact on secure grid operation (including cybersecurity) by transmission and distribution system operators can be expected.

Environmental impacts - When the deployment of smart grid indicators leads to better utilisation and more efficient management of the existing electricity grid capacity, reductions in greenhouse gas emissions can be expected as a result of more cost-effective renewable energy integration.

3.2. Energy data exchange for primary and secondary use

3.2.1. Policy context

The increasing digitalisation of the energy system is reshaping the conditions for the operation of electricity markets and networks in the Union. In a system characterised by growing electrification, decentralised assets, variable renewable generation and rising flexibility needs, data becomes a strategic asset for both operational and innovation purposes. The timely, secure and interoperable exchange of energy data is essential not only for established market processes, but also for smarter grid operation, consumer-facing energy services and the development of advanced digital and AI-based applications. Against this background, it is necessary to assess whether the existing Union framework

([72]) ACER estimated a 60% increase in average total grid costs between 2022 and 2050. The use of SGIs is expected to contribute to keeping this cost increase in check. See ACER, 'Electricity infrastructure development to support a competitive and sustainable energy system – 2024 Monitoring Report' (ACER, 2024), p. 32.

on energy data access, exchange and reuse provides a sufficiently coherent basis to support these evolving needs.

The EU has developed a comprehensive framework of legislative and policy initiatives addressing data access, sharing and use in the energy sector. This framework combines horizontal instruments, such as the Data Act ([73]), the General Data Protection Regulation (GDPR) ([74]), the Data Governance Act (DGA) ([75]), the Electronic Identification Regulation (eIDAS) ([76]) and EU cybersecurity legislation ([77]), with sector-specific legislation, such as the Electricity Directive and the Electricity Regulation . This broader framework is also evolving through newer cross-sector digital initiatives, including the Commission's digital simplification agenda under the Digital Omnibus ([78]), the proposed European Business Wallets ([79]), and the rollout of the EU Digital Identity Wallets ([80]).All of these may further shape the practical conditions for trusted digital identification, authentication, data portability and cross-border administrative simplification relevant to energy-data exchanges. Together, these instruments provide the legal foundation for energy data exchange, particularly with respect to the primary use of data necessary for system operation and market functioning.

Within this framework, sectoral legislation plays a central role in structuring data access and exchange in electricity markets. The Electricity Directive, the Electricity Regulation, the Commission Implementing Regulations on Interoperability Requirements and Non-discriminatory and Transparent Procedures for Data Access ([81]) ex Article 24 of the Electricity Directive, and the Energy Performance of Buildings Directive ([82]) establish rules governing metering and consumption data, customer switching procedures and the functioning of energy services such as demand response, energy communities and energy sharing. They also provide the basis for cooperation between TSOs and DSOs in market operations. For these specific use cases they aim to enable access to relevant data for eligible parties and support the day-to-day functioning of the energy system.

Horizontal data legislation also contributes to this framework by facilitating data access and reuse across sectors. The Data Act, the DGA, the Free Flow of Non-Personal Data

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([73]) Regulation (EU) 2023/2854 of the European Parliament and of the Council of 13 December 2023 on harmonised rules on fair access to and use of data and amending Regulation (EU) 2017/2394 and Directive (EU) 2020/1828 (Data Act).

([74]) Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation).

([75]) Regulation (EU) 2022/868 of the European Parliament and of the Council of 30 May 2022 on European data governance and amending Regulation (EU) 2018/1724 (Data Governance Act).

([76]) Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market and repealing Directive 1999/93/EC.

([77]) Directive (EU) 2022/2555 of the European Parliament and of the Council of 14 December 2022 on measures for a high common level of cybersecurity across the Union, amending Regulation (EU) No 910/2014 and Directive (EU) 2018/1972, and repealing Directive (EU) 2016/1148 (NIS 2 Directive); Regulation (EU) 2019/881 of the European Parliament and of the Council of 17 April 2019 on ENISA (the European Union Agency for Cybersecurity) and on information and communications technology cybersecurity certification and repealing Regulation (EU) No 526/2013 (Cybersecurity Act) L 151/15; Regulation (EU) 2024/2847 of the European Parliament and of the Council of 23 October 2024 on horizontal cybersecurity requirements for products with digital elements and amending Regulations (EU) No 168/2013 and (EU) 2019/1020 and Directive (EU) 2020/1828 (Cyber Resilience Act) L series.

([78]) https://digital-strategy.ec.europa.eu/en/library/digital-omnibus-regulation-proposal.

([79]) https://digital-strategy.ec.europa.eu/en/policies/business-wallets.

([80]) https://ec.europa.eu/digital-building-blocks/sites/spaces/EUDIGITALIDENTITYWALLET/pages/694487738/EU+Digital+Identity+Wallet+Home.

([81]) Two of a series of Commission implementing regulations ex art. 24 of the Electricity Directive have already been adopted. They are: 1) Commission Implementing Regulation (EU) 2023/1162 of 6 June 2023 on interoperability requirements and non-discriminatory and transparent procedures for access to metering and consumption data; and 2) Commission Implementing Regulation (EU) 2026/855 of 14 April 2026 on interoperability requirements and non-discriminatory and transparent procedures for access to data required for customer switching. More implementing regulations are expected to be adopted in the future.

([82]) Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the energy performance of buildings (recast).

Regulation ([83]), the Open Data Directive (ODD) ([84]) and the High-Value Datasets framework ([85]) aim to support data availability, promote interoperability and enable cross-border data flows, including in the energy sector. These instruments are intended to foster a broader European data ecosystem where energy data can be accessed and reused more efficiently. However, data held by public undertakings is explicitly excluded from the scope of the DGA's provisions on the reuse of protected data ([86]). This means that the reuse of energy data held by TSOs and DSOs, for example, would not be covered by the DGA and the ODD, given that their industrial or commercial character would prevent them from qualifying as a body governed by public law ([87]). Indeed, TSOs and DSOs may sometimes not be classified as public undertakings. This is based on the definition of the term 'public undertaking' in both the DGA and ODD

> *'any undertaking over which the public sector bodies may exercise directly or indirectly a dominant influence by virtue of their ownership of it, their financial participation therein, or the rules which govern it; for the purposes of this definition, a dominant influence on the part of the public sector bodies shall be presumed in any of the following cases in which those bodies, directly or indirectly:*
>
> *(a) hold the majority of the undertaking's subscribed capital;*
>
> *(b) control the majority of the votes attaching to shares issued by the undertaking;*
>
> *(c) can appoint more than half of the undertaking's administrative, management or supervisory body'.* ([88])

Only data held by those TSOs and DSOs subject to such dominant influence by public sector bodies would thus be included in the scope of the ODD.

The ODD designates certain datasets as high-value, for which the applicable rules are set out in an Implementing Regulation ([89]). The high-value datasets with particular relevance for secondary energy data use are geospatial data, earth observation and environment data, meteorological data, company and company ownership data, and mobility data ([90]). However, the High-Value Datasets Regulation only applies to high-value datasets that are held by public sector bodies as defined in the ODD ([91]). This means that the High-Value Datasets Regulation does not apply to data held by public undertakings ([92]). Thus, high-value datasets held by, for example, TSOs or DSOs, even where these are considered public undertakings, are excluded from the scope of the High-Value Datasets Regulation and from the access and reuse rules on high-value datasets discussed below.

([83]) Regulation (EU) 2018/1807 of the European Parliament and of the Council of 14 November 2018 on a framework for the free flow of non-personal data in the European Union.
([84]) Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information (recast).
([85]) Commission Implementing Regulation (EU) 2023/138 of 21 December 2022 laying down a list of specific high-value datasets and the arrangements for their publication and re-use.
([86]) DGA, Article 3(1)(a).
([87]) DGA, Article 2(18).
([88]) DGA, Article 2(19); ODD, Article 2(3). Note that the ODD's definition of public undertaking applies only to the undertakings active in the sectors covered by the Directive.
([89]) Commission Implementing Regulation (EU) 2023/138 of 21 December 2022 Laying down a List of Specific High-Value Datasets and the Arrangements for Their Publication and Re-Use, OJ L19/43 (High-Value Datasets Regulation).
([90]) The thematic categories of high-value datasets are (1) Geospatial; (2) Earth observation and environment; (3) Meteorological; (4) Statistics; (5) Companies and company ownership; (6) Mobility. See High-Value Datasets Regulation, Article 13 and Annex I
([91]) Full definition in ODD, Article 2(3).
([92]) See also High-Value Datasets Regulation, Recital 7, which states that '[the ODD] stipulates in its Article 14(3) that this Implementing Regulation shall provide that the availability of high-value datasets free of charge is not to apply to specific high-value datasets held by public undertakings where that would lead to a distortion of competition in the relevant markets. *However, data held by public undertakings are not included in the scope of this Implementing Regulation'* (emphasis added).

At the same time, the EU legal framework includes safeguards designed to ensure trust in data exchange. The GDPR, together with the eIDAS Regulation and the EU cybersecurity legislation, lays down requirements related to data protection, identification, authentication and system security. These elements contribute to establishing a secure and reliable environment for energy data sharing across the EU.

In addition, the EU has established a horizontal framework for AI. The AI Act ([93]) introduces rules aimed at ensuring the safe and trustworthy deployment of AI systems, while policy initiatives such as the AI Continent Action Plan ([94]) and the Apply AI Strategy ([95]) seek to promote the uptake of AI and strengthen the EU's position in the global AI landscape.

Taken together, these legislative and policy initiatives have contributed to progress in structuring energy data exchange and supporting digitalisation in the sector. At the same time, several instruments are still in an early phase of implementation, and their combined practical effects will need time to materialise. For now, the framework still appears insufficiently integrated to address in a fully coherent way certain energy-sector-specific challenges, notably as regards interoperability, data availability, governance and innovation. This is explained in the next section.

3.2.2. Problem definition

Power systems are becoming increasingly complex due to the growing integration of variable renewable energy sources, the electrification of end-use sectors and the increasing decentralisation of generation and flexibility resources. This translates into an increasing need to monitor (and control) the electricity system in more detail. System operators need to be able to process large quantities of data as the basis for network operations, in order to observe the system at higher granularity. Therefore, innovative tools such as smart energy services and AI applications for the energy sector are essential to support a more informed operation of a complex system. Such tools will help make systems more flexible, efficient and resilient and increase grid productivity. This matters at European scale as it is one big interconnected and interdependent system: vulnerabilities can spread and cause negative effects beyond an individual system operators' system. This also requires an appropriate digital backbone for the energy system, including interoperable data infrastructures, cloud-edge computing capacities, AI-IoT platforms and digital twins that can support trusted data exchange and real-time operational intelligence across the system. At the same time, many of the enabling technologies, infrastructures and capabilities required for this transformation are not specific to the energy sector alone. The energy system can benefit from synergies with the wider digital economy and with adjacent sectors such as mobility, buildings and industry, including through the reuse and adaptation of cloud-edge infrastructures, AI models, digital twins, interoperable IoT architectures, software components and digital skills. Such cross-sectoral synergies can help reduce development costs, avoid duplication and shorten time to market for digital and AI-enabled solutions in the energy sector.

([93]) Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act).

([94]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, AI Continent Action Plan, COM(2025) 165 final.

([95]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Apply AI Strategy, COM(2025) 723 final.

Effective energy data exchange and interoperability are critical to enable smart energy services and the development of robust AI models. Smart energy services – such as demand response, dynamic pricing and smart charging – enable consumers to take full advantage of retail market liberalisation and digitalisation. The EU legal framework already covers the **primary use of energy data**, meaning the operational data exchanges between specific actors for services such as metering, billing, supplier switching, demand response and grid operation. However, implementation varies significantly across Member States, creating complexity, legal uncertainty and barriers to cross-border smart energy services. Furthermore, horizontal legislation like the Data Act, with in Chapter III horizontal provisions applicable to data sharing in a business-to-business relationship does not fully address the specificities of regulated energy data and regulated entities. As a result, providers of demand-response or smart electric-vehicle charging services, often redesign software interfaces and renegotiate data-access procedures for each national market hindering the cross-border growth of smart energy services. At the same time, the framework for the s**econdary use of energy data**, meaning the pooling and reuse of energy data beyond its original operational purpose, for example, for research, analytics or AI model development, is less developed. Public datasets remain fragmented or limited for advanced analytics. While horizontal legislation provides safeguards on data protection and cybersecurity, there is no clear sector-specific framework for structured energy data pooling or for the use of AI models. As a result, energy companies or grid operators often hesitate to share detailed data for research purposes or to train AI models. This limits access to high-quality real-world datasets and means that developers often have to rely instead on limited, incomplete or synthetic datasets, which can slow down the development, testing and validation of robust AI models.

The latter, the development and deployment of European AI models and model-based applications in energy, including energy-specific models as well as the adaptation and fine-tuning of more general-purpose models for energy-system use cases, in particular is constrained by barriers to data exchange/access and data pooling.

As the energy sector moves towards greater investment in use-case-specific models, there is an increased need for access to specialised datasets, which may be controlled by one company or a small number of companies ([96]). These companies might limit data access for a range of reasons, including commercial and privacy considerations. On the one hand, data holders may withhold datasets to protect business models or fend off competition ([97]). On the other hand, privacy concerns can contribute to hesitancy in information sharing, particularly around individual-level data ([98]). While the anonymisation or aggregation of data can be a solution in this regard, it might come at the cost of accuracy and efficiency. Technical fragmentation and lack of interoperability are another barrier to data access by AI developers ([99]). Data silos, legacy infrastructure and absence of harmonised data standards further limit AI's effectiveness ([100]).

Existing data access regimes focus primarily on primary use (e.g. billing, customer services, network operation) and are often limited to specific datasets such as consumption data. They do not allow systematic access to the diverse, large-scale datasets required to

([96]) CERRE, 'What policy interventions for a competitive AI sector?' Section 2 (2025).
([97]) *Ibid.*
([98]) See Use Case 3 in European Commission: Directorate-General for Energy, Arrowsmith, G., Cozzini, M., Di Costanzo, B., Haack, J. et al., *Support for the preparations of a strategic roadmap for digitalisation and AI in the energy sector*, Publications Office of the European Union, 2026, https://data.europa.eu/doi/10.2833/3572353.
([99]) BRIDGE, Data Management Working Group, 'Artificial Intelligence' (2025); ETIP SNET, 'Unlocking the Potential of AI and Generative AI in European Smart Grids: A Strategic Position Paper and Guide for Action' Section 4.2.2 (2025).
([100]) *Ibid.* ENTEC2 study.

train general-purpose AI models, including grid operational data, flexibility data, and aggregated system data. While the Chapters II and III of the Data Act provide a framework for sharing data, including sensitive data, with the appropriate safeguards, electricity grid operators face legal uncertainty and are reluctant to share sensitive or commercially valuable data in the absence of a clear public-interest legal basis, safeguards, and governance. There is no framework that allows lawful, trusted secondary use of energy data. Despite the potential of AI, several challenges hinder its widespread deployment in grid operation and planning. Models that perform well in simulations often struggle in real-world environments where data may be noisy, incomplete or inconsistent. High-quality real-world datasets remain scarce, and access is often restricted due to privacy, regulatory, or commercial concerns. In research and benchmarking, simplified network models and synthetic datasets are therefore widely used to ensure comparability across methods, since access to detailed real-world grid data is often restricted. While highly useful for innovation and reproducibility, such benchmarks remain abstractions and often omit details that are essential for industry-grade operations.

Besides the impact on innovation, this absence of a trusted data exchange framework also **undermines Europe's strategic autonomy, as it increases reliance on non-European AI models trained on non-EU datasets** and governed by foreign legal and technological standards for the operation of critical European energy infrastructure. In a fragmented European landscape, individual TSOs, DSOs or energy companies often lack the scale, bargaining power and technical ecosystem to negotiate access to data, cloud infrastructure and model-development capacities on terms comparable to those available to large global technology firms ([101]). This creates a structural advantage for large non-European data and cloud companies, which can leverage their control over key layers of the AI stack — including hyperscale cloud, computing infrastructure, machine-learning frameworks and proprietary models — to position themselves as the natural providers of AI services for grid operation and planning ([102]). Where European operators act in isolation and data remains fragmented across jurisdictions and entities, operators are less able to pool sufficient high-quality datasets to develop viable European alternatives foreign providers, on the other hand, can offer ready-made models and services trained on broader datasets and supported by superior compute capacity.

If not addressed, this risks locking the operation of critical European energy infrastructure into non-European technological dependencies. If grid observability, forecasting, congestion management or optimisation increasingly rely on foreign AI models, the EU may face vulnerabilities not only in terms of transparency and accountability, but also in terms of continuity of access, cybersecurity and operational resilience. In a context of geopolitical tensions, trade restrictions or changes in foreign legal or commercial conditions, access to updates, support, computing resources or even the underlying service itself could become uncertain, with possible implications for security of supply. At the same time, such dependence would weaken the emergence of a European industrial AI sector in one of the EUs most promising strategic application domains. Energy is one of

([101]) European Economic and Social Committee, & Centre for European Policy Studies. (2025). Generative AI and foundation models in the EU: Uptake, opportunities, challenges, and a way forward. Publications Office of the European Union. https://doi.org/10.2864/8377116 ; Widuto, AI and the energy sector. Briefing, European Parliamentary Research Service (EPRS), PE 775.859, Jul. 2025.

([102]) European Commission: Directorate-General for Energy, Arrowsmith, G., Cozzini, M., Di Costanzo, B., Haack, J. et al., *Support for the preparations of a strategic roadmap for digitalisation and AI in the energy sector*, Publications Office of the European Union, 2026, Section 2.6.4 "Ensuring Technological Sovereignty in the Adoption of AI in Europe's Energy Sector" https://data.europa.eu/doi/10.2833/3572353.

the sectors where Europe has real industrial depth, engineering know-how and system expertise.

In this context, several structural challenges affect the availability, use and exchange of energy data in the EU.

Fragmentation and insufficient interoperability of existing data exchange frameworks represent a first significant barrier. Differences in data models, formats, ontologies and interfaces persist between Member States and between system operators, and the uptake of common standards and open application programming interfaces (APIs) remains limited. As a result, effective data exchange between TSOs, DSOs and other market participants is hindered, affecting coordination both within and across borders, as well as system optimisation and innovation ([103]). In this context, open-source approaches can also play an important enabling role, as they can support transparency, auditability, interoperability and vendor independence, while facilitating the collaborative development and uptake of digital tools across the electricity system.

In the second half of 2025 the European Commission ran an Open Public Consultation (OPC) to support the development of a Strategic Roadmap for Digitalisation and AI in energy. Respondents very often cited **limited access to high-quality data, cybersecurity and data privacy concerns, and a lack of interoperability and standards as main barriers to the adoption of digital and AI technologies in the energy sector** ([104]). Moreover, respondents considered the **lack of data interoperability** and **insufficient use of commonly agreed data exchange standards**, the **absence of an established data governance framework**, and the lack of consistent data access regulatory frameworks to be the first, second and third barriers, respectively, to the establishment of a common European energy data space to enable demand-side flexibility and smart energy service ([105]). Questionnaires answered by Member States in preparation for the second meeting of the Smart Energy Expert Group (SEEG) in autumn 2025 show that convergence at the EU level is generally welcomed and that a **European governance or coordination layer is considered necessary** to ensure continuous alignment ([106]). Similarly, one of the main recommendations of the BRIDGE Regulation Working Group in its report on energy sharing is to establish a clear EU-level framework for data governance in the energy sector ([107]).

Respondents to the OPC identified **power grid management** (real-time monitoring, predictive maintenance, grid balancing), **demand management** (smart consumption, demand-side flexibility, dynamic pricing) and **renewable energy integration** (grid integration, dispatch optimisation) as the three **areas of the energy system that would benefit most from the deployment of digital and AI technologies**, ([108]).

([103]) The JRC has recently surveyed DSOs about data sharing. The survey revealed that only 63% of DSOs share data about demand and generation forecasts with the TSOs. The number is lower for data about power generation facilities. The granularity with which data are shared varies. See JRC, 'DSO Observatory 2024 – Unlocking Flexibility in Europe' (2025), pp. 52-55, available at: https://publications.jrc.ec.europa.eu/repository/handle/JRC141953.

([104]) See 'Task 5: Analysis of the Open Public Consultation to the Strategic Roadmap for Digitalisation and Artificial Intelligence (AI) in the Energy Sector' in European Commission: Directorate-General for Energy, Arrowsmith, G., Cozzini, M., Di Costanzo, B., Haack, J. et al., *Support for the preparations of a strategic roadmap for digitalisation and AI in the energy sector*, Publications Office of the European Union, 2026, https://data.europa.eu/doi/10.2833/3572353.

([105]) *Ibid*, p. 22.

([106]) DG ENER, 'Summary of responses by associations and Member States to the SEEG plenary of 23/10/2025' (2025).

([107]) BRIDGE, Regulation Working Group, 'Report on energy sharing' (2025).

([108]) Ibid 'Task 5 Report: Analysis of the Open Public Consultation to the Strategic Roadmap for Digitalisation and Artificial Intelligence (AI) in the Energy Sector' ENTEC2 Study.

The **European Parliament** has also underlined the importance of digitalisation and smart grids for the future operation of the electricity system. In its resolution on electricity grids ([109]), it highlights the role of smart grids in improving congestion management and optimising the electricity distribution of renewables, while stressing their contribution to network flexibility through the integration of digital tools that facilitate demand-side response and collective self-consumption. The Parliament further notes that **data management technologies and smart energy appliances, often leveraging artificial intelligence, can significantly increase the efficiency of existing grid capacities and maximise the use of existing assets**, thereby reducing the need for new infrastructure, for example by providing real-time information on energy flows. On that basis, it urges the Commission and the Member States to further enable and increase the digitalisation of the European electricity system in order to optimise power system operation, and **calls on the Commission, TSOs and DSOs to develop an energy data exchange framework** based on technical expertise and practice, **ensuring the secure, transparent and interoperable management, exchange and storage of energy data in the Union**. Such a framework, in the Parliament's view, should **facilitate data pooling and sharing through appropriate governance structures and data-sharing services**, while enabling system operators and other relevant actors to operate the grid securely and intelligently through the integration of flexibility and innovative technologies.

Experts and stakeholders have collaborations in many areas, particularly technical and semantic interoperability for certain use cases. Some of these initiatives operate within formal European standardisation frameworks, such as the CEN-CENELEC-ETSI Smart Grid Coordination Group ([110]), while others are voluntary initiatives or expert-led groupings, such as the Coalition of the Willing on Bidirectional Charging ([111])

The Joint Report of the SEEG, the Sustainable Transport Forum (STF) and the European Coalition of the Willing (CoW) on Bidirectional Charging ([112]) recommends establishing a harmonised, cross-sector European interoperability and testing ecosystem, backed up by relevant sectoral legislation, in order to define a common European testing environment. Such an environment should align with energy and other sectoral frameworks, incorporate relevant use cases and EU-wide mandatory certification processes, and integrate with adjacent domains such as mobility and buildings.

Digital Europe released a recent white paper on grid performance, developed with its Energy Executive Council – comprising 11 senior executives from leading energy and green technology companies – in which data access and grid-level interoperability are highlighted as one of the main priority policies to future-proof Europe's grids ([113]).

Finally, a number of EU strategies and stakeholder-led initiatives support the digitalisation of the energy system and the development of interoperable data ecosystems. The Digitalising the Energy System Action Plan ([114]), the Strategic Roadmap for Digitalisation

([109]) European Parliament, Resolution of 19 June 2025 on "Electricity grids: the backbone of the EU energy system" (2025/2006(INI)), P10_TA(2025)0136. Available at https://oeil.europarl.europa.eu/oeil/el/procedure-file?reference=2025/2006(INI).

([110]) See, for example, CEN-CENELEC, 'Smart Grids and Meters' CEN-CENELEC Topics (2026) https://www.cencenelec.eu/areas-of-work/cen-cenelec-topics/smart-grids-and-meters/cen-cenelec-etsi-coordination-group-on-smart-grids-cog-sg/.

([111]) See, for example, Coalition of the Willing on Bidirectional Charging, 'Joint Report by European Working Group 1 "Car Charging and Aggregators" and European Working Group 2 "Energy and Grid Topics" in the "Coalition of the Willing on Bidirectional Charging' (2024).

([112]) EC, 'Joint Report - Data Exchange for Demand-Side Flexibility and Smart and Bidirectional Charging' (European Commission, Directorate-General for Energy 2026). - https://op.europa.eu/en/publication-detail/-/publication/f56915a6-5582-11f1-b3e2-01aa75ed71a1.

([113]) DIGITALEUROPE; Advancing Europe's Grid Performance Why Europe must digitalise its grids, May 2025.

([114]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Digitalising the Energy System – EU Action Plan, COM(2022) 552 final.

and AI in the Energy Sector ([115]) and the European Data Strategy ([116]), together with initiatives such as BRIDGE ([117]) and Data4Energy ([118]) and projects like EDDIE ([119]), Enershare ([120]), Data Cellar ([121]), Synergies ([122]), Omega-X ([123]), all supported under Horizon Europe, and INSIEME ([124]), launched under the Digital Europe Programme, contribute to the development and testing of use cases, technical solutions and governance approaches for energy data exchange.

Another example is AI.grids, which is a pan-European, bottom-up collaborative initiative launched in June 2026 ([125]), as a flagship action of the Strategic Roadmap for Digitalisation and AI in energy ([126]), to develop AI foundation models specifically designed for power system operations . It brings together 48 organisations, representing TSOs, DSOs, research institutions, technology providers and SMEs. Its purpose is to address the growing complexity of Europe's electricity system, driven by variable renewables, electrification and distributed energy resources, by training and deploying AI foundation models for grid planning and operation. Data availability is identified as a key condition for success.

Existing EU legislation covers important aspects of the primary use of energy data, including secure and non-discriminatory access to metering and consumption data, but it does not sufficiently incentivise grid operators to make operational and system data available for broader innovative uses, such as AI training. This leaves an important regulatory gap for secondary use.

Although AI.grids is putting in place project-specific contractual and governance arrangements for data exchange among participants, these are ad-hoc solutions designed for one initiative. They do not provide a scalable or durable basis for broader research and innovation across the European energy sector.

A common EU framework would reduce fragmentation by establishing shared data governance rules, secure data exchange mechanisms, and interoperability arrangements. This would make it easier for different actors to collaborate across borders and across transmission and distribution levels. Standardised legal and contractual provisions at EU level would lower transaction costs and legal uncertainty for research and innovation projects. Instead of each consortium having to negotiate its own arrangements from scratch, actors could rely on common rules and governance mechanisms. Finally, a European framework would help ensure that the benefits of initiatives such as AI.grids are not limited to a small set of participants. The project is intended to benefit European system operators broadly, especially those with fewer resources, and a common framework would support wider access, replication, and scaling across many energy-sector use cases.

([115]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Strategic Roadmap for Digitalisation and AI in the Energy Sector, COM(2026) 501 final.
([116]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A European Strategy for Data, COM(2020) 66 final.
([117]) BRIDGE Data management Working Group.
([118]) Sub-group on "Data for Energy" (D4E) (E03926/3) of the Smart Energy Expert Group (E03926).
([119]) https://eddie.energy/.
([120]) https://cordis.europa.eu/project/id/101069831.
([121]) https://datacellarproject.eu/.
([122]) https://energydataspaces.eu/.
([123]) https://omega-x.eu/.
([124]) https://insieme.energy/index.html.
([125]) Digitalisation of the energy system.
([126]) Strategic roadmap for digitalisation and AI in energy.

Complementing these governance-oriented efforts, emerging digital infrastructure initiatives are beginning to provide parts of the digital backbone needed for a more data-driven energy system, including digital twins and federated cloud-edge and AI-IoT platforms developed in projects such as TwinEU, ODEON ([127]) and HEDGE-IoT ([128]). These efforts also create opportunities for cross-sector learning and reuse. Many of the underlying technologies and building blocks for smart energy services and AI applications — such as federated data infrastructures, open interfaces, digital twins, edge computing, AI benchmarking tools and secure cloud environments — are being developed in interaction with the wider digital sector and with other sectors undergoing parallel digital transitions. This can support faster deployment and reduce costs by allowing the energy sector to build on existing technological and organisational capabilities rather than developing all components from scratch.

3.2.3. Objectives of the proposal

The proposal aims to enhance the exchange of and access to energy data for both **primary and secondary use**, with the objective of increasing the productivity of the grid by making use of innovative tools.

Regarding the primary use of energy data, the proposed Article 18a(4) obliges TSOs and DSOs to manage and exchange grid data ([129]) in a manner that enables the development, deployment and effective use of smart grids in order to ensure the efficient, secure and flexible operation of the electricity system. These exchanges would take place within the principles of Chapter III of the Data Act. ([130]). TSOs and DSOs should also collaborate in using available data and develop and implement data-driven solutions to monitor, optimise and coordinate network operation.

Regarding the secondary use of energy data, the proposed Article 18a(5) mandates the establishment of a voluntary secure electricity grid data exchange framework by DSOs and TSOs, facilitated by ENTSO-E and the EU DSO Entity. Detailed governance rules for this data exchange framework would be developed by ENTSO-E and the EU DSO Entity and would be complemented by Commission requirements on the lawful, secure and controlled reuse of data for public-interest research and innovation purposes. The objective of this provision is to support the development of innovative data-driven technologies enabling efficient and safe grid operation and optimisation, including through the use of AI. Under the proposal, all European TSOs and DSOs should be able to access any such innovative technologies by filing a request through the coordinated arrangement jointly facilitated by the ENTSO-E and the EU DSO Entity.

([127]) ODEON (https://odeonproject.eu/) which aims to enable a reference Federated Energy **Data** Spaces implementation that will facilitate the integration of the value chain around energy (and other sectors) **data.**

([128]) HEDGE-IoT (https://hedgeiot.eu/) is a Horizon Europe project that develops an interoperable IoT, edge/cloud and AI framework to digitalise Europe's energy system, enabling secure data exchange, greater grid flexibility, higher renewable integration and smarter energy services through large-scale demonstrations across Europe.

([129]) As explained in the recital 13 of the proposal electricity grid data can include, depending on the use case, network topology, grid parameters and asset characteristics, connection and capacity data, real-time measurements from Supervisory Control and Data Acquisition (SCADA) systems and other operational measurements, state estimation and power flow data, voltage, load flow and congestion data, outage and maintenance data, dispatch, redispatch and curtailment data, flexibility needs, and operational forecasts, as well as limits and constraints relevant for transmission and distribution system operation.

([130]) Electricity Regulation creates the obligation; TSOs and DSOs must cooperate and exchange/use relevant grid data. Sector-specific rules define the purpose and safeguards; The data may be used only for specific electricity-system objectives, namely the development, deployment and effective use of smart electricity grids in order to ensure the efficient, secure and flexible operation of the electricity system. Data Act Chapter III may apply in the background. The rule creates a B2B obligation to make data available, so the terms should be fair, reasonable, non-discriminatory and transparent.

3.2.4. Expected benefits and impacts

As explained in the previous section, the existing EU legal framework already contains important building blocks on digitalisation and access to electricity data, but these provisions do not create a sufficiently clear and operational framework for **system-level grid data exchange for smart grid operation and innovation**.

The first way in which the proposal adds value is that Article 18a(4) creates in a more explicit and operational way a **direct legal obligation on TSOs and DSOs themselves to manage and exchange grid data with each other** for clearly identified system purposes. Existing law points in that direction, especially Article 57 of Regulation (EU) 2019/943 on TSO-DSO cooperation, but it remains relatively general and focused on cooperation in network planning and operation. It does not spell out with comparable precision that TSOs and DSOs must exchange grid data in a manner that enables the development, deployment and effective use of smart grids, nor that they must do so specifically to ensure efficient, secure and flexible system operation and to support innovative, data-driven solutions for monitoring, optimisation and coordination of network operation.

The second area of added value concerns the relationship between retail-level data rules and system-level data needs. The current EU legislation is strongest where the market function is already clearly defined, notably for metering, consumption data, customer switching and demand response. That is why Article 24 of Directive (EU) 2019/944 could already underpin detailed implementing rules, and why Implementing Regulation (EU) 2023/1162 could focus on interoperability requirements and access procedures for metering and consumption data. However, those instruments are not designed as a general framework for all forms of grid-relevant data exchange across operators and voltage levels.

A third way in which the proposal adds value pertains to the **legal basis for secondary use of energy data** in Article 18a(5). Access to interoperable and high-quality real-world data is a critical factor for the development of AI applications in the energy sector, as highlighted by reports by BRIDGE ([131]), CERRE ([132]), ENTEC ([133]) and ETIP SNET ([134]). The scarce availability of these datasets currently hinders AI innovation in use cases in grid operation, flexibility activation, forecasting, and maintenance ([135]).

Current EU law, such as the Data Act provides a horizontal governance framework for controlled and trusted data sharing and reuse but as several instruments, especially the Data Governance Act does not apply to most of the TSOs and DSOs, there is a clear need for an electricity-specific framework secondary use framework. Such a framework would effectively enable TSOs and DSOs to pool or make available relevant data under common safeguards and governance in a trusted setting in order to develop, test and validate innovative digital tools for grid planning, operation and optimisation.

([131]) BRIDGE, Data Management Working Group, 'Artificial Intelligence' (2025).

([132]) CERRE, 'What policy interventions for a competitive AI sector?' (2025).

([133]) European Commission: Directorate-General for Energy, Arrowsmith, G., Cozzini, M., Di Costanzo, B., Haack, J. et al., *Support for the preparations of a strategic roadmap for digitalisation and AI in the energy sector*, Publications Office of the European Union, 2026, https://data.europa.eu/doi/10.2833/3572353, p13.

([134]) ETIP SNET, 'Unlocking the Potential of AI and Generative AI in European Smart Grids: A Strategic Position Paper and Guide for Action' Section 3.6 (2025).

([135]) Use Cases 1-4 (2025) in European Commission: Directorate-General for Energy, Arrowsmith, G., Cozzini, M., Di Costanzo, B., Haack, J. et al., *Support for the preparations of a strategic roadmap for digitalisation and AI in the energy sector*, Publications Office of the European Union, 2026, **https://data.europa.eu/doi/10.2833/3572353**.

3.2.4.1. *Energy system benefits*

Available analysis, referenced below, supports the assumption that smoother, enhanced data exchange for grid operation and the development and use of innovative technologies will contribute to the objective of making the operation of electricity systems more efficient, secure and flexible.

Regarding the primary use of energy data (Article 18a(4), the proposal will lead to enhanced data exchange and the deployment of innovative grid technologies and smart energy services. This will release more capacity on the existing grid, in particular by unlocking flexibility resources that are increasingly needed by electricity systems.

In 2022, the European Commission's Energy Transition Expertise Centre (ENTEC) provided high-level modelling of the maximum **flexibility potential that a series of use and business cases based on digital solutions could deliver in 2030 and 2050** ([136]). The study considered use and business cases such as price-responsive charging and discharging of EVs, district heating and cooling, virtual power plants for the intraday market, congestion management and ancillary services using EVs. Although some of these use and business cases remain challenging and may require support, the study concluded that they have a **flexibility potential of 230 GW in 2030 and an additional 600 GW in 2050** ([137]). Remarkably, the study states that this potential could fully cover the flexibility needed to deliver congestion management and ancillary services in 2050; it could also roughly match the flexibility needed in wholesale energy markets ([138]).

A similar conclusion emerges from a 2026 ENTEC study published as part of the preparation of the strategic roadmap for digitalisation and AI in the energy sector ([139]):

- Peak load reduction and cost savings: By activating flexibility (trough digitalisation), **AI-optimised demand side management (DSM) can significantly cut peak demand**. By 2030, up to 60 GW of peak supply needs could be met by flexible demand instead of new power plants, **saving roughly EUR2.7 billion per year** in generation capacity investments. Full-scale Demand Response deployment across Europe could yield between EUR11.1 and EUR29.1 billion in annual savings on investment needs between 2023 and 2030;

- Integration of renewables and emissions reduction: DSM improves the alignment of demand with renewable supply (e.g. shifting EV charging to midday solar peak or windy nights). This reduces curtailment of renewables and reliance on fossil backup, cutting emissions. A full deployment of demand flexibility in the EU could **save an estimated 37.5 Mt of CO_2 in 2030** (an ~8% reduction of power sector emissions) by avoiding fossil generation during peak times;

- Grid resilience and reliability: Active demand management can alleviate grid stress during contingencies, e.g. AI can reduce loads in a region to prevent an overload or

([136]) European Commission: Directorate-General for Energy, McKinsey & Company, Guidehouse, Fraunhofer Institute for Systems and Innovation Research ISI, Trinomics, Utrecht University, TNO, Antretter, M., Klobasa, M., Kühnbach, M., Singh, M., Knorr, K., Schütt, J., Boer, J. d., Rolser, O., Hernandez Diaz, D., Fitzschen, F., Garcerán, A., Reina, R., Stemmer, S., Steinbach, J.Popovski, E., *Digitalisation of energy flexibility*, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2833/113770.

([137]) Ibid. p. 15 These estimates are net of possible duplications and resource competition. The overall gross estimate was 255 GW higher..

([138]) *Ibid*., pp. 13-14.

([139]) European Commission: Directorate-General for Energy, Arrowsmith, G., Cozzini, M., Di Costanzo, B., Haack, J. et al., *Support for the preparations of a strategic roadmap for digitalisation and AI in the energy sector*, Publications Office of the European Union, 2026, p 15 https://data.europa.eu/doi/10.2833/3572353.

help balance the grid during a supply shortfall, acting as an automatic safety net. This fast adaptive load control adds to grid stability;

Regarding the secondary use of energy data (Article 18a(5)), the complexity of electricity systems, including the way power is generated, transmitted, distributed and consumed, creates the potential for innovative technologies, including those using AI, to provide benefits by improving efficiency, decision-making, and resilience ([140]). More specifically, AI can create benefits for renewable generators and system operators through improved operation and maintenance ([141]). Although the potential for AI in system planning was also mentioned by various stakeholders in the OPC, the available evidence and examples were more limited ([142]), and this aspect was therefore not further developed. The following paragraphs summarise the potential benefits for system operators in grid operation and maintenance.

Regarding the operation of grids by system operators, AI can bring important benefits in short-term applications, leading to (1) increased system observability and more efficient use of existing network capacity and (2) improved forecasting of system imbalances ([143]).

First, with respect to increased system observability and more efficient use of existing network capacity, dynamic line rating systems could activate 115–175 GW of additional transmission capacity globally at a fraction of the cost of equivalent new power lines. The value of AI in this context lies in maximising the benefit of this additional capacity ([144]). Furthermore, AI can identify or calibrate grid models based on smart meter and other grid measurements and can estimate the state of power grids, including voltage, current and transformer temperatures ([145]). Distribution grids, in particular, tend to have low observability, which AI can improve ([146]). AI techniques can also enhance optimisation processes for complex distribution grids through improved optimal power flow calculations, potentially reducing computational needs relative to traditional tools. In addition, **AI methods have been shown to be up to 100–400 times faster** than traditional AC powerflow solvers. They can screen millions of contingency scenarios in minutes rather than days, although accuracy decreases in larger or more congested systems ([147]).

AI can find solutions that minimise transmission losses and generation costs more effectively than static methods. In power generation, **AI-based operations and**

([140]) IEA, 'Energy and AI' World Energy Outlook Special Report (2025). Beyond this extensive study by the IEA, see also IRENA, 'Digitalisation and AI for power system transformation' (IRENA, 2025).

([141]) ETIP SNET, 'Unlocking the Potential of AI and Generative AI in European Smart Grids: A Strategic Position Paper and Guide for Action', Chapter 4.1.3 (2025). More broadly, IEA (2025) estimates the potential benefits of AI application in power plants. In their Widespread Adoption Case, the application of AI in power plant operations and maintenance yields potential cost savings of up to USD 110 billion annually by 2035 from avoided fuels and lower costs. For a summary of the impact on infrastructure planning and maintenance, see also Nicolò Rossetto and Valerie Reif, 'Digitalization of the electricity infrastructure: a key enabler for the decarbonization of the power sector' in Juan Montero and Matthias Finger (edited by), A Modern Guide to the Digitalization of Infrastructure (Edward Elgar Publishing 2021), pp. 228-231.

([142]) For an example of the impact of digitalisation of grids more broadly on planning, a recent paper by DIGITALEUROPE provides the example of the Italian DSO Areti, which is using digital strategic flexibility management to 'optimise its hardware investments by 45 per cent, saving €420 million over the next eight years'. See Vincenzo Renda and Katrin Saarep, 'Powering Europe's Future: How AI and Digital Grids Can Secure Europe's Climate and Industrial Leadership' (DIGITALEUROPE 2025), p. 12.

([143]) IEA (2025) highlights that despite the potential benefits of short-term operational applications, adoption remains limited. A survey of grid operators across 13 countries from all over the world found that only 23% use AI for real-time operations, compared with 54% for grid-development planning and nearly 70% for asset maintenance and operation planning. IEA, 'Energy and AI' World Energy Outlook Special Report Chapter 3.4.1 (2025).

([144]) *Ibid*.

([145]) ETIP SNET, 'Unlocking the Potential of AI and Generative AI in European Smart Grids: A Strategic Position Paper and Guide for Action', Chapter 4.1.1 (2025).

([146]) *Ibid*.

([147]) *Ibid*.

maintenance optimisation could save up to USD110 billion annually by 2035 in fuel and operation and maintenance costs (Widespread AI adoption scenario) ([148]).

Second, with respect to improved forecasting for system imbalances TSOs such as RTE in France and Elia in Belgium already use AI for real-time imbalance forecasting, helping reduce uncertainty and informing more accurate reserve sizing ([149]). This also leads to savings in balancing costs ([150]),

AI-driven predictive maintenance helps cut unexpected outages and costly emergency repairs, which could lead to **maintenance cost reductions of approximately 25–30%, breakdown incidents cut by approximately 70%, and downtime reduced by approximately 40% on average when moving from reactive to predictive maintenance (using AI/Internet of Things)** ([151]). Avoiding just one major transformer failure or power plant forced outage can save millions in damage and lost revenue, leading to lower system costs ([152]). TSOs and DSOs are beginning to integrate predictive maintenance tools into their workflows to extend asset lifetimes, reduce unplanned outages, optimise maintenance planning and ensure grid stability ([153]). According to McKinsey, AI-driven predictive maintenance can increase asset productivity by up to 20% and reduce overall maintenance costs by up to 10% ([154]).

3.2.4.2. Digitalisation and innovation

Innovation, especially from companies new to the industry, may be hindered by barriers to data access. The proposal will support easier exchange of electricity grid data, which will boost innovation and enhance the development of technologies, including those using AI, that enable more efficient grid operation. The business model of smart energy service providers usually relies on the availability of data and their inexpensive integration into their business processes.

Insufficient data interoperability poses a persistent barrier to the uptake and the development of smart energy services, including for grid operation. Beyond a physical infrastructure able to generate and transmit data, data exchange relies on data interoperability and the use of commonly agreed data exchange standards. To be able to exchange data, the parties involved need to agree on the way the elements forming the data are structured (data models), on the way the elements of the data are "written down" using bits and bytes (data formats), on the relationship between concepts in the real world and concepts in computer systems (data ontologies), and on the protocols used to communicate the data ([155]). Without an agreement on those aspects, which can take the form of standards and open APIs, exchanging data becomes technically difficult, if not impossible. Open-source software and open-source reference implementations can further support this process by making technical specifications more easily reusable, testable and scalable across Member States, while reducing vendor lock-in and lowering entry barriers for innovative market participants. In case the parties willing to exchange data use different standards, a middleware must be developed to deal with the interfaces and enable data

([148]) IEA, Energy and AI Special Report, Chapter 3 (International Energy Agency, 2023).
([149]) IEA, 'Energy and AI', World Energy Outlook Special Report, Chapter 3.4.1 (2025).
([150]) *Ibid*. ENTEC2, Study - Use Case 3 (2025); IEA, 'Energy and AI', World Energy Outlook Special Report, Chapter 3.4.1 (2025).
([151]) *Ibid*. ENTEC2, Study – p 12.
([152]) *Ibid*. ENTEC2, Study – p 12
([153]) *Ibid*. ENTEC2, Study - Use Case 4 (2025); ETIP SNET, 'Unlocking the Potential of AI and Generative AI in European Smart Grids: A Strategic Position Paper and Guide for Action', Chapter 4.1.1 (2025).
([154]) *Ibid*. ENTEC2, Study - Use Case 4 (2025), citing McKinsey & Company (2017).
([155]) For an introduction to these concepts and other technical aspects of data exchange, see Tim Schittekatte, Valerie Reif and Leonardo Meeus, 'The EU electricity network codes (2020 ed.)', pp. 122-147 (Florence School of Regulation, 2020).

exchange to happen. Developing a dedicated middleware can be costly and represents a barrier to scalable data exchange.

The proposal further strengthens the cross-border provision and use of innovative energy services by providing for a coordinated arrangement for interoperable electricity grid data exchange. It supports the suitability and use of innovative solutions for grid operation by providing a means for developing such solutions based on data from all Member States that are part of the voluntary arrangement for secondary grid data use based on common frameworks for testing, benchmarking and validation of outputs. The proposal also **explicitly requires that any developed innovative solutions must be allowed to be used by all European TSOs and DSOs, thereby ensuring that the benefits of data-driven energy systems innovation can manifest themselves across the entire Union**.

3.2.4.3. Competitiveness and strategic autonomy

The efficient and secure operation of electricity networks increasingly depends on the development and deployment of advanced digital and data-driven solutions. By fostering the development of such solutions, including AI solutions, the proposal will increase the EU's competitiveness and contribute to enhance its strategic autonomy. The following paragraphs illustrate these expected impacts.

Access to large and high-quality datasets is a precondition for testing and training competitive AI foundation models ([156]). In this respect, the EU is well positioned thanks to its extensive scientific and geospatial datasets (such as Copernicus and Eurostat), ongoing deployment of sector-specific data spaces, and open-science practices ([157]). By requiring system operators to establish a secure electricity grid data exchange framework for the voluntary exchange of electricity grid data enabling the development, testing, integration and deployment of innovative technologies supporting the efficient and safe grid operation and optimisation, the proposal fills the gap in EU legislation on the secondary use of energy data. Specifically, it facilitates the accessibility and interoperability of high-quality data, i.e. granular and context-rich data (possibly coupled with their metadata), with the benefit of scaling up the use of AI in the energy sector. This will help make the training of AI models more efficient and effective, and their application in the energy sector will ultimately enhance the EUs competitiveness.

Regarding the concept of strategic autonomy, given its diffusion beyond national security, it now also extends to questions of who controls critical technology, standards and data flows ([158]). Efforts to create the incentives and conditions for the development of European AI capabilities for the energy sector, including energy-specific foundation models and the adaptation of more general-purpose models to energy-system use cases and the EU's legislative action on AI take place in the context of fierce global competition in all aspects of the development of such models. In such a context, this proposal, consistently with the measures announced under the 'AI Continent Action Plan', will **reduce the risk of the EU's dependence on third countries concerning the development of AI foundation models designed to smarten the electricity grid**.

([156]) A recent ETIP SNET report defines AI foundation models broadly as '[l]arge AI models trained on vast datasets, capable of performing a wide range of tasks and adaptable (fine-tunable) to specific applications'. See ETIP SNET, 'Unlocking the Potential of AI and Generative AI in European Smart Grids: A Strategic Position Paper and Guide for Action' (2025), p. 84.

([157]) Vaida Gineikyte-Kanclere, Militsa Eggert and Goda Skiotyte, 'European Software and Cyber Dependencies. Study Requested by the ITRE Committee' (2025), available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2025/778576/ECTI_STU(2025)778576_EN.pdf.

([158]) *Ibid*.

3.2.4.4. *Administrative and compliance costs*

The proposal provides for a governance framework for the secondary use of electricity grid data and the deployment of innovative solutions. The framework is to be compliant with applicable energy and data legislation, including the Data Act, the GDPR and the AI Act, and further supported by Commission requirements. Setting up a secure framework for voluntary electricity data exchange will entail administrative and compliance costs for the TSOs and DSOs participating, as well as for ENTSO-E and the EU DSO Entity.

Analysis by CERRE, ENTEC and SEEG (referenced above) shows that the current complexity of the European legal framework (including the GDPR and the AI Act) creates significant barriers and compliance costs, particularly for smaller firms or challenger firms ([159])This can constrain innovation and competition across the AI supply chain ([160]). One example is the compliance costs for AI systems classified as "high-risk" under the AI Act, which can reach hundreds of thousands of euro ([161]). **By providing an energy-specific governance framework for data exchange for secondary use, the proposal could simplify this complexity and remove some of the barriers and compliance costs**.

3.2.4.5. *Consumer costs and empowerment*

Smart energy services can deliver concrete economic benefits to active customers by optimising the use of their energy-related assets. A SmartEN and DNV study estimates the direct benefits of demand-side flexibility to consumers to be in the order of EUR 100 billion per year, while indirect benefits are calculated to reach up to EUR 300 billion per year by 2030 ([162]). Seamless data exchange is particularly important to reward final customers who purchase aggregation services that compensate demand response based on actual performance rather than on a statistical, and inevitably somewhat artificial, baseline ([163]). Smooth data exchange between assets located on the customer premises and the rest of the system is also important to run these aggregation services in a highly automated way without burdening the final customer with the need to take frequent action ([164]).

An improved secondary use of energy data help contain network tariffs. Network tariffs are collected to ensure the recovery of investment and operational costs of system operators; they represent about 20% of the final average electricity price paid by household consumers. These tariffs are expected to increase significantly over the coming years ([165]). **Increased efficiency in network operation due to the use of digital technologies, including AI-based solutions, can limit the increase in costs for system operators and thus the increase in network tariffs paid by consumers**. Improved secondary use of energy data can also facilitate the tasks of system operators and improve the reliability of electricity systems. Therefore, consumers could benefit from a better electricity supply, with a reduced frequency and duration of interruptions.

([159]) Challenger firms refer to non-incumbents and new entrants competing with established actors in the market. They are typically smaller companies, start-ups, or later entrants that lack the regulatory capacity and resources of dominant firms.

([160]) CERRE, 'What policy interventions for a competitive AI sector?' (2025); DG ENER, 'Summary of responses by associations and Member States to the SEEG plenary of 23/10/2025' (2025); *Ibid*. ENTEC2 Study - Task 2: Market analysis of AI in energy' (2025).

([161]) *Ibid*. ENTEC2 Study, referring to Haataja & Bryson (2021).

([162]) SmartEN and DNV, 'Demand-side flexibility - Quantification in the EU' (SmartEN, 2022), pp. 30-32.

([163]) For an introduction to the challenges associated with demand-response baselining, see Nicolò Rossetto, 'Measuring the intangible: an overview of the methodologies for calculating costumer baseline load in PJM', FSR Policy Brief 2018/05 (2018).

([164]) On the challenges of customer engagement with energy markets, see OneNet project, 'D11.5 Recommendations for customer engagement strategies' (2023).

([165]) ACER and CEER, 'Rewarding Flexibility: How retail contract choice can help unlock consumer flexibility – 2025 Monitoring Report' (ACER, 2025), p. 24.

3.2.4.6. *Skills and employment*

The deployment of data exchange and AI-based solutions impacts the people who use them. Without proper training, employees may struggle to understand or trust AI tools, limiting their effectiveness. The deployment of these technologies is also likely to change the needs of firms active in the energy sector, expanding demand for ICT and digital experts. According to DigitalEurope, over one million new roles will be needed by 2030 to support the energy transition and scale up clean tech manufacturing, spanning emerging domains such as smart grids, renewable energy systems and data infrastructure. They will require not only engineering capabilities but also advanced competencies in AI, cybersecurity and digital technologies ([166]).

3.2.4.7. *System security and cybersecurity*

Cybersecurity is a key enabler for many critical sectors to successfully embrace the digital transformation and fully grasp the economic, social, and sustainable benefits of digitalisation. As such, it plays an important role in primary and secondary energy data use, constituting a necessary precondition to both facilitate the uptake of smart energy services and the development of energy-specific AI foundation models.

However, the infrastructure for the generation and transmission of energy data can be inadequate from a cybersecurity point of view. The digitalisation of the energy system naturally increases the possible points where malicious actors can attack, potentially combining cyber and physical attacks (hybrid attacks). There is an inevitable tension between data sharing and cybersecurity: the more data flows are allowed between the centre and the periphery of a system, the higher the risks in terms of cybersecurity ([167]). These risks increase further in case the data flow can support the malicious disconnection and re-connection of a certain load or generation asset from the electricity grid. For instance, the hacking of smart meters of final customers can have potentially serious consequences, as it can lead to the sudden disconnection and reconnection of a significant part of the load in an electricity system, which may be quite difficult, if not impossible, for system operators to handle.

It is also important to highlight that the secondary use of electricity data to develop and test AI models for electricity grid operations may involve cybersecurity-sensitive information. As AI is increasingly integrated into core grid functions, including stability control, flexibility management and predictive maintenance, the importance of addressing AI-specific risks grows accordingly ([168]). Identified risk categories include unintentional AI failure, adversarial attacks such as data poisoning or model poisoning techniques ([169]), and supply chain compromises, where AI software ecosystems are targeted through

([166]) DIGITALEUROPE, 'Advancing Europe's Grid Performance Why Europe must digitalise its grids' (2023), p. 6.

([167]) Different views exist with regard to the higher or lower level of cyber risks that different data management models (DMMs) in the energy sector would generate. Some argue that centralised DMMs are riskier than decentralised DMMs, while others argue the opposite. The Commission considers that each type of DMM has advantages and disadvantages in terms of cybersecurity.

([168]) DG ENER, 'Summary of responses by associations and Member States to the SEEG plenary of 23/10/2025' (2025); ENTEC2, 'A2 Study: Digitalisation and Artificial Intelligence (AI), Task 2: Market analysis of AI in energy' (2025); ETIP SNET, 'Unlocking the Potential of AI and Generative AI in European Smart Grids: A Strategic Position Paper and Guide for Action', Section 2.5 (2025).

([169]) Based on JRC, 'Generative AI Outlook Report: Exploring the Intersection of Technology, Society, and Policy' (2025), data poisoning and model poisoning can be summarised as follows. Data poisoning is the insertion of adversarial samples into large and often unverified internet-sourced training datasets, allowing attackers to introduce vulnerabilities, backdoors, or biases that may compromise a model's performance and lead to harmful outputs. Model poisoning is the manipulation of GenAI systems, especially open weight models, by distributing models that contain hidden threats such as malware or backdoors that remain inactive until triggered and may persist even after fine-tuning or additional safety training. A recent ETIP SNET report defines 'GenAI' as 'AI systems capable of generating novel content (text, images, code, data) based on patterns learnt from training data, often prompted by user input'. ETIP SNET, 'Unlocking the Potential of AI and Generative AI in European Smart Grids: A Strategic Position Paper and Guide for Action' (2025), p. 84.

conventional cybersecurity threats ([170]). In this context, **the proposal mitigates some of these risks by requiring the ENTSO-E and the EU DSO Entity to define and communicate to the Commission safety and cybersecurity measures to ensure the safe integration of developed solutions within system operators' internal processes and operations**. In addition to that, the proposal empowers the Commission to adopt implementing acts setting out requirements to enable the lawful, secure and controlled reuse of data for research and innovation public-interest purposes, supporting the operation and optimisation of the electricity system.

3.2.4.8. Environmental impacts

AI models could enhance system performance by significantly improving forecasts of renewable energy output and consumption patterns. Accurate predictions of weather-driven fluctuations in energy generation and demand enable grid operators to anticipate imbalances and take proactive measures. This improved foresight allows for more efficient dispatch of resources ([171]), better utilisation of storage and flexible loads, and smoother integration of intermittent renewables into the grid. Consequently, AI contributes to increased system stability while supporting higher shares of clean energy.

If flexible resources are not effectively harnessed through data-driven approaches and smart services, the energy system may have to continue to rely heavily on traditional forms of flexibility. Utility-scale assets such as natural gas power plants could continue to play a significant role in balancing supply and demand. While these assets provide reliable, dispatchable capacity, their continued prominence may slow down decarbonization and limit the overall environmental benefits of renewable integration. Therefore, maximising the potential of smart energy services and AI-driven optimisation is crucial to reducing dependence on fossil-based flexibility and advancing a cleaner, more resilient energy system.

At the same time, the increasing reliance on digital solutions, in particular the boom of AI, as well as smarter energy services that rely on many more data sources raise concerns about the environmental footprint of growing data collection and processing needs. In the coming years, larger volumes of data are expected to be gathered, transmitted, and analysed, and used for training AI models, which will drive demand for data centres and digital infrastructure. At the same time, technological developments such as edge computing, distributed machine learning, frugal AI, more efficient use of computing resources and, where relevant, islanding and local control capabilities are beginning to alleviate some of these pressures by enabling more data processing and decision-making closer to where data is generated, reducing unnecessary data transfers to central systems, lowering compute and energy needs, and improving the resilience and efficiency of digitalised energy-system operation. These facilities can be energy-intensive and, if powered by non-renewable sources, may contribute to additional greenhouse gas emissions. Moreover, the expansion of data infrastructure can place further pressure on electricity systems and natural resources, including water. As put forward in the Strategic Roadmap on digitalisation and AI in the energy sector ([172]) addressing these challenges requires improving the energy efficiency of data centres, increasing their use of renewable energy, connecting them in optimal locations in relation to energy generation and grid access, and promoting responsible data management practices to ensure that the digitalisation of

([170]) ETIP SNET, 'Unlocking the Potential of AI and Generative AI in European Smart Grids: A Strategic Position Paper and Guide for Action' Section 2.5 (2025).
([171]) Benedikt Nilges et. al, 'Is demand-side management environmentally beneficial? Analyzing the greenhouse gas emissions due to load shifting in electric power systems', Journal of Cleaner Production 434 (2024).
([172]) COM(2026) 501 final.

energy systems supports, rather than undermines, overall sustainability goals. The Cloud and AI Development Act aims to achieve the same objectives for data centres deployed in data centre acceleration zones.

4. Smart Meters

4.1. Policy context

The current EU framework has led to uneven and, in several cases, insufficient smart meter deployment, limiting the development of demand-side flexibility and the effective functioning of the internal electricity market.

4.1.1. Role of smart metering in the electricity system

The proposed smart metering provisions aim to help improve the efficient use and overall performance of electricity grids by strengthening the electricity system's technical and digital capabilities. This allows grid conditions to be monitored more effectively and operations to be optimised in near real time, while enabling consumers, and other market actors to make better use of demand-side flexibility.

In practice, this contributes to a more efficient use of the electricity network by aligning demand more closely with generation. As a result, congestion and redispatch needs are reduced, system costs are lowered, and renewable curtailment is limited. In addition, this improved efficiency facilitates the electrification of end uses, including electric mobility and heating.

This objective is supported by a broader enabling framework combining smart meters, smart and digitalised grids, and better use of electricity system data. Together, these elements support more flexible and efficient electricity systems, dynamic retail markets and greater consumer empowerment.

Within this framework, smart meters play a central role. They go beyond measuring electricity consumption and form a key part of the digital layer needed for a more flexible, electrified and decentralised electricity system. By providing near real-time insights and access to granular data, they make it possible to support flexible consumption and time-based billing. Without smart meters, dynamic and time-differentiated contracts cannot be accurately billed, and suppliers and aggregators cannot develop offers that reward flexibility ([173]). They therefore constitute a key enabler of demand-side flexibility, particularly in a system with increasing shares of variable renewable energy.

4.1.2. Existing EU legislative framework

Directive (EU) 2019/944 already provides a framework for smart metering deployment. Article 19 requires Member States to ensure the deployment of smart metering systems that support the active participation of final customers in the electricity market, while Annex II sets out the principles governing deployment decisions. In particular, Annex II provides that the deployment of smart metering systems may be subject to an economic assessment of the long-term costs and benefits for the market and individual consumers. Where such an assessment is positive, at least 80% of final customers should be equipped with smart meters within seven years of the positive assessment, or by 2024 for Member States that started systematic deployment before 4 July 2019. This 80% level therefore constitutes a conditional benchmark rather than a binding EU-wide target, as its application depends on the outcome of national cost-benefit assessments.

([173]) COM(2026) 850 final, Report on market-based electricity supply prices, effective retail market competition and promoting remuneration of flexibility in retail contracts.

The Directive further requires smart metering systems to be interoperable and capable of supporting consumer energy management systems. Article 20 establishes minimum functional requirements relating to interoperability, data access, cybersecurity, data protection and the provision of near real-time consumption information to consumers. This ensures that smart metering systems can support consumer participation and the development of digital energy services.

However, the possibility to subject deployment to national cost-benefit assessments has contributed to uneven outcomes across the EU, including delayed or partial rollouts. As a result, system-wide benefits are not fully realised and the development of flexibility services remains limited in several Member States. While Annex II envisages a forward-looking assessment of costs and benefits, experience from across Member States suggests that many cost-benefit analyses did not fully capture certain categories of benefits, in particular those related to demand-side flexibility, renewable integration, consumer participation and the development of innovative services. At the same time, some cost components may have been overstated, as meter replacement and system maintenance would in any case have been required over time.

4.1.3. State-of-play and deployment gaps across the EU

Overall smart meter penetration across the EU remains just over 60%, with significant differences across Member States. This is a result of cost-benefit assessments that are not always comprehensive. According to the available state-of-play data ([174]), 15 Member States are already above 80% ([175]) while five remain below 80% ([176]) and seven are lagging behind ([177]) either because rollouts are delayed or because no large-scale deployment has been decided.

This uneven distribution is further illustrated in Table 1, which provides an overview of deployment levels across Member States, including penetration rates, rollout status and market uptake indicators. Several Member States remain significantly below the levels required to enable effective participation in flexibility markets, with some still below 10% penetration.

This situation highlights a clear structural problem: the current framework has led to uneven and, in several cases, insufficient deployment of smart metering systems across the EU. As a result, a significant share of consumers and market actors are unable to access flexibility-based services, and the associated system-wide efficiency gains remain underexploited. This fragmentation limits the effective functioning of the internal electricity market and constrains the development of demand-side flexibility at scale.

([174]) ACER-CEER Energy Retail Market Monitoring Report 2024 and 2025.
([175]) Fifteen Member States have a penetration rate for electricity smart meters over 80% (DK, EE, ES, IT, LV, LU, AT, PT, SI, FI, SE, have an almost 100% penetration, followed by IE, FR, MT, NL, with penetration rates between 80% and 95%).
([176]) Five Member States are still below 80% (BE with 46%, HR with 34%, LT with 58%, PL with 36%, RO with 27%).
([177]) Seven Member States lag behind either because their rollouts are delayed (EL, CY) or because they have not decided to go ahead with a large-scale rollout (BG, CZ, DE, HU, SK).

Table 1: Overview of smart meter rollout for electricity across the EU

	Smart meter rollout - households (ref ACER Electricity Country sheets – July 2025)	**Smart meter rollout - households** (ref ACER Electricity Country sheets – December 2024)	**Smart meter rollout – non-households** (ref ACER Electricity Country sheets – July 2025)	**Uptake of market based dynamic price contracts among households** (ref ACER Monitoring Report 2025 – ACER dataset)	**Number of metering points (millions)** (ref ACER)	**Number of DSOs (the entity usually tasked with the rollout)** (ref EUDSO Entity)
Belgium	46%	35%	79%	0%	6.28	16
Bulgaria	Not available	0%	Not available	0%	5.3	4
Czechia	Not available	3%	Not available	1%	6.28	252
Denmark	100%	100%	Not available	Not available	3.2	38
Germany	2%	1%	2%	1%	47.5 ([178])	866 ([179])
Estonia	99%	99%	100%	Not available	0.76	32
Ireland	84%	69%	78%	0%	2.55	1
Greece	12%	1%	Not available	0%	7.71	1
Spain	99%	99%	99%	31%	30.49	333
France	94%	94%	95%	0%	40.13	138
Croatia	34%	24%	95%	Not available	2.58	1
Italy	100%	100%	100%	1%	37.61	123
Cyprus	0%	0%	0%	Not available	0.7	1
Latvia	99%	99%	99%	16%	0.8	10
Lithuania	51%	58% ([180])	95%	3%	1.82	3
Luxembourg	99%	99%	99%	0%	0.36	5
Hungary	Not available	9%	Not available	0%	5.71	6
Malta	93%	93%	87%	0%	0.39	1
Netherlands	90%	90%	90%	6%	8.7	6
Austria	97%	80%	97%	Not available	4.91	124
Poland	36%	27%	65%	0%	19.3	231
Portugal	99%	86%	0%	0%	6.51	13
Romania	27%	23%	45%	0%	9.02	8
Slovenia	97%	95%	Not available	3%	0.99	1
Slovakia	Not available	15%	Not available	Not available	2.7	146
Finland	99%	99%	100%	27%	3.81	77
Sweden	100%	100%	100%	17%	5.64	150

4.1.4. Problem definition and rationale for EU action

Against this identified problem of uneven deployment and insufficient smart meter deployment, which limits system efficiency and market functioning, the proposal introduces a minimum deployment trajectory across the EU including targeted flexibility for Member States with particularly low levels of deployment.

The proposed smart meter provisions would affect Member States that remain below 50%–75% penetration or have not initiated an effective large-scale rollout. In particular, the measure is expected to primarily affect countries such as Bulgaria, Czechia, Germany,

([178]) 52.2 million connection points according to EU DSO Entity https://eudsoentity.eu/wp-content/uploads/2024/11/DSO-map_web.pdf.
([179]) Distribution system operator and supplier-led rollout.
([180]) National figure corrected in the 2025 reporting.

Hungary, and Slovakia, which currently have only partial deployment and no plans for wide-scale rollout of smart meters. Germany, for instance, had originally opted for a more restricted deployment on the basis of its 2013 cost-benefit assessment ([181]), but is now planning to roll out around 20 million smart meters by 2030 ([182]), corresponding to around 40% of total metering points in the country.

The objective of a wider-scale rollout is also reflected in recent EU policy initiatives, including the AccelerateEU framework, which emphasises the need to speed up the deployment of smart metering systems as a key enabler of a more digital, flexible and efficient electricity system, supporting consumer participation, demand response and renewable energy integration.

4.1.5. Stakeholders' views and market perspectives

Stakeholders across the electricity value chain consistently highlight the importance of accelerating smart meter deployment as a prerequisite for flexibility, active customer engagement and the digitalisation of the electricity system. In response to the AccelerateEU initiative, ESMIG, representing smart meter manufacturers and solution providers, welcomed ([183]) the introduction of an EU-level smart meter deployment objective, noting that widespread deployment is necessary to unlock flexibility services and empower consumers.

Similarly, SmartEn, representing the flexible demand management industry highlighted that flexibility market development is still restricted in some Member States by the slow rollout of smart meters and that deployment is essential for devising innovative tariff structures, including dynamic electricity price offers ([184]). Service providers further underlined that dynamic tariffs, smart charging and other flexibility services rely on granular smart meter data, enabling consumers to respond to price signals and lower their electricity costs ([185]).

Electricity companies and network operators likewise identify smart meters as a key pillar of digitalised distribution networks and an essential enabler of demand response, renewable integration and efficient grid operation ([186]).

These views are broadly consistent with those of public authorities and regulators, including ACER ([187]), which highlighted the importance of consumer access to flexibility services and dynamic retail offers for electricity markets to work properly.

([181]) Ernst & Young, Cost-benefit analysis for the comprehensive use of smart metering systems – Final report – Summary, commissioned by the German Federal Ministry of Economics and Technology, published 30 July 2013, https://www.bundeswirtschaftsministerium.de/Redaktion/EN/Publikationen/cost-benefit-analysis-for-the-comprehensive-use-of-smart-metering-systems.pdf?__blob=publicationFile&v=1.

([182]) This is an expected outcome of the measures introduced in the German national bill to restart the digitilisation of the energy transition (GNDEW) which entails some amendments to the Metering Point Operation Act (MsbG); see also https://www.ffe.de/en/publications/the-smart-meter-rollout-in-germany-and-europe/.

([183]) ESMIG on AccelerateEU, 22 April 2026 https://www.esmig.eu/european-commission-launches-accelerate-eu-initiative/; and on AI and energy digitalisation roadmap, 3 June 2026, https://www.esmig.eu/roadmap-on-ai-and-digitalisation-in-the-energy-sector-recognises-importance-of-smart-metering/.

([184]) SmartEn position paper: Recommendations for electricity market design improvements, 15 December 2022, https://smarten.eu/wp-content/uploads/2022/12/FINAL-smartEn_EMD_PositionPaper-1.pdf.

([185]) Octopus Energy: How smart meters are the key to a flexible grid, 5 September 2025, https://octopus.energy/blog/smart-meters-and-flexibility/.

([186]) For example, Eurelectric's publications: Power2People – supporting residential customers in their energy transition, 4 June 2025, https://www.eurelectric.org/publications/residential-customers/; and Power Barometer 2025, https://powerbarometer.eurelectric.org/wp-content/uploads/2025/09/Power-Barometer-2025-full-report.pdf.

([187]) ACER-CEER Market Monitoring Report: "How electricity contract choices can unlock consumer flexibility and lower bills", 27 November 2025, acer.europa.eu/sites/default/files/documents/Publications/ACER-CEER-2025-Retail-monitoring.pdf.

Regulatory monitoring ([188]) further confirms that access to smart metering data is a key enabler for dynamic contracts and consumer participation, while low smart meter penetration continues to be a structural barrier to developing flexibility markets in several Member States.

Overall, this indicates broad support across manufacturers, service providers, utilities, network operators and regulators for accelerating smart meter deployment.

4.1.6. Deployment benchmarks and challenges

Reaching 50% by 2030 in all Member States, including those currently lagging behind, requires faster deployment in slower Member States. This means reaching sustained annual rollout rates broadly in line with those achieved in leading Member States during peak rollout phases, while allowing for a limited extension in duly justified cases.

Experience from Member States that have already completed or are close to completing large-scale rollouts provides useful benchmarks. During the peak phase of the Linky rollout, France deployed approximately 4–6 million smart meters per year, corresponding to around 10–15% of its total metering points annually. Italy followed a similar path, while Ireland achieved rollout rates of around 12–14% annually. These examples indicate that sustained annual deployment rates in this range are achievable if Member States come up with a clear deployment plan.

Compared with these benchmarks, some Member States, in particular those with low current penetration, are likely to face significant acceleration requirements. Germany, for example, with approximately 47.5 million metering points and current penetration estimated at around 2% according to the latest ACER figures, would need to install around 23 million additional smart meters to reach 50% coverage by the target date. This would mean a rollout pace of 5 million meters per year, corresponding to 10% of total metering points annually.

The benchmarks indicate that these deployment rates are technically feasible. However, the conditions under which rollouts take place vary significantly across Member States.

One factor influencing the speed and efficiency of smart meter deployment is the structure of the DSO landscape in each Member State (see Table 2). DSOs are typically responsible for installing and operating smart metering systems, which form part of their regulated asset base and are therefore closely linked to network investment decisions. In countries with few DSOs or a more centralised structure, rollout programmes have generally been implemented through coordinated and standardised approaches, allowing for economies of scale, streamlined procurement and faster deployment. By contrast, Member States with more fragmented DSO landscapes, in some cases involving several hundred operators, need to ensure well-coordinated deployment, align technical specifications and achieve sufficient scale in procurement and implementation. Without a clear Member State rollout programme, fragmentation can increase administrative complexity, lead to different technical solutions and slow down deployment compared to more coordinated models. Austria is a Member State with many DSOs (124 for a population of 9.2 million) which successfully rolled out smart meters to practically all consumers (97%).

Germany's experience (with many DSOs) shows how regulatory and structural factors can negatively affect deployment speed (smart meter penetration reaching around 2% of

([188]) ACER-CEER 2024 and 2025 Market Monitoring Reports.

consumers by the end of 2024). However, recent national legislation ([189]) is now seeking to accelerate deployment, potentially by around 20 million intelligent metering systems by 2030 ([190]).

In such contexts, or where more complex requirements or less mature deployment frameworks are involved, reaching rollout speeds similar to the frontrunners' may require closer coordination at national level, including developing common technical standards, joint or centralised procurement approaches and stronger regulatory guidance. Cooperation between DSOs, national regulatory authorities and public authorities, as well as exchange of best practices across Member States, can help speed up deployment while ensuring interoperability and cost-efficiency. This is particularly relevant for Member States with both a fragmented DSO structure and low current penetration levels, where achieving rapid scale-up may depend on more coordinated deployment frameworks.

Overall, this clearly underscores the importance of robust coordination mechanisms and supportive regulatory conditions to sustain high and consistent deployment rates over time across the EU.

4.1.7. Internal market implications

The current uneven distribution of smart meters across the EU limits the effective functioning of the single market and constrains the development of innovative products and services, as consumers and market actors in low-deployment Member States are structurally excluded from flexibility-based offers.

Ensuring that smart meters are deployed with the functionalities required under EU legislation, including access to near real-time data, interoperability and compatibility with home energy management systems and other smart devices, is therefore essential for full flexibility and consumer participation.

4.1.8. Industrial supply chain and security considerations

From a strategic perspective, smart meter deployment also has implications for industrial competitiveness, supply chains and critical infrastructure resilience.

Most smart meters deployed in the EU are currently supplied by European or European-headquartered firms, but global supply chains, including components and sub-assemblies sourced from non-EU countries, are becoming increasingly relevant.

Stakeholders ([191]) ([192]) indicate that the European smart metering sector remains globally competitive, but faces structural challenges linked to fragmentation of the single market. Differences in national technical standards, communication protocols, cybersecurity

([189]) The German *Gesetz zum Neustart der Digitalisierung der Energiewende, GNDEW* is the 2023 law restarting the digitalisation of the energy transition. On smart meters, it sets a binding rollout path for intelligent metering systems (*intelligente Messsysteme / iMSys*), with targets for mandatory installation cases. For most relevant cases, the law requires rollout to start immediately or by 2025, with at least 20% installed by 31 December 2025, 50% by 31 December 2028, and 95% by 31 December 2030. For some larger, specific cases starting later, the timetable shifts to 20% by 2028, 50% by 2030 and 95% by 2032.

([190]) See consumer policy analysis by ConPolicy, https://www.conpolicy.de/en/project/evaluation-of-the-implementation-of-european-energy-consumer-rights-in-germany.

([191]) For example, stakeholders such as the European association of smart energy solution providers ESMIG, and the PRIME (PRIME = PoweRline Intelligent Metering Evolution) Alliance which focus on developing a telecom solution in support of smart metering functionalities and the smart grid.

([192]) ESMIG: Position paper on the revision of the Cybersecurity Act, 12 May 2026, https://www.esmig.eu/esmig-publications/position-paper-on-revised-cybersecurity-act/ and Position paper on the revision of the EU Public Procurement rules, 26 January 2026, https://www.esmig.eu/esmig-publications/position-paper-on-the-revision-of-eu-public-procurement-rules/.

requirements and procurement practices have limited economies of scale, increased costs and affected growth prospects for European manufacturers.

At the same time, the presence of non-EU suppliers has grown significantly in recent years. This reflects the increasing globalisation of supply chains, while calling into question resilience and security of supply.**Error! Bookmark not defined.** Industry estimates suggest that non-EU suppliers account for around 20% of the EU smart metering market. Evidence from procurement procedures also indicates that price differentials between bids can be substantial, which may cast doubt on the level playing field in public procurement, including in relation to potential distortions affecting competition.

It should be also borne in mind that smart metering systems form part of critical electricity infrastructure, with long asset lifetimes (typically 15 years or more) and direct interaction with grid management and sensitive consumption data. This raises additional questions about cybersecurity, resilience and potential vendor dependency risks.

In this context, a coordinated and predictable EU deployment trajectory can help create a competitive European ecosystem by enabling economies of scale, fostering innovation and strengthening resilience. At the same time, EU requirements on functionality, interoperability, cybersecurity ([193]) and data protection, together with evolving procurement ([194]) and foreign subsidy frameworks ([195]), help ensure a level playing field and mitigate risks associated with global supply chains.

4.1.9. Role of public procurement and EU frameworks

In practice, EU and national public procurement frameworks are a key instrument for addressing these challenges. Smart meters fall within the scope of existing EU procurement rules when purchased by contracting authorities, utilities or energy sector contracting entities, in particular under Directive 2014/25/EU ([196]). Procurement procedures may be used, in compliance with applicable EU law, as a strategic lever to ensure that smart meter rollouts are secure, interoperable and resilient.

Procurement requirements may include technical and functional specifications on cybersecurity, data protection, interoperability, access to updates, auditability, incident response and security of supply. This is particularly relevant in light of the increasing reliance on complex global supply chains. The requirements should be designed in a proportionate, non-discriminatory and technology-neutral manner that is consistent with EU procurement principles. At the same time, full use should be made of existing tools under the utilities procurement framework, including provisions on tenders involving products originating in non-EU countries, as set out in Article 85 of Directive 2014/25/EU.

([193]) See Regulation (EU) 2024/2847 (Cyber Resilience Act); Directive (EU) 2022/2555 (NIS2); and Regulation (EU) 2019/881 (Cybersecurity Act).

([194]) On 14 October 2025, the Commission published its evaluation of the three EU public procurement Directives (SWD(2025)332 final and SWD(2025)333 final), namely Directive 2014/23/EU on Concessions, Directive 2014/24/EU on Public Procurement and Directive 2014/25/EU on Utilities. Covering the 2016-2024 period, the evaluation forms part of the preparations for the upcoming Public Procurement Act, expected in the second quarter of 2026, and follows the Better Regulation Guidelines.

([195]) Regulation (EU) 2022/2560 of the European Parliament and of the Council of 14 December 2022 on foreign subsidies distorting the internal market, OJ L 330, 23.12.2022, ELI: http://data.europa.eu/eli/reg/2022/2560/oj.

([196]) Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014 on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC, OJ L 94, 28.3.2014, p. 243, ELI: http://data.europa.eu/eli/dir/2014/25/oj.

Smart metering systems are not explicitly identified as a standalone technology category under Regulation (EU) 2024/1735 ([197]) (Net-Zero Industry Act - NZIA). However, as set out in the Annex to the Regulation, smart meters, elements of advanced metering and control infrastructures are included under electricity grid technologies. Smart metering systems therefore form part of the broader grid technology ecosystem, and act as enabling digital infrastructure for the electricity system. Their deployment is closely aligned with the objectives of strengthening the EU's net-zero technology ecosystem, including through procurement practices that support sustainability, resilience and security of supply. In this context, the relevance of the NZIA should be taken into account.

4.2. Objectives of the proposal

4.2.1. Introduction of a two-step EU-wide deployment trajectory

The proposal introduces targeted measures on smart metering deployment, namely a minimum EU-wide deployment trajectory of at least 50% of final customers by the end of 2030, rising to 75% by the end of 2033. For Member States with deployment levels below 30% at the date of entry into force of the proposal, a limited extension of the deadlines would be appropriate. Cost-benefit assessments would apply only to deployment beyond that 75% level.

The proposed two-step deployment trajectory is designed to reflect how benefits materialise in practice. A first threshold at 50% is intended to ensure a sufficient level of deployment for demand-side flexibility, dynamic pricing and competitive retail offers to emerge across all Member States. Increasing this level to 75% allows these benefits to scale and deliver system-wide gains, including more efficient use of the network and improved renewable energy integration.

Based on current deployment levels, a 50% requirement for all would bring EU-wide penetration close to around 75–80%, while a 75% requirement would raise it to almost 90%. At the same time, maintaining cost-benefit assessments beyond 75% is intended to ensure proportionality and allow Member States to reflect national circumstances. This approach strikes a balance between ambition, efficiency and flexibility, while supporting consumer empowerment and the effective functioning of the single energy market.

4.2.2. Complementarity with existing EU legislation

This proposal does not alter the functional and technical requirements set out in the Electricity Directive. Rather, it complements the existing framework by introducing a minimum deployment trajectory across the EU.

It thus addresses persistent rollout disparities that have emerged under the current approach based on cost-benefit assessments, while maintaining flexibility beyond that level. This approach ensures a minimum level of deployment for market functioning and system efficiency, while preserving the role of cost-benefit assessments where appropriate.

Moreover, the proposed measures do not affect Member States' responsibilities for organising their energy systems.

([197]) Regulation (EU) 2024/1735 of the European Parliament and of the Council of 13 June 2024 on establishing a framework of measures for strengthening Europe's net-zero technology manufacturing ecosystem and amending Regulation (EU) 2018/1724, OJ L, 2024/1735, 28.6.2024, ELI: http://data.europa.eu/eli/reg/2024/1735/oj.

4.2.3. *Internal market and system objective*

The proposal establishes a clear EU-level minimum deployment trajectory for Member States lagging behind. This will help reduce fragmentation and avoid the emergence of a two-speed single market. It will also ensure that consumers and SMEs in low-deployment countries are not structurally excluded from smart energy services, such as flexible supply contracts and active participation.

In aggregate, increasing smart meter penetration to levels up to 75% per country, corresponding to an EU-wide penetration rate of 80–90% of final customers would enable the EU to capture most of the associated benefits. These include not only direct operational savings, but also broader system efficiencies, such as improved use of existing infrastructure, reduced curtailment of renewable generation and lower peak demand.

These effects help lower overall system costs and, over time, improve affordability for households and businesses. The scale of these benefits depends on the level of deployment: at lower levels, impacts remain localised and fragmented, whereas higher levels of deployment allow flexibility services and market-based solutions to scale and generate system-wide effects.

The proposed thresholds are designed to ensure the single market works properly and flexibility services are created, while remaining proportionate in light of costs and national circumstances.

Overall, the objective is to achieve a sufficient and more even level of smart meter deployment across the EU. This will help boost consumer participation, improve system efficiency, facilitate renewable energy integration and support electrification, while preserving flexibility for Member States beyond the minimum trajectory to account for national circumstances.

4.3. Expected benefits and impacts

4.3.1. *Benefits and positive impacts*

The impacts of smart metering deployment can be seen across retail markets, the electricity system and the wider economy, and are closely linked to the level of deployment. At lower levels of penetration, impacts remain limited and fragmented, whereas higher levels allow flexibility services and consumer participation to scale, generating system-wide effects.

4.3.1.1. *Market functioning and access to services*

Smart meters are a prerequisite for flexible retail offers, including dynamic and time-differentiated contracts. Without them, suppliers cannot create offers that reward flexibility or accurately bill such contracts, and consumers cannot access price signals reflecting system conditions.

Evidence from regulatory monitoring ([198]) indicates that access to smart metering data is key for developing flexible contracts, while low smart meter penetration remains a barrier in several Member States ([199]).

([198]) ACER-CEER 2025 Market Monitoring Report.
([199]) ACER/CEER note that limited smart meter roll-out prevents consumers from engaging in flexibility and demand shifting, while it also makes it more difficult for suppliers and third parties to offer flexibility services.

Ensuring a minimum level of deployment is therefore necessary for the effective functioning of competitive and innovative retail electricity markets.

4.3.1.2. Benefits for the retail market, consumers, SMEs

For consumers, including SMEs, smart meters improve access to dynamic and time-of-use contracts, increase billing accuracy, facilitate switching, and provide more transparent consumption information.

Empirical evidence, as also shown in the Commission smart metering benchmarking report ([200]), suggests energy savings in the range of approximately 5%–8% for electricity, depending on consumer engagement. These savings can translate into lower electricity bills, particularly when combined with dynamic pricing or time-of-use tariffs.

SMEs, particularly those with flexible loads, such as refrigeration, heating/cooling, electric vehicle charging or storage, can benefit from more granular price signals allowing them to shift their consumption and reduce their electricity costs.

4.3.1.3. System-level benefits and efficiency gains

At system level, smart meters enable demand to respond to system conditions. This contributes to reduced peak demand, lower balancing and redispatch costs, improved network planning and better renewable energy integration.

By allowing consumption to shift towards periods of high renewable generation, smart meters reduce renewable curtailment and make better use of existing infrastructure. These effects: (i) translate into significant efficiency gains; (ii) reduce the need for costly investments in generation and network capacity; and (iii) support a more cost-efficient energy transition. Lower system costs translate over time into improved affordability for households and businesses.

4.3.1.4. Evidence from cost-benefit analyses and benchmarking

Available evidence from the Commission smart metering benchmarking report and national cost-benefit analyses shows that the deployment of smart metering systems is associated with positive net benefits in most Member States. Across positively assessed cases, the weighted average cost per electricity metering point is found to be approximately EUR 172, while the corresponding benefits amount to around EUR 253. However, for the reasons set out below it is likely that these assessments overestimated costs and, more importantly, underestimated benefits.

Although deployment requires significant upfront investment, particularly given the scale of national metering systems, the benefits are expected to outweigh costs when system-wide and long-term impacts are taken into account. Since this benchmarking exercise was carried out, both the costs of individual smart meters and supporting ICT infrastructure are likely to have decreased, while – more importantly – the associated benefits have increased, in particular because earlier assessments did not fully capture system-level and flexibility related benefits.

([200]) European Commission: Directorate-General for Energy, Tractebel Impact, Alaton, C. and Tounquet, F., Benchmarking smart metering deployment in the EU-28 – Final report, Publications Office, 2020, https://data.europa.eu/doi/10.2833/492070.

These benefits include operational savings for distribution system operators (e.g. remote reading, fewer field interventions), improved billing accuracy and reduced losses. In addition, smart metering enables broader system-level benefits that are more difficult to quantify but potentially significant.

These benefits extend beyond operational savings and contribute to a structural improvement in the functioning of the electricity system, enabling a shift from supply-driven to demand-responsive system operation. The measure is therefore expected to boost competitiveness: a more flexible demand side can reduce system costs and wholesale price peaks, helping make electricity more affordable for households and businesses. Benefits include: (i) improved network planning; (ii) more efficient integration of renewable energy; (iii) reductions in balancing and redispatch needs; and (iv) a reduced need for network reinforcement, particularly as electrification increases demand flexibility.

4.3.1.5. Practical examples of realised benefits

Practical experience illustrates how these benefits materialise.

For consumers, smart meters enable the use of dynamic or time-of-use contracts, allowing households to shift consumption, for example for electric vehicle charging or heating, to periods of lower prices and higher renewable generation. In some markets, this is reflected in retail offers that provide significantly reduced or even zero-priced electricity during certain hours, enabling consumers to cut and better manage their electricity bills while contributing to lower peak demand and less reliance on more expensive and carbon-intensive generation.

At system level, smart meters provide system operators with granular and timely information on consumption patterns, enabling more effective demand response. In periods of network congestion or high renewable output, consumption can be shifted or increased locally, reducing the need to curtail renewable generation or invest in costly network reinforcement. This contributes to improved use of existing infrastructure, lower system costs and more stable network charges over time.

Experience in Member States with high smart meter penetration, such as Finland, shows that widespread deployment has contributed to a significant uptake of flexible retail contracts, including dynamic price offers and digital energy services, enabling consumers to respond to price signals and participate more actively in energy markets.

4.3.1.6. Broader economic and innovation impacts

The measure also helps create a European digital energy ecosystem, including metering technologies, data services, cybersecurity solutions and flexibility platforms. This boosts innovation, competitiveness and the emergence of new market services.

4.3.2. Costs, risks and mitigating measures

4.3.2.1. Costs of deployment and distributional effects

The main cost relates to the investment required for smart meter deployment, including metering devices, installation and supporting systems. This cost is typically borne initially by distribution system operators and recovered through network tariffs or metering charges.

Costs are not expected to be evenly distributed across Member States. Those with low deployment levels at present will clearly face higher costs to reach the minimum levels – as other Member States have already incurred those costs. Any burden associated with this proposal will thus lie with those Member States with particularly low smart meter deployment.

Additionally, Member States with fragmented distribution system structures may also face procurement challenges and administrative burdens related to coordinating the actions of many individual actors. However, it should also be noted that, in any case, the energy transition and the growth in distributed generation included in the system are increasing the need for more cooperation between distribution system operators, and the rollout of smart meters can fit into a more general framework.

4.3.2.2. Limitations of previous cost-benefit assessments

The Commission benchmarking report estimated average costs per metering point of EUR 202 (weighted average EUR 172) and benefits of EUR 271 (weighted average EUR 253). However, since this study was carried out, the costs of individual smart meters has probably decreased and, more importantly the benefits of smart meters have also increased. The benchmarking report also clarifies that weighted averages are calculated using only positively assessed cases, that is, Member States' rollout scenarios where the cost-benefit analysis was favourable. Within these cases, values are weighted by the number of metering points. As a result, the weighted average reflects cost and benefit levels observed in large-scale, economically justified deployment scenarios, with greater influence from countries with larger rollout volumes. The lower weighted average therefore reflects this stronger influence of large-scale rollout programmes, which tend to be associated with lower unit costs.

Moreover, although these figures provide a useful reference, available evidence suggests that earlier cost-benefit analyses did not fully reflect the range of impacts associated with smart metering deployment. In particular, benefits related to demand-side flexibility, renewable integration, consumer participation and the development of innovative energy services are difficult to quantify and were not systematically included. As the volume of variable renewable production in the energy system expands, these benefits will become increasingly important. More specifically related to this proposal the introduction of network tariffs that reward flexibility and lead to more efficient grid operation and development will not be possible without the rollout of smart meters. This represents a key component necessary to keep network costs, and thereby energy prices, affordable.

At the same time, certain cost components may have been overstated due to technological uncertainty and limited standardisation at the time of the assessments. In addition, the costs associated with replacing conventional meters and maintaining legacy systems over time were not always fully taken into account.

Experience from Member States with advanced deployment indicates that realised benefits can exceed initial projections, particularly where smart metering is combined with enabling market frameworks.

These limitations highlight the need for a policy approach that ensures a minimum level of deployment despite uncertainties in earlier cost-benefit assessments, provides proportionate flexibility for Member States starting from low deployment levels, and takes national circumstances into account beyond that minimum threshold.

4.3.2.3. *Risks and mitigating measures*

Potential risks include: (i) cost pass-through to consumers and SMEs via network tariffs; (ii) cybersecurity and data protection concerns; (iii) interoperability challenges; and (iv) stranded assets where early-generation meters lack required functionalities ([201]). There is also a risk that benefits may not fully materialise without appropriate market developments.

These risks are mitigated by the phased approach, which ensures a minimum level of deployment, includes a limited extension of the deadlines in duly justified cases, and preserves flexibility beyond 75% by allowing Member States to rely on updated cost-benefit assessments where appropriate.

In parallel, existing EU requirements on interoperability, data access, cybersecurity and consumer protection ensure that deployed systems meet the necessary functional standards and safeguard sensitive data.

Public procurement frameworks also contribute to mitigating supply chain and security risks by allowing contracting authorities and utilities to set appropriate requirements, including for non-EU suppliers, in line with Directive 2014/25/EU.

The progressive rollout further reduces the risk of stranded assets by allowing for technological upgrades and alignment with evolving requirements over time.

4.3.2.4. *Role of the broader regulatory framework*

The effectiveness of the proposed measure for smart meter deployment is supported by the broader regulatory framework, including provisions on dynamic pricing, data access ([202]) and consumer empowerment under the Citizens Energy Package ([203]).

These measures enable active consumer participation and the development of flexible retail offers, ensuring that the benefits of smart metering are realised in practice.

4.3.2.5. *Cost-efficiency over time*

As deployment progresses and reaches a sufficient level, it becomes more cost-efficient due to economies of scale and established operational processes, while marginal benefits may decrease.

This supports the choice of 75% as an appropriate balance between ambition, efficiency and proportionality.

([201]) Smart metering systems must comply with Article 20 of the Electricity Directive on functionalities, while the specific provision on validated and near real-time data is crucial for energy services rewarding flexible consumption.

([202]) Including the technical rules set out in Commission Implementing Regulation (EU) 2023/1162 of 6 June 2023 on interoperability requirements and non-discriminatory and transparent procedures for access to metering and consumption data, OJ L 154, 15.6.2023, p. 10, ELI: http://data.europa.eu/eli/reg_impl/2023/1162/oj.

([203]) Communication on the Citizens Energy Package (COM(2026)115 final) and the related web-site: https://energy.ec.europa.eu/topics/markets-and-consumers/energy-consumers-and-prosumers/citizens-energy-package_en.

5. TAXATION

5.1. Policy context

5.1.1. Problem definition

The price of electricity as reflected in consumers' energy bills is determined by a complex interplay of factors, including wholesale commodity costs, network charges, taxes, levies and other charges. These factors are influenced by policies adopted at EU, Member State or, in some cases, sub-national level. For example, excise duties on energy products and electricity must comply with minimum rates established under the Energy Taxation Directive, but may also be subject to additional taxes and levies established at Member State or sub-national level.

Taxation has several distinct objectives. Apart from its revenue raising objective, electricity taxation also adds to the price signal and thereby influences individual and business consumption choices.

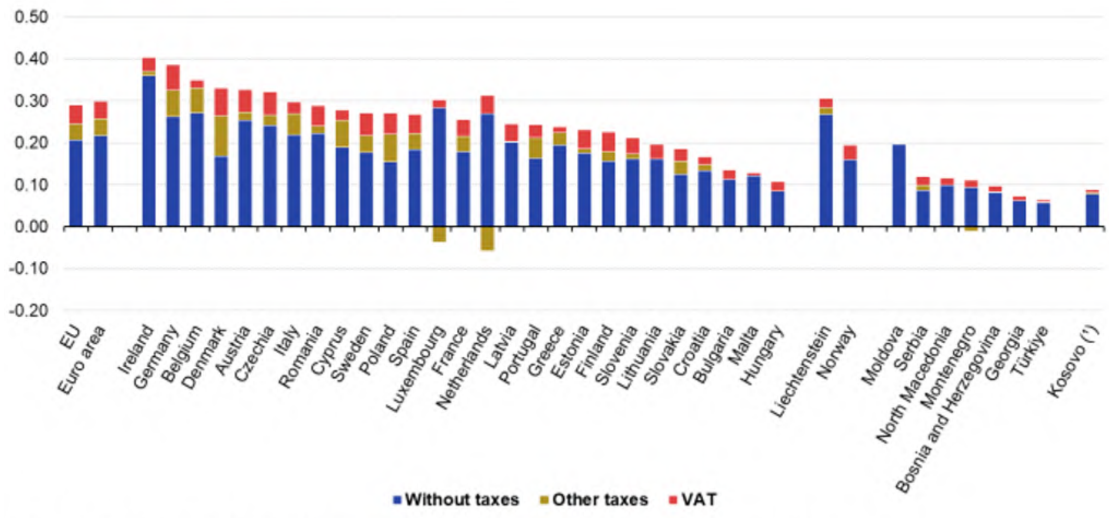
This initiative presents a legislative proposal designed to address price determinants that are most affected by existing EU legislation such as the Energy Taxation Directive in order to incentivise greater electrification of end uses.

5.1.2. Current and proposed fiscal framework for energy

Figures 1 and 2 show the contribution of taxes and levies (including VAT, excise and other national taxes and levies) on the consumer prices of household electricity in the second half of 2025. According to Eurostat, during the second half of 2025, the relative share of taxes (including VAT, excise and national taxes and levies) in household electricity price was highest in Denmark (49.1% of the total price, and lowest in Luxembourg and in the Netherlands, where the net impact was negative (-6.3% and -5.2%, respectively). The latter reflects that the subsidies provided to the consumers where larger than the levied taxes ([204]).

(204) Electricity price statistics - Statistics Explained - Eurostat

Figure 1: Electricity prices for household consumers, second half 2025 (EUR per kWh) consumption from 2 500 kWh to 4 999 kWh – band DC



(¹) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.
Source: Eurostat (online data code: nrg_pc_204)

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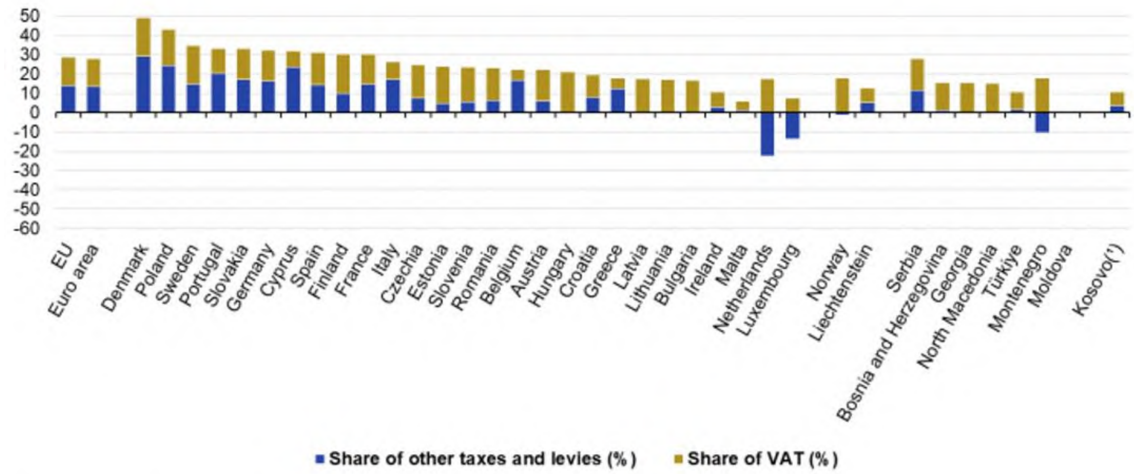
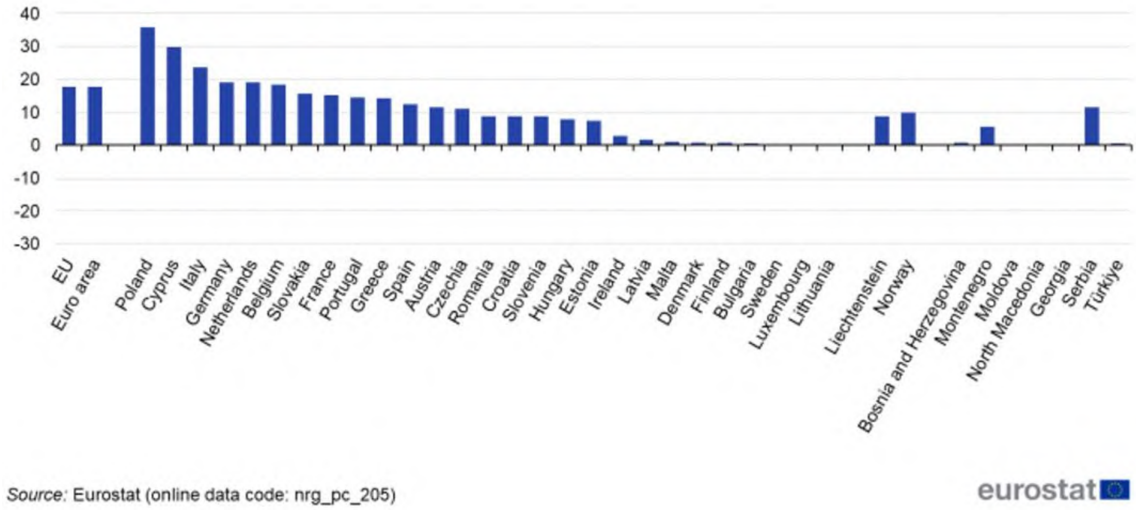
Figure 2: Share of taxes and levies paid by household consumers for electricity, second half 2025 (%) consumption from 2 500 kWh to 4 999 kWh – band DC



(¹) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.
Source: Eurostat (online data code: nrg_pc_204)

For non-household electricity prices, the share of taxes also varies significantly across the EU. In the second half of 2025, the share of non-recoverable taxes and levies was highest in Poland and Cyprus, where taxes made up 36% and 29.9%, respectively, of the total price of electricity. At the other end of the spectrum, Lithuania and Luxembourg applied the lowest tax, with 0.2% and 0.5%, of final electricity price, respectively.

Figure 3: Share of taxes and levies paid by non-household consumers for electricity, second half 2025 (%) consumption from 500 MWh to 1 999 MWh – band IC.



The Energy Taxation Directive sets out minimum tax rates for electricity and energy products (in Article 10 and Annex 1, Table C) for users within the scope of the Directive. Article 2 of the Directive excludes from the scope of the Directive electricity and energy products used principally for chemical reduction and in electrolytic and metallurgical processes, and energy products and electricity used for mineralogical processes.

The Directive sets minimum rates for electricity at 0.5 EUR/MWh for business use within the scope of the Directive and 1 EUR/MWh for non-business use. Similarly, the Directive sets out minimum rates for natural gas for heating purposes (in Article 9 and Annex 1, Table C). These minimum rates are 0.15 EUR/GJ for business use and 0.3 EUR/GJ for non-business use. Article 15(1)(h) of the Directive provides for optional total or partial exemptions from or reductions in taxation for electricity and natural gas used by households. For business use, Member States have multiple options for sectoral or use exemptions or reductions for electricity and natural gas.

The Directive allows tax reductions to be applied on electricity for energy-intensive businesses, provided the minimum levels of taxation prescribed in the Directive are respected on average for each business. An 'energy-intensive business', as defined in Article 17 of the Directive, means a business entity where either the purchases of energy products and electricity amount to at least 3.0 % of the production value or the national energy tax payable amounts to at least 0.5 % of the added value. Within this definition, Member States may apply more restrictive concepts, including sales value, process and sectoral definitions.

Additionally, Article 17 of the Directive permits excise rates below the minimum including a zero rate for both electricity and natural gas used by energy-intensive businesses. However, these rates are subject to the conditions detailed in Article 17(4). This condition consists of the requirement for businesses that benefit from the possibility of a reduced level of taxation down to zero to enter into agreements, tradable permit schemes or equivalent arrangements. These agreements, schemes or arrangements must then lead to the achievement of environmental objectives or increased energy efficiency broadly equivalent to what would have been achieved if the standard minimum rates had been observed.

In 2021 the Commission proposed a recast of the Directive. ([205]) It remains under discussion in the Council. In its Clean Industrial Deal and Action Plan for Affordable Energy (APAE), the Commission called upon the Council to urgently conclude its negotiations on this critical piece of legislation. ([206])

A crucial part of the proposal for a recast of the Directive concerned switching from volume to energy content-based taxation, eliminating relative incentives for fossil fuel use and introducing a ranking of rates according to their environmental performance. Moreover, the current tax structure would be simplified by categorising energy products (used as motor or heating fuels) and electricity and ranking them according to their environmental performance. The 'Environmental performance' was defined in relation to other EU policies under the European Green Deal and in particular to the other proposals in the 'Fit for 55' package. According to this ranking, conventional fossil fuels, such as gas oil and petrol would be taxed at the highest rate. This would constitute the 'reference rate'. The next category of rates would apply to fuels that are fossil-based but less harmful and still have some potential to contribute to decarbonisation in the short and medium term. Two-thirds of the reference rate would apply, for example, to natural gas, LPG and hydrogen of fossil origin for a transitional period of 10 years. Thereafter, this rate would increase to the full reference rate. The next category consisted of sustainable but not advanced biofuels. To reflect their contribution to decarbonisation, half of the reference rate would apply. The lowest rate would apply to electricity, regardless of its use, advanced biofuels, bioliquids, biogases and hydrogen of renewable origin. The rate applicable to this group is set significantly below the reference rate for fossil fuels as electricity and these fuels can drive the EU's clean energy transition towards achieving the objectives of the European Green Deal and ultimately climate neutrality by 2050.

The taxation principles in this Regulation align both with the current framework established by the Directive and with the principle described in the previous paragraph as set out in the Commission proposal to amend the Directive.

This proposal builds on policies announced in the Commission Communication on the Citizens Energy Package. ([207]) The Package pursues electrification which will over time bring lower and more stable prices decreasing European dependence, while improving sustainability and competitiveness. Member States have a role to play by setting the right incentives – for instance, making the use of electricity relatively more attractive through tax incentives. The energy bills households and businesses pay are influenced by network charges, national taxes and levies, the wholesale energy price and the level of individual consumption. On average, electricity taxes and levies account, on average, for 25% of the price for households and 15% of the price for businesses.

This proposal is consistent with and complements the proposal for the Industrial Accelerator Act (IAA[208]). The IAA proposal aims to strengthen the EU's long-term economic resilience, prosperity and strategic autonomy by supporting industrial production and accelerating decarbonisation. It has the following objectives: first, it seeks to leverage access to the single market and exploit its scale of the Single Market to boost

([205]) COM(2021) 563 final.

([206]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Action Plan for affordable energy, Brussels 26 February 2025, COM(2025) 79 final.

([207]) Communication from the Commission to the European Parliament and the Council on the Citizens Energy Package, Strasbourg 10 March 2026, COM(2026) 115 final.

([208]) COM(2026) 100 final, Proposal for a Regulation of the European Parliament and of the Council establishing a framework of measures for the acceleration of industrial capacity and decarbonisation in strategic sectors and amending Regulations (EU) 2018/1724, (EU) 2024/1735 and (EU) 2024/3110.

demand for European low-carbon industrial products and net-zero technologies. Second, it aims to maximise the quality of foreign investment in the EU and its benefits for the Single Market in the most strategic sectors. Third and finally, it will deploy manufacturing projects at scale by speeding up and simplifying permitting and by helping create industrial clusters in industrial manufacturing acceleration areas ('acceleration areas').

Some Member States are already putting in place measures in line with the principles set out in the proposal. Germany and France have lowered, or are in the process of lowering, the electricity tax rate for energy- intensive industries, while Belgium is reducing excise on electricity while progressively increasing excise on gas, among other fossil fuels ([209]).

5.2. Objectives of the proposal

The provisions on taxation are ancillary to the measures on network charges, supporting the primary objective of the amendment to the Electricity Regulation, as explained in Section 2.

In practice, the proposal can be summarised as follows:

- Measure 1: a general principle to be followed by Member States when setting the excise rates for electricity and gas, where the rate should not be higher than the rate for gas:
- Measure 2: a clarification that the conditions on meeting environmental requirements will be deemed to have been met in all cases where reduction in or exemption from excise duties is applied to electricity supplied to energy-intensive businesses s, given the positive impact of the expansion of electrification on decarbonisation and on achieving the EU climate targets.

As such, the measures aim to reduce the price disparity between electricity and gas by introducing a more favourable tax framework for electricity relative to gas, as the framework currently favours gas in several Member States (detailed in section 2.3). This adjustment seeks to mitigate that price advantage of gas by promoting a relatively lower rate on electricity. The proposal thereby incentivises electrification in line with it being a cleaner and more efficient energy source. By enhancing the cost-competitiveness of electricity, the initiative supports the transition towards a more electrified and energy independent EU.

Measure 1 requires Member States to set national excise duty rates under Council Directive 2003/96/EC in such a way that electricity is not taxed more heavily than gas. This measure aims to contribute to aligning taxation structures to support the use of electricity over gas by households and businesses.

For measure 2, it requires Member States to consider the condition contained in Article 17(4) of Council Directive 2003/96/EC, i.e. the achievement of environmental objectives or increased energy efficiency broadly equivalent to what would have been achieved if the standard Community minimum rates had been observed, to have been met in all circumstances where reduced or zero rates of taxation are set for supplying electricity to energy-intensive businesses. Such conditionality is deemed to be fulfilled owing to the

([209]) https://www.bundesregierung.de/breg-en/federal-government/reduction-in-energy-prices-2358994; https://www.dekamer.be/FLWB/PDF/56/1378/56K1378001.pdf.

intrinsically positive environmental and climate impact of the uptake of electricity and its role in achieving the EU's net-zero targets.

This proposed measure to facilitate reduced electricity taxation offers distinct advantages for energy-intensive industries with high electricity consumption that fall within the scope of the Directive, such as certain manufacturing and heavy industries. The measure could help mitigate energy cost pressures, particularly in sectors facing intense global competition and high exposure to volatile energy markets.

Key benefits include:

- Lower energy costs and enhanced competitiveness: by reducing the tax burden on electricity, energy-intensive business would face lower operational costs, improving their competitiveness .
- Accelerated electrification and decarbonisation: A more favourable tax regime for electricity would incentivise industries to transition from fossil fuels (mainly gas) to cleaner electric alternatives. This supports the EU's climate objectives, helping industries meet decarbonisation targets and comply with regulatory requirements.
- Stimulating investment in clean technologies: reduced electricity costs would make electrification more economically viable, encouraging industries to adopt electric machinery, heat pumps, and other low-carbon technologies. This aligns with the EU's industrial strategy and promotes a circular economy by fostering sustainable production methods.
- Enhanced energy security and resilience: by reducing reliance on gas imports, industries would contribute to greater energy security and resilience. A more stable and predictable energy cost structure would improve long-term planning for industrial investments, reducing exposure to geopolitical risks and price fluctuations, and minimising exposure to external supply shocks, such as the 2022 energy crisis and the current Middle East crisis ([210]).

Together, these provisions will result in a more favourable taxation landscape for electricity relative to gas.

5.3. Expected benefits and impacts

Taxation of electricity and gas at Member State level includes not only excise rates under Directive 2003/96/EC but also other national taxes and VAT. However, the proposal relates exclusively to excise duties under Directive 2003/96/EC, and not to other taxes or levies imposed at Member State level or VAT. As such, the analysis of the impacts of the proposal will focus on that Directive.

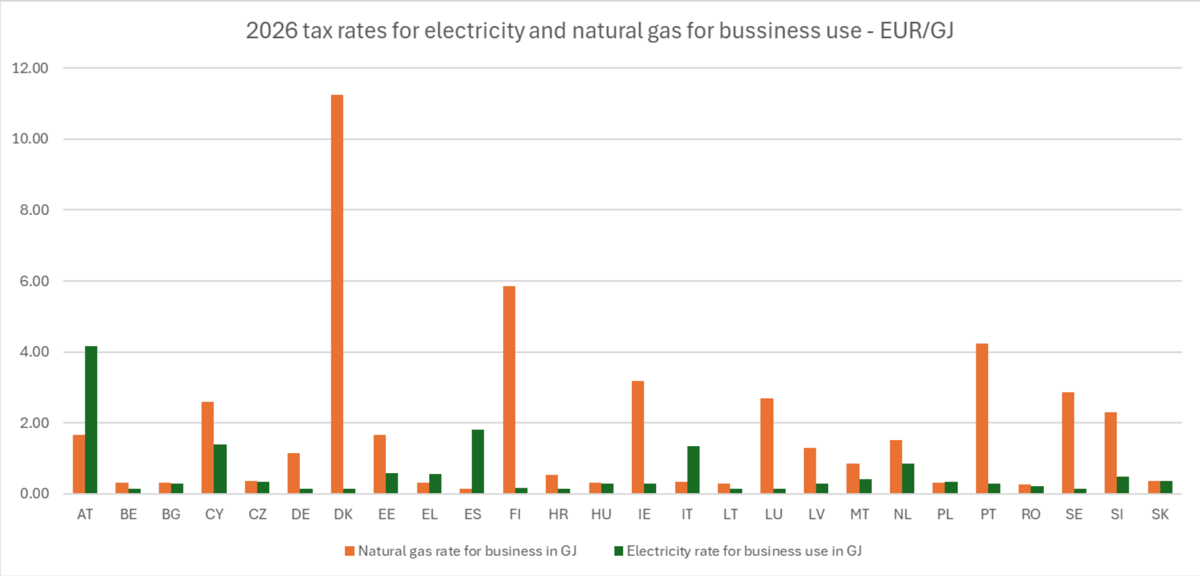
Under the current framework, most Member States tax systems already set electricity excise rates at a lower rate than natural gas or at least an equal rate than natural gas. The analysis as shown below indicates that eight Member States will be impacted and will need to adjust the national excise rates applicable to electricity and/or national gas ([211]).

([210]) A tale of two energy crises – initial conditions matter.

([211]) Assessment based on the Taxes in Europe Database, which relies on input provided by Member States.

Figures 4 and 5 show the different statutory or nominal rates for taxation of electricity and natural gas for both business and non-business use.

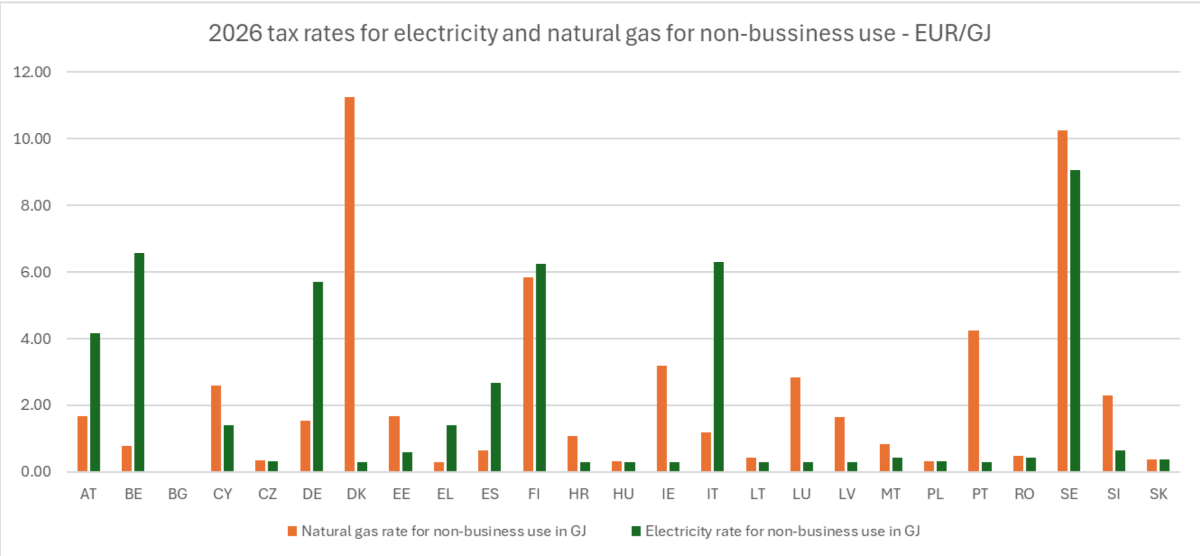
Figure 4: 2026 tax rates for electricity and natural gas for business use



Source: Taxes in Europe database (2026)

Figure 4 shows nominal tax rates for natural gas and electricity for business use as as per 1 January 2026. Where Member States have different rates based on consumption, the highest consumption band has been selected to better reflect energy-intensive users. FR (55 and 7 EUR/GJ for natural gas and electricity respectively) does not fit on the chart due to its high nominal taxation levels.

Figure 5: 2026 tax rates for electricity and natural gas for non-business use



Source: Taxes in Europe database (2026)

Figure 5 shows nominal tax rates for natural gas and electricity for non-business use at 1 January 2026. FR (55 and 8 EUR/GJ) and NL (17 and 25 EUR/GJ) do not fit on the chart due to their high nominal taxation levels.

For BE, IT, EL, ES, DE, AT, NL, FI and PL, differentials were found in nominal tax rates on electricity compared to the same rates for gas for non-businesses use (Figure 5). For IT, EL, ES, AT and PL, negative differentials were found in nominal tax rates on electricity compared to those for gas for businesses (Figure 4). These Member States potentially would have to reduce their electricity taxation to comply with the new Regulation. BE and NL are currently already in a tax shift from taxing electricity to taxing gas. ([212])

For these Member States**, compliance with measure 1 can be achieved by lowering the rate for electricity, raising the rate for gas, or a combination of both.** For instance, Belgium plans to support electrification by lowering excise tax on electricity and increasing tax on gas, resulting in an estimated net revenue increase of EUR 95 million EUR by 2029 ([213]).

Given the current market conditions resulting from geopolitical events, we expect the Member States concerned to prioritise reductions in electricity excise over increases in gas excise. However, the decisions they take will be influenced by prevailing conditions at the time the legislation enters into force ([214]) as well as ensuring compliance with EU fiscal rules ([215]).

Impact on energy bills

There is a significant variation in the potential effect of the measure requiring Member States not to tax electricity higher than gas in the energy bills of households and businesses (measure 1) in the Member States concerned. When looking at the effect on each consumer, a representative consumption band is considered.

The following analysis considers business consumers those whose annual consumption falls in the range 2.000-20.000 MWh. This consumption band is identified by Eurostat as the most representative consumption band for business use in most Member States. In relation to non-business consumers, annual consumption is considered to falls in the range 2 500 - 5 000 kWh. This consumption band is defined identified by Eurostat as the most representative consumption band in 23 out of 28 Member States. Itis also used by Eurostat as the reference in its analysis. ([216])

Assuming none of their consumption is currently exempted from taxation or subject to reduced rates and full cost pass-through applies for the reduction in electricity taxation resulting from this proposal, Table 2 shows the potential impact on energy bills in a scenario where compliance with this principle is achieved exclusively through reduction in electricity taxation

([212]) Link to Belgian and Netherlands' legislation or governemnt websites:
https://www.dekamer.be/FLWB/PDF/56/1378/56K1378001.pdf and
https://www.rijksfinancien.nl/sites/default/files/bestanden/belastingplan-2023/02-Wetsvoorstel-Belastingplan-2023-MvT.pdf.

([213]) Stroomfactuur daalt gemiddeld met 34 euro, aardgasfactuur stijgt met 75 euro | De Standaard.

([214]) According to the "One Europe, One Market Roadmap", the objective is to reach an agreement by Q2/2027.

([215]) Regulation (EU) 2024/1263 of the European Parliament and of the Council of 29 April 2024 on the effective coordination of economic policies and on multilateral budgetary surveillance and repealing Council Regulation (EC) No 1466/97.

([216]) Energy prices and costs in Europe 30/11/2016, COM(2016) 769, https://eur-lex.europa.eu/resource.html?uri=cellar:69cbbdb1-b708-11e6-9e3c-01aa75ed71a1.0001.02/DOC_8&format=PDF.

Table 2: Potential annual impact on electricity bills of different consumer profiles in affected Member States (in EUR)

	Non-business use annual savings		***Business use annual savings***	
	consumption of 2 500 kWh	**consumption of 5 000 kWh**	**consumption of 2 000 MWh**	**consumption of 20 000 MWh**
	EUR	EUR	EUR	EUR
BE	52	104		
IT	46	92	7 192	71 920
EL	10	20	1 840	18 400
ES	18	36	12 000	120 000
DE	37	75		
AT	22	45	18 048	180 480
NL	75	151		
FI	4	7		
PL	0.05	0.09	36	360

Source: Taxes in Europe database (2026)

For energy-intensive businesses, the impact of the measure allowing Member States to apply a reduction or a zero rate for electricity taxation follows the same analytical framework. This assessment considers the potential energy cost savings for the highest tiers of electricity consumption in Member States. Table 3 gives the potential savings in EUR per MWh by taking the weighted price information from Eurostat by Member State, capturing businesses with electricity consumption of over 20 GWh, as a proxy for an energy-intensive business.

In practice, all Member States can already implement targeted reductions or exemptions for this group of consumers, with some already having in place legal frameworks allowing for such reductions or exemptions. The proposal simply makes it easier to fulfil the condition allowing Member States to permit such reductions or exemptions.

Given the many different reductions that can be applied by Member States, the impact of the measure will be estimated by assuming that: (i) no Member State has such reductions or exemptions for energy-intensive businesses in place; (ii) all Member States will decide to apply this option; (iii) all businesses in those consumption brackets would meet the definition of energy-intensive businesses set out in the Directive; and (iv) all Member States would fully exempt the electricity supplied to those businesses from excise taxation.

Given these assumptions, **the estimated impact in this analysis will be considerably higher than the measure's anticipated real-world effects.** Additionally, there is no available data isolating the excise duties on electricity supplied to energy intensive businesses. Eurostat data, comprising all environmental taxes, fees, levies or charges imposed at national level, is therefore used to quantify the potential effects.

Table 3: Weighted average of environmental taxes, fees, levies or charges relating to air quality and other environmental purposes, and taxes on emissions of CO2 or other greenhouse gases and weighted average total electricity price of businesses with a consumption of over 20 GWh per Member State

Member State	***Environmental tax component of the electricity price (EUR/MWh)***	***Total electricity price (EUR/MWh)***
AT	13.8	148.4
BE	3.4	108.7
BG	1.0	114.4
CY	57.9	223.6
CZ	12.9	202.1
DE	20.5	155.5
DK	1.1	115.4
EE	1.6	97.9
EL	0.8	126.4
ES	2.2	99.7
FI	0.5	47.5
FR	2.5	75.1
HR	0.5	132.1
HU	1.0	165.2
IE	0.3	184.6
IT	0.7	140.9
LT	0.0	114.7
LU	0.0	115.1
LV	0.0	102.9
MT	1.5	101.2

Member State	*Environmental tax component of the electricity price (EUR/MWh)*	*Total electricity price (EUR/MWh)*
NL	7.0	112.0
PL	45.1	162.4
PT	0.5	99.2
RO	0.4	140.4
SE	0.5	64.4
SI	0.9	128.4
SK	1.3	157.3

*Source: Eurostat Electricity prices components for non-household consumers - annual data (*2025 data (Eurostat nrg_pc_205_c)*).*

Impact on Member State budgets

As the Member States concerned have different options to comply with measure 1, different revenue scenarios are possible. This document therefore presents a forecasted range, from compliance exclusively through reductions in electricity excise (scenario 1) to compliance exclusively through increases in gas excise (scenario 2). In reality, **the expected revenue impact lies somewhere between these two scenarios**.

In addition, the forecasted revenue impacts are based on total electricity excise revenue and nominal rates in each Member State, and do not reflect the fact that some of the consumption already benefits from reduced rates or exemptions. For example, in at least one Member State affected by the proposal (Belgium), the rail sector is exempt from electricity excise duties ([217]) while energy-intensive industries benefit from exemptions or reductions detailed in the above sections ([218]). As a result, the revenue implications detailed in Table 4 are unlikely to be realised because much of the electricity consumption in question either falls outside the scope of the Directive or already complies with this proposal through exemptions or reduced rates.

The estimated forecast ranges between a revenue loss of EUR 5 199 million to a revenue increase of EUR 16 599 million (-0.03% - 0.11% of EU GDP in 2024).

Total revenue reported by all Member States for 2024 from Energy Taxation Directive electricity taxation was EUR 18.023 million EUR (0.1% of EU GDP) ([219]).

([217]) The landscape of carbon and energy pricing and taxation in Belgium (2024).
([218]) The competitiveness and decarbonisation challenges facing energy-intensive industries.
([219]) Measured against 2024 EU GDP of 1.7 trillion EUR National accounts and GDP - Statistics Explained - Eurostat.

Table 4: Potential electricity tax revenue loss due to reducing electricity tax rates to the level of natural gas tax rates (scenario 1) and the potential natural gas tax revenue gain due to raising natural gas tax rates to the level of electricity taxation (scenario 2) (in EUR million) (220)

	Scenario 1: potential loss due to electricity tax reduction		***Scenario 2: potential gain due to natural gas tax increase***	
MS	**EUR (Mil)**	**% of Member State GDP**	**EUR (Mil)**	**% of Member State GDP**
AT	-557	-0.12	1397	0.31
BE	-445	-0.8	1340	0.24
DE	-1884	-0.05	2804	0.07
EL	-102	-0.03	79	0.02
ES	-155	-0.01	1214	0.06
FI	-30	-0.01	4	>0.01
IT	-2.024	-0.09	9761	0.4
PL	-2	->0.01	1	->0.01
EU	**-5.199**	**-0.03%**	**16.599315**	**0.11%**

Source: in-house estimates based on TEDB and Eurostat data.

Estimating the fiscal impact of measure 2 is more challenging for a number of reasons. Firstly, the proposal is limited to taxes within the scope of the Directive, whereas data on the taxation of energy-intensive businesses covers a much wider range of taxes and levies (Table 3). Secondly, the measure facilitates a reduction in these taxes through automatic recognition of the condition but does not require Member States to reduce such taxes.

Table 3 provides a useful assessment of the overall level of environmental taxation (including energy taxation) which energy-intensive businesses are subject to. The exact fiscal impact on Member States is difficult to determine but, owing to the measure facilitating rather than requiring changes to national taxation regimes, scope exists for Member States to carry out such fiscal assessments as they deem appropriate before deciding whether to use the flexibility available under this measure.

(220) Even though the Netherlands, report a difference in nominal tax rates on electricity compared to the same rates for gas for non-business use, could not be included in this analysis, due to a reported negative electricity revenue. This is due to its application of a lump-sum tax credit for each connection to the grid.

6. GRID CONNECTION MEASURES

6.1. Policy context

6.1.1. Problem definition

Timely electricity network access is crucial for the competitiveness and decarbonisation of the European industry, including automotive and transport sectors, energy intensive industry, digitalisation of economy related to establishment of data centres. It is also essential for fulfilling the goals of the Clean Industrial Deal, Accelerate EU and achieving climate neutrality by 2050, as well as for addressing housing needs and related basic societal needs. Delays in grid connections slow down the clean transition and European economic growth.

There are multiple root causes leading to situations in which grid users must wait several months or even years to get a grid connection, ranging from process-related and organisational constraints, to regulatory, supply chains and technical difficulties. They can be summarised as follows:

a) Grid connection queues due to inadequate grid planning and delayed grid development, not accounting for different lead times in development of network infrastructure (8-10 years on higher-voltage levels) and project development (3-5 years on average),

b) Grid connection queues due to incorrect placement of the request, due to lack of locational signals and lack of transparency on available and planned network capacity,

c) Grid connection queues due to inefficient grid connection procedures.

Given that letter a) has been addressed by the European Grids Package ([221]), and letter b) is being addressed by the Article 18 and Article 18a of this legal proposal, the following assessment only focuses on letter c), on inefficiencies related to grid connection procedures.

Grid connection queues are present in at least 16 Member States based on the evidence collected in 2025. ([222]) Some countries are rarely affected due to slower electrification or uptake of renewable energy sources, while others are experiencing severe grid congestion. Analysis done on 2024 data ([223]) noted some queues were 30 times the amount of the peak load, pointing to high presence of speculative and immature requests in the queue. For instance, in Slovakia, estimates show some 50% of the reserved capacity in the grid connection queue remains unused([224]).

The existence of speculative and immature requests hindering timely grid access as one of the major hurdles to electrification and decarbonisation was also confirmed by a targeted

([221]) https://ec.europa.eu/commission/presscorner/detail/en/ip_25_2945.

([222]) Fraunhofer ISI, Fraunhofer IEG, Guidehouse, REKK, Study on network development planning, tariff structures and connection requests for electricity distribution grids, September 2025, https://op.europa.eu/en/publication-detail/-/publication/08843617-9cf8-11f0-97c8-01aa75ed71a1.

([223]) Boston Consulting Group centre for energy impact: Mind the queue, Connection reform for the electricity grid, 2025. https://web-assets.bcg.com/f5/79/77645d12463793d174af9ae00d4a/mind-the-queue-connection-reform-for-the-electricity-grid-r2.pdf.

([224]) Gridlock to grid growth: tackling connection queues for a smoother energy transition – Eurelectric, 2025.

stakeholder consultation under the European Grids package, running between 25 June and 25 July 2025. Among the respondents which represented system operators, regulatory authorities, Member States, energy market stakeholders as well as representatives of civil society, 66 % agreed that there is a problem with speculative and immature requests in their geography and in the EU, and 56 % agreed that grid capacity is locked due to non-maturing requests. Moreover, 82 % of respondents agreed or partly agreed that measures contributing to relieving congestion in the grid as part of the grid connection procedures could be helpful. Slightly lower number of respondents (71 %) agreed or partly agreed with added value of measures considering contribution of connection requests to clean transition, services of general interest or based on other criteria.

6.1.2. Existing EU legislative framework

Requirements on network access and grid connections are specified in the Electricity Directive and the Electricity Regulation. The Electricity Directive requires that regulatory authorities ensure that access to grids is applied objectively and without discrimination between system users (Article 6). Importantly, the option of refusing access to the network is only possible under clearly defined conditions, namely if the grid lacks the necessary capacity, or, as specified by the Renewable Energy Directive ([225]), on justified grounds of safety concerns or technical incompatibility of the system components. Such a refusal must be based on objective and technically and economically justified criteria. In this case, information on the measures necessary to reinforce the network need to be provided by system operators.

The Electricity Directive hence provides a general obligation on DSOs and TSOs to ensure non-discriminatory third-party access to their networks while leaving flexibility to regulatory authorities to design details of their connection procedure to reflect specificities of their respective systems.

Building on existing legal framework, the Commission put forward a Guidance on efficient and timely grid connections ([226]) ("Guidance") as part of the European Grids package. The Guidance provided concrete recommendations for coordinated network planning involving society and industry, more efficient utilisation of existing grids, including through design of network tariffs, connection charges or flexibility, and finally, transparency of grid hosting capacity and connection procedures. Concerning the grid connection procedures, the Guidance stresses the need to move away from first-come first-served allocation of network capacity towards a system considering maturity and progress of grid connection requests, as well as their impacts on congestion, or environmental, social or economic benefits.

6.2. Objectives of the proposal

While the long-term solution to the challenge of insufficient network capacity is the accelerated build out of grids in a forward-looking manner, more short-term solutions can be advanced in parallel to ensure timely grid connection of clean energy generation and electrified loads. As explained in section 6.1.1, grid connection measures adopted in situation of grid congestion, based on a specific situation in respective Member States, are part of the solution to more efficient and timely network access.

([225]) Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources.

([226]) Commission Notice, 'Guidance on efficient and timely grid connections' (C/2025/6703).

In this relation, objective of the proposal is to complement the provisions of the Guidance related to efficient and non-discriminatory grid connection procedures in case of congestion in the EU legal framework and further specify the existing rules under the Article 6 of the Directive (EU) 2019/944 by making explicit mention of the option to prioritise sectors, network users within a sector, or impacts on network congestion, economic, social or environmental considerations, as long as these are based on transparent and non-discriminatory criteria. At the same time, proposal leaves space to consider national conditions by leaving full discretion over selection of respective measures to the national regulatory authority. They must however ensure that other measures addressing grid congestion, implementing the existing EU legal framework, like cross-sectorial network planning involving stakeholders, flexible connection agreement or use of non-wire and digital solutions to ensure network efficiency, are in place. By this requirement, the proposal reinforces the existing EU legal framework.

6.3. Expected benefits and impacts

6.3.1. *Benefits to network users and economic impacts*

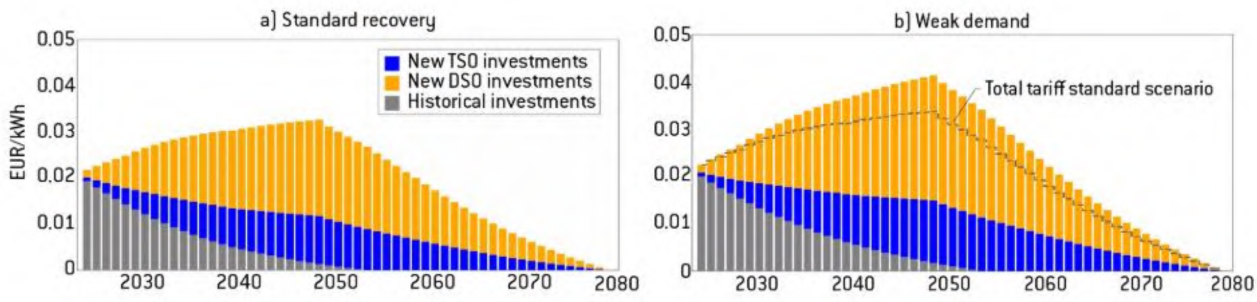
Setting clear entry criteria for grid connection requests to ensure projects that are ready-to-build are not disadvantaged (first-ready first-served principle) has a positive impact on network users in terms of more efficient and timely processing of applicants that are ready to be connected in near future and deterring speculative and immature applicants from submitting a connection request.

Establishing clear milestones allowing for filtering the queue in case of future need (milestone-based approach), also has positive impact on overall length of the connection procedure by regular cleaning of the grid connection queue and hence enabling reallocation of available grid capacity.

Regular cleaning of the connection queue and measures targeting speculative applications would also have positive impacts on more accurate network planning and development, enabling system operators to focus on most needed projects based on more mature and stable grid connection requests. This would also have positive impact on overall cost of system operation, as part of the administrative work related to prolonged administration of connection requests staying in the queue for longer time periods would not be necessary anymore, and the related human resources could be reallocated to other tasks of the system operators, increasing the overall efficiency.

There is also an indirect positive impact on network tariffs as criteria deterring speculative or immature connection requests could in turn lead to potential decrease in network development needs. Impacts of new grid costs on individual customers depend on projections for the future energy demand since redistribution of total costs over a larger customer base will reduce network tariffs per unit, as illustrated in the figure 1. On the left-hand side, standard recovery is linked to the situation where assumptions on future grid usage (i.e. volume of loads connected) materialise, this would reflect the situation in which there are concrete measures deterring speculative or immature requests adopted. On the right-hand side, weak demand means the expected demand (as assumed in the incoming grid connection requests) does not materialise, offtake from electricity grid is lower, and hence fixed CAPEX cost must be spread across a smaller consumer base.

Figure 1: Average grid tariffs for different consumer base ([227]*)*



Provisions enabling prioritisation of sectors based on economic, environmental and social criteria in accordance with specific national situations and preferences in case grid hosting capacity is insufficient, allow for earlier connection of most critical uses as deemed necessary by the Member State, hence bringing positive effects in terms of social, climate or economic impacts. Likewise, prioritisation of individual users based on their contribution to reducing congestion can contribute to overall efficiency.

6.3.2. Administrative costs

Proposed provisions on grid connection measures in case of congestion fully builds on the existing legal framework, notably on the Article 6 the Electricity Directive. Hence, these provisions do not bring any additional administrative costs to Union or national authorities, as the Article provides a clarification on the existing responsibility of regulatory authorities to set conditions for non-discriminatory and transparent third-party grid access while further enhancing legal clarity how these principles can be reconciled with prioritisation. Related provisions on other measures ensuring efficient use and planning of grids are fully based on existing legal provisions.

If provisions on consideration of maturity and progress in grid connection queues are implemented on national level, they can lead to some administrative impacts for applicants for the grid connection, as they would need to prove their projects are sufficiently mature and would need to report on achieving the milestones as set in the grid connection process. However, if compared with total benefits in terms of earlier grid access and taking into consideration that related documentation like zonal permits, installation-specific permit, land rights or financial feasibility would need to be submitted at later stage of the grid connection process in any case to prove the project exists and is ready to be connected, these impacts are considered negligible.

6.3.3. Environmental impact

Provisions on consideration of maturity and progress of grid connection requests, as well as considering environmental criteria or project's impact on grid congestion may lead to earlier connection of clean energy sources to the grid and to more efficient use of existing grid capacities, hence reducing need for production of electricity from fossil sources. Analysis points to the fact that enabling timelier grid access could unlock as much as 120 GW of mature renewable projects waiting in the connection queue (as of February 2026). ([228]) Better planning and faster permitting of electricity grids may help avoid

([227]) Bruegel Heussaff, C., Zachmann, G. (2025): Upgrading Europe's electricity grid is about more than just money.

([228]) https://ember-energy.org/latest-insights/crossed-wires-grid-capacity-could-block-eu-energy-security/.

approximately EUR 37 billion in annual redispatching costs in 2040, and efficient grid connection procedures are supposed to contribute to these avoided system costs. ([229]) Likewise, faster connection of new electrified loads will help the related consumer groups to switch faster from the use of fossil fuels and hence reduce their carbon and environmental footprint.

7. SUMMARY OF THE COSTS AND BENEFITS

This proposal combines targeted measures on network charges, smart grids and innovation, smart metering and taxation and grid connections with the common objective of reducing overall electricity system costs, improving the efficient use of existing infrastructure and supporting a more affordable, secure and decarbonised electricity system. As reflected in the preceding sections, the expected impacts differ across the individual measures in terms of timing, affected actors and degree of quantifiability. Some measures are expected to generate direct economic benefits, while others primarily create enabling conditions for more efficient system operation, stronger flexibility, better market functioning and lower long-term investment needs. The proposal also entails certain administrative, compliance and implementation costs, in particular for NRAs, system operators and, where relevant, Member States. However, these costs are generally expected to remain proportionate to the objectives pursued and, in most cases, to be outweighed over time by broader system benefits and avoided costs.

With regard to **network charges**, the proposal is expected to generate significant benefits to the network and system users. More specifically, designing network charges to **reduce peak load** through **capacity charges** can play a crucial role in reducing the overall need for grid reinforcements. In the Netherlands alone, this could lead to reductions of **EUR 22.5 billion**. Adding a **dynamic time-of-use element** to the charges for system users is a significant tool to drive more grid-friendly behaviour and ultimately result in cost savings. A study carried out by Agora Energiewende in 2023 focusing on the potential for flexibility at household level in Germany found that **households with dynamic tariffs** could save **EUR 600 per year** in the long term. These significant financial savings also imply lower electricity costs for all consumers if dynamic time-of-use tariffs are widely used. In relation to **locational charges**, increased decentralised generation from renewable and other sources has implications for overall system costs especially at distribution level. Over time, this helps to reduce costly network congestion, **reduce overall investment needs and minimise network costs for all system users**. This is particularly relevant for Member States which suffer from significant internal network congestion. The flexibility solutions which the proposed measures are expected to incentivise should also bring significant savings for the power system in general. The French NRA estimated savings of nearly **EUR 7 billion** over 15 years for the TSO alone. The proposed measures on network charges are unlikely to generate significant administrative costs to NRAs and system operators.

With regard to **smart grids and innovation**, smarter and more digitalised grids can generate significant system benefits by improving grid observability, flexibility and operational efficiency.

([229]) European Commission, Joint Research Centre, Thomassen, G., Fuhrmanek, A., Cadenovic, R., Pozo Camara, D. and Vitiello, Redispatch and Congestion Management (2024).

Based on a study from the Commission in 2022, digital and data-driven flexibility solutions could unlock around **230 GW by 2030** and an additional **600 GW by 2050 ([230])**; by 2030, up to **60 GW** of peak supply needs could be met by flexible demand instead of new generation, with estimated savings of around **EUR 2.7 billion per year** in generation capacity investments and **EUR 11.1–29.1 billion per year** in reduced grid investment needs ([231]); full demand-flexibility deployment could also avoid about **37.5 Mt of CO_2** in 2030. In addition, AI-based grid operation can improve forecasting, congestion management and maintenance, with indicative evidence pointing to **25–30% lower maintenance costs**, around **70% fewer breakdowns**, roughly **40% less downtime**, and faster network analysis and optimisation. **Increased efficiency in network operation due to the use of digital technologies, including AI-based solutions, can limit the increase in costs for system operators and thus the increase in network tariffs paid by consumers.** The main costs are more limited but real: the measures entail **low to moderate administrative and implementation costs** for regulators, TSOs, DSOs, ENTSO-E and the EU DSO Entity, including reporting, governance, testing and data-sharing arrangements; some smaller DSOs may be disproportionately affected; participation in the voluntary secondary-use framework would also create compliance costs for participating actors, and where AI-based tools qualify as high-risk, compliance costs can be significant, but only if put on the market. There are also cybersecurity and digital-infrastructure costs and risks, which the proposal seeks to mitigate through governance, safety and security requirements.

With regard to **smart meters**, the proposal is expected to generate significant **system, market and consumer benefits** by enabling demand-side flexibility, improving system efficiency and supporting renewable integration. More specifically, by providing accurate and granular consumption data and enabling dynamic pricing, smart meters allow **consumers and SMEs** to adjust their consumption in response to price signals, leading to electricity **savings** of around **5–8%** and **more predictable energy bills**. At **system level**, smart meters enable **demand response**, more efficient network planning and **peak demand reduction**, thereby improving the use of existing infrastructure and contributing to lower balancing and redispatch costs. In this context, the Commission's Affordable Energy Action Plan indicates that **improved system operation and flexibility** could avoid grid management costs of up to EUR 26 billion per year by 2030 and reduce grid investment needs by up to 35%, to which smart metering contributes as a key enabling component. These effects also support **renewable integration** by reducing curtailment and improving the alignment of consumption with generation, while enabling **dynamic retail offers, aggregation and data-driven energy services**. The main **costs** relate to the **deployment of metering systems and supporting ICT infrastructure**, typically borne by DSOs and recovered through network tariffs. Available evidence indicates **positive net benefits**, with average **benefits of around EUR 253 per metering point** compared to **costs of approximately EUR 172**, likely understating the full range of system and market benefits. Potential risks include **cost pass-through to consumers**, **cybersecurity and interoperability challenges**, and the risk that benefits may not fully materialise without appropriate market frameworks. These risks are mitigated through the **phased deployment**

([230]) European Commission: Directorate-General for Energy, McKinsey & Company, Guidehouse, Fraunhofer Institute for Systems and Innovation Research ISI, Trinomics, Utrecht University, TNO, Antretter, M., Klobasa, M., Kühnbach, M., Singh, M., Knorr, K., Schütt, J., Boer, J. d., Rolser, O., Hernandez Diaz, D., Fitzschen, F., Garcerán, A., Reina, R., Stemmer, S., Steinbach, J.Popovski, E., *Digitalisation of energy flexibility*, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2833/113770, p. 15.

([231]) European Commission: Directorate-General for Energy, Arrowsmith, G., Cozzini, M., Di Costanzo, B., Haack, J. et al., *Support for the preparations of a strategic roadmap for digitalisation and AI in the energy sector*, Publications Office of the European Union, 2026, p 15 https://data.europa.eu/doi/10.2833/3572353.

approach and existing EU requirements. Overall, the measure is expected to deliver net positive impacts over time.

With regard to **taxation**, the proposal is expected to result in a more favourable fiscal regime for electricity relative to gas in the Member States where this is not currently the case. This includes a specific provision for energy-intensive businesses. This will contribute to a more consistent price signal in favour of the electrification of end uses. Such price signals will influence consumer and business choices and contribute to the achievement of the EU's climate and energy objectives.

With regard to **grid connection measures,** the proposal is expected to lead to faster adoption of grid access frameworks considering maturity of incoming grid connection requests, their progress in the connection queue as well as their impact on network congestion. This should lead to faster connection of mature projects and to reallocation of available grid capacity to mature projects waiting in the queue, hence to quicker connection of electrified loads and clean electricity generation, thus to significant economic benefits stemming from earlier project implementation, as well as to environmental benefits. As the proposal builds on existing legal framework, expected administrative costs are expected to be minimal, and costs for grid connection applicants are considered appropriate vis-à-vis the achieved wider economy, environmental and social benefits.

Taken together, the measures in this proposal are **consistent with the European Climate Law ([232])**. They support the transition towards climate neutrality by improving the efficiency and flexibility of the electricity system, facilitating the integration of renewable energy, supporting electrification and reducing structural reliance on fossil fuels. More specifically, the measures on network charges, smart grids, data exchange and smart metering help enable demand-side flexibility, better use of existing infrastructure and reduced curtailment of renewable electricity which should result in lower emission of greenhouse gasses. The taxation measures support a more coherent fiscal framework for electrification by helping ensure that electricity is not placed at a relative disadvantage compared with more carbon-intensive energy carriers. While some measures may entail additional deployment of digital infrastructure and related energy use, the overall effect of the proposal is to support a more decarbonised, resilient and efficient energy system, in line with the Union's climate-neutrality objective for 2050 and the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030.

([232]) Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), ELI: http://data.europa.eu/eli/reg/2021/1119/oj.