DSO ENTITY
DSOs FOR EUROPE

Electricity grids: A cornerstone for a competitive European economy and prosperous society

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Executive summary

This report sheds light on **the role of DSOs for the EU's economy and society**. As core enablers of the clean energy transition with most RES/DER connected to the distribution grid and key-actors in providing households and industries with affordable and reliable energy, **DSOs are central for the delivery of the EU's energy objectives: sustainability – affordability – reliability.** DSOs connect all households and most industries and businesses to the grid, provide a reliable supply with high levels of failure safety and contribute directly and indirectly to the EU's employment and economic growth.

While the network component of the electricity bill has gone down or remained stable during past decades in most Member States, the significant investments that are needed in the distribution grid due to the decentralisation of the energy system and increasing electrification have incited concerns over potential increases in the network component of the bill, which usually amounts to 1/3 of the bills in the EU. This report alleviates concerns about increases in network tariffs and their potential negative effects on the EU's economy and citizens. By drawing on good practices and studies from Member States **the report shows how DSOs positively contribute to the EU economy and how investments in DSOs will be central in reducing energy bills in the long run**.

<u>In a nutshell, the report covers the following:</u>

- **It debunks myths around the energy bill and the share of DSOs cost in it** by highlighting the – often overlooked - difference between energy costs and electricity bills and by explaining the three components of the electricity bill of which grids – TSOs and DSOs – are on average responsible for 1/3.
- **It shows how investments in grids ensure affordability in the long run** by connecting RES/DER, allowing electrification to happen and enabling flexibility leading to less curtailment, re-dispatch costs and/or queued connection requests. Further, the negative effects and (higher) costs of not investing in grids is explained with examples from the Netherlands, Spain and Austria.
- **It elaborates how anticipatory investments, and a forward-looking long-term regulatory approach** leads to dynamic efficiency and ultimately to lower network tariffs with examples from Italy and Poland.
- **The effect of the degree and speed of electrification on the unit cost of electricity** is explained by showing that a faster pace of electrification will reduce the unit cost of electricity.
- **Further, it is demonstrated how the usage of public funding** from the EU and national level can alleviate negative effects on consumer bills with an example from Poland.
- **The report also highlights external challenges to grid build-out that affect DSOs' operations and their efficiency.** The topics of permitting, supply chains, public procurement and staffing are mentioned in this regard with some good practices that show a way forward.

Finally, the report closes by stressing **DSOs' reliance on the right conditions to deliver** on their objectives. Among those conditions a forward-looking regulatory framework that allows for anticipatory investments, more EU (funding) support for DSOs and EU-leadership on strategic topics such as supply chains or public procurement are mentioned. Given the national and divers character of DSOs the report underlines **the need for well-orchestrated actions and good cooperation between the EU and national level** to arrive at the right balance between direct EU activities and a plurality of national solutions.

1. The relevance of DSOs for the EU's economy and society

One of the most crucial preconditions for a successful business location is the **availability of a stable and reliable energy supply provided by a resilient energy infrastructure**. In the past decades electricity grids have been close partners and key-enablers of European businesses and industries like the Grid Action Plan (GAP) rightly stated:

> *"**Electricity grids are a true European success story** of integration, cooperation and mutual support. […] Interconnected and stable electricity grids are the backbone of a well-functioning energy market. The European Union has one of the most extensive and resilient electricity networks in the world, spanning over 11 million kilometers across its internal market and ensuring that high-quality electricity is delivered to its consumers every day." (COM 2023/767)*

Apart from the GAP, recent publications such as the Clean Industrial Deal (COM/2025/85) or the Action Plan for Affordable Energy (COM/2025/79) repeated the success story of the EU's electricity grids but also stressed that "Europe must invest more in modernising and expanding its network of energy transmission and distribution infrastructure" (COM/2025/30). It was emphasised that "**only by accelerating investments in clean energy and infrastructure […] [we] can make energy affordable"** (COM/2025/79), thereby, stressing the core role of grids to connect renewables as cheap energy resources and to decarbonise.

This urgency was also underlined by the recent widespread power blackout that affected millions of households and businesses in Spain and Portugal in April 2025. The Iberian blackout highlighted the growing complexity and importance of maintaining reliable electricity supply in an increasingly electrified and decentralised energy system. The incident served as a powerful reminder that Europe's electricity infrastructure must keep pace with accelerating demands and system complexity and investments in grids are central.

While cross-border electricity infrastructure and interconnectors (TSOs) are important enablers for a further deepening of the EU's electricity market, its distributed nature has gained significance given the rapid growth of decentralised energy resources and bi-directional flows all connected to the distribution grid. This requires more active and complex system management and better cooperation between DSOs and TSOs to ensure a reliable and resilient energy system. **The majority of the infrastructure is operated by DSOs**; i.e. 10m km out of the 11m km EU electricity grids are operated by DSOs which are connecting all residential, and the majority of industrial customers. DSOs are operating their grids at maximal efficiency and capacity and invest in expanding, upgrading but also smartening the grids.

DSOs provide value for the EU's economy and society:

1) DSOs connect most industrial customers and secure access to capacity

While in this "system of systems" TSOs operate large-scale transmission networks and connect power plants, some large industrial consumers and DSOs, DSOs handle local energy distribution and serve all households, small- and medium sized businesses as well as industrial users. Although there is no specific data in the EU about the percentage of industrial consumers connected to the transmission or distribution grid, it can be assumed that **most of them are connected to the distribution level** (see table below). The number is not only dependent on which voltage level the industrial consumer is connected to (mostly to the medium- voltage grid which is served by the DSOs), but also if in a Member States DSOs are operating high-voltage grids (>110kV).

Country	Industry connected to DSOs
BE – Belgium	99%
BG – Bulgaria	99%
CZ – Czechia	98%
DK – Denmark	99%
DE – Germany	99%
EL – Greece	99%
ES – Spain	99%
IE – Ireland	98%
IT - Italy	99%
LT – Lithuania	99%
LU - Luxembourg	98%
NL – Netherlands	99%
PL - Poland	99%
PT - Portugal	99%

Overview table: *Percentage of industry connections to the DSO grid in 2024 (data collected by members of DSO Entity's CEG*).

This shows that DSOs are key for:

- **Securing access to capacity**, which entails the efficient connection of new businesses and industries to reduce their costs and increase their competitiveness.
- **Supporting the potential for the development of new energy related products**. Currently, the deployment of certain products could be limited by the capacity of the grid, e.g. it is important to enable the grid to support additional fast chargers for EVs. By reducing such barriers through grid expansion, the grid facilitates the development of these new technologies that foster overall innovation and Europe's competitiveness.

2) DSOs guarantee high levels of failure safety (up-time)

Given that most of the industry is connected to distribution grids their reliability is critical for seamless industrial production and operations. With a high-degree of safety and an all-time low in interruption time of only 0.9 hours (54 minutes) per year for the EU-average[1], the reliability of the EU grid infrastructure is remarkably higher than the infrastructure in the USA with approximately 7 hours (430 minutes) of interruptions per year[2]. As highlighted by the high-impact 2025 Iberian blackout, Europe cannot afford to postpone strategic grid investments. Such events provide an opportunity to reassess grid adequacy and accelerate measures that will future proof the entire electricity system.

In times of an increasingly unstable geopolitical situation with more registered attacks on critical infrastructure investments in the (cyber)resilience of grids are key to ensure a high level of safety. Only in 2022, 1101 weekly attacks towards utilities were identified globally.[3] Regulatory frameworks that ensure that DSOs can invest sufficiently in their resilience are vital, i.e. regulation cannot only focus on short-term cost-efficiency and lower electricity prices for consumers but must ensure a long-term stable electricity system that is equipped against potential threats and crisis to ensure a reliable supply to industry and households. Customer protection not only means the lowest costs in all situations, but also the reliable availability of assets and services when needed.

A good practice to mention here is the resilience incentive introduced by the Italian NRA (ARERA) in 2018. Since then, ARERA requires DSOs to prepare a resilience plan, aimed to mitigate the impact of extreme snowstorms, windstorms, tree fall and heat waves integrated with the Network Development Plan. The resilience plan contains details regarding the costs, implementation times and related benefits of each intervention. ARERA also defined an economic incentive mechanism to promote the implementation of interventions with a Cost/Benefit analysis >1.

3) DSOs are creating value for the society as a whole (e.g. economic growth, employment)

Locally operating DSOs are an important economic factor in all Member States and relevant providers of high-quality direct and indirect jobs. The expected high investment needs will primarily be materialised in the countries themselves with infrastructure works providing for additional jobs. Currently the grid sector in the EU provides for 835 000 direct and indirect jobs[4]. DSOs do not only contribute positively to the labor market but to the local economy with studies in different countries showing the benefits of the DSOs for the national GDP and society.

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[1] Please note that the calculation of an exact EU-wide average for the SAIDI is difficult because data reporting in Member States differs. However, the World Bank's Doing Business studies for 2019 and 2020 calculated an average SAIDI for the EU-countries based on existing materials which is quoted in the text referring to data from 2020.

[2] Aaron Larson (2024) “U.S. Power Distribution System Reliability Has Declined Over the Past Decade: How to Make It Better”, quoting U.S. Energy Information Administration (EIA), in 2021. PowerMag. Available online.

[3] Eurelectric (2024) A snapshot of Cybersecurity in the EU, p.4

[4] Eurelectric (2024) DSO Handbook, p.5

Greece: Greek DSO substantially contributes to the economy and energy objectives

The Greek DSO, HEDNO, led a quantitative assessment of its impact on the national economy and society for the period 2024 to 2030, on the grounds of HEDNO's grid modernisation, climate resilience and RES integration acceleration investments. The study considers the direct, indirect and induced effects of HEDNO's investments and operations, its contribution to the Greek GDP and employment levels.

The study found HEDNO's contribution to the national economy to be substantial, **accounting for around 0.7% of Greece's GDP annually and supporting more than 40,000 jobs throughout the period**. Beyond its economic footprint, HEDNO was identified as key for reaching Greece's environmental and energy goals. By enabling the connection of over 60% of new RES installations since 2021, the company has helped facilitate a projected reduction of over 2.3 million tons of CO_2 emissions by 2030, alongside an estimated €1.9 billion in cost savings within the national electricity mix.

The study underlined HEDNO's strategic investments in climate resilience, with more than 35% of its capital expenditure through 2030 dedicated to the resilience and strengthening of its networks.

Spain: Regulatory limits for investments impede economic growth and employment[5]

A recent study in Spain showed that investments in distribution networks are key to achieve not only the ecological transition but also economic growth. The study explains that restrictive regulatory limits such as the limit for investments in distribution networks generates distortions and translates into employment losses and reductions in the growth of added value of the Spanish economy. Only by raising the regulatory investment limit, hard-fixed to 0.13% of GDP would enable to mobilise more than 7,720 million euros of extra investment in distribution networks, 44% more than contemplated in the initial scenario, which would allow alignment with the objectives of the National Energy and Climate Plan (NECP).

In Spain, **the value chain for the distribution network deployment** counts more than 37,000 companies and 305,000 jobs. The regulatory limitation to the investment results in a loss of added value to the Spanish economy of 10 billion euros between 2021 and 2030. **That is 1,000 million euros per year of Gross Value added (GVA) for the economy.** Furthermore, with a strong positive drag on sectors of the economy such as professional activities, industry, commerce or construction. In the labor market, increasing the limit of investment in distribution would allow us to generate more than 16,000 additional jobs and the mentioned period.

[5] Metyis, for Iberdrola Group (2020) Liberar la inversión en redes de distribución en España – Una oportunidad para el crecimiento economico y el empleo.

France: Increased DSO investments lead to direct and indirect job growth (EU supply chains)[6]

Enedis, the French DSO which manages 95% of the national distribution network, plans to invest 96 billion euros between 2022 and 2040 to develop the network, and adapt it to climate change. To this effect, Enedis has **contracted almost 3.6 billion euros worth of electrical equipment (compared with an average of 850 million euros up to 2020).** As two-thirds of this electrical equipment is manufactured in France, and the rest in the European Union, it is estimated that Enedis' investments in electrical works and equipment represent 60,000 direct jobs. Through these contracts, Enedis contributes to the reindustrialisation of the country, particularly in rural areas, while reducing its carbon footprint thanks to the proximity of its production sites. In addition, Enedis will have entrusted its contractors with around 2.5 billion euros worth of work, about half of which will be carried out by small and medium-sized businesses in the regions.

[6] Enedis (2024) Press release: Enedis sécurise ses besoins et engage 3,6 milliards d'euros d'achats en matériels électriques auprès de la filière des réseaux électriques. Available online.

2. Energy prices, electricity bills and the grid component

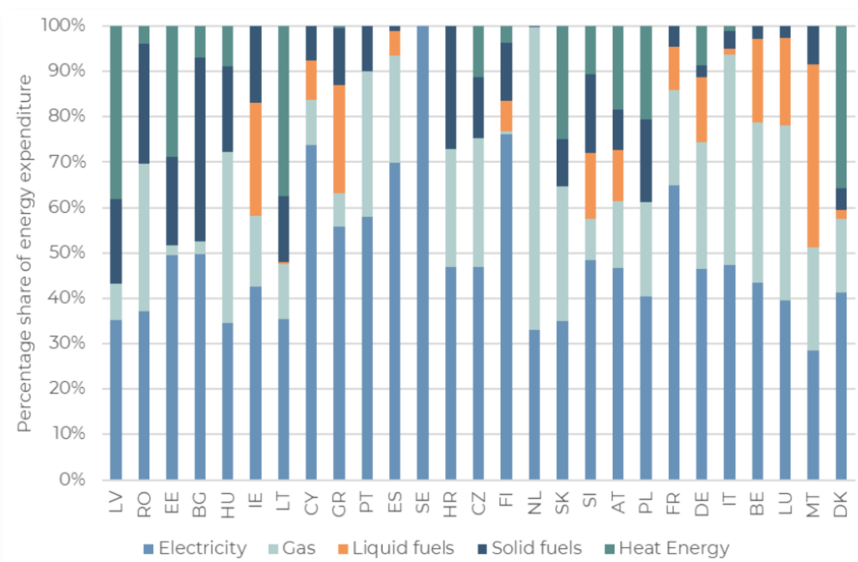
The Draghi report[7] and other recent publications of the European Commission identified high energy prices as a challenge for the EU's competitiveness and its global standing. The Action Plan for Affordable Energy highlighted that EU electricity retail prices for the industry were 2.2. higher than those in the US, twice those in China and 1.2. times higher than in Japan (Q2 2024). Although these communications highlight the need to significantly invest in grids to bring energy prices down in the long term, **an expected increase in network tariffs is often viewed with concern**. However, most of these concerns are unjustified and can be defused by analysing the discussion in greater detail.

<u>Two common misunderstandings can be identified:</u>

- A lack of differentiation between **energy costs and the electricity bill**
- A lack of differentiation between **the different components of the electricity bill**

Energy costs vs. electricity bills:

Affordability and competitiveness will be affected by the **overall price of energy and not the electricity bill alone**. Therefore, one needs to put the effect of cost in grids in perspective: In most countries, electricity represents less than 50% of the average expense on energy in most households as can be seen in the graph below.



Source: *European Commission, 2025, Study on energy prices and costs: evaluating impacts on households and industry – 2023 edition. Available [here](#).*

[7] Mario Draghi (2024). The future of European Competitiveness – A competitiveness strategy for Europe, European Commission. Available online.

Of that 50% (electricity) less than 30% is coming from grids and especially the recent price spikes in electricity were not caused by the network component as the graph shows below.

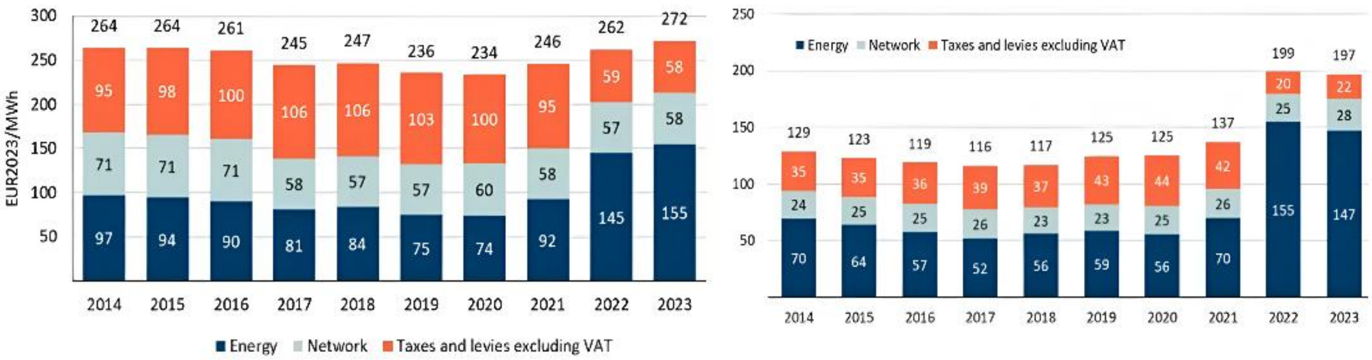


Figure 2. EU electricity bills for households (DD band, left) and industry (ID band, right) in real 2023 prices[11]

Source: *European Commission (COM/2025/79), Action Plan for affordable energy, p.3.*

As a result, grids represent about 20% of the cost of energy of the average household. That is divided between TSOs and DSOs. We lack a precise division of those costs but, if we assume 75%[8], then can point out that **DSOs represent approximately 15% of the overall energy costs**. Therefore, even if **DSO costs were to increase, the overall variation in energy expenditure would not be significant.**

To put developments into perspective, the electricity bill can certainly change for two reasons:

- There might be **variations in quantity**, i.e. electricity bills will increase as demand for electricity increases. However, there will be a substitution effect as the quantity of electricity will increase as electricity will substitute other energy sources (e.g. petrol or gas). Therefore, one needs to consider the overall energy bill rather than only focusing on one vector alone.
- There might be **variations in price/unit cost**, i.e. electricity bills would increase if unit costs were to increase. However, most of the necessary investments are the same activities that DSOs have done in the past and economies of scale could result in lower unit costs. Therefore, some studies show that the unit cost could go down in the future if electrification intensified. (see chapter 3).

Explanation of the electricity bill:

Despite differences in Member States the average electricity bill in the EU consists of three core components:

1. **Commodity cost** for the produced electricity, usually measured in kWh.

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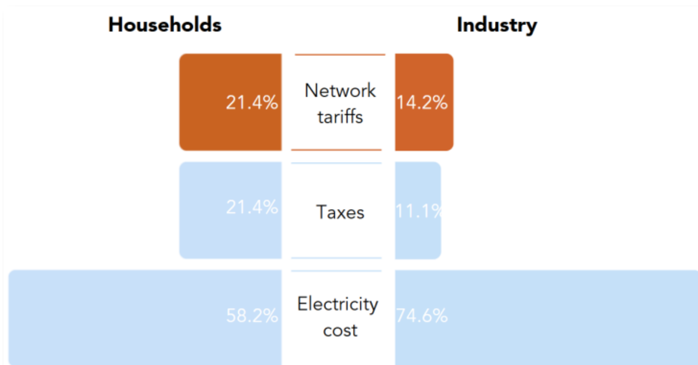
[8] Assumption based on the subsequent publication* where it is stated that "in 2023 […] the overall amount of transmission network charges in the EU was around EUR 20 billion and distribution network charges around EUR 60". *European Commission (2025): Guidelines on future proof network charges for reduced energy system costs. C (2025) 4010.

2. **Network cost** for the delivery of electricity (transmission and distribution) including capital costs as well as the costs for maintaining and operating the system
3. **Taxes and levies** which can differ per country but usually include the value-added tax (VAT), electricity taxes, renewable energy levies and/or other environmental taxes or government charges

While network costs differ in EU countries on average they amount to 1/3 % of the electricity bill. During the recent energy crisis their share was even less due to higher commodity prices as visible in the graphs. According to a recent study of the EC in recent years network charges have represented between **24-29% of the electricity bill for households**[9]. Reasons for a lower network cost would be areas with high population density where costs are spread among more consumers or countries with government-subsidised grids.



Source: *European Commission (COM/2025/79): Action Plan for affordable energy, p.3.*

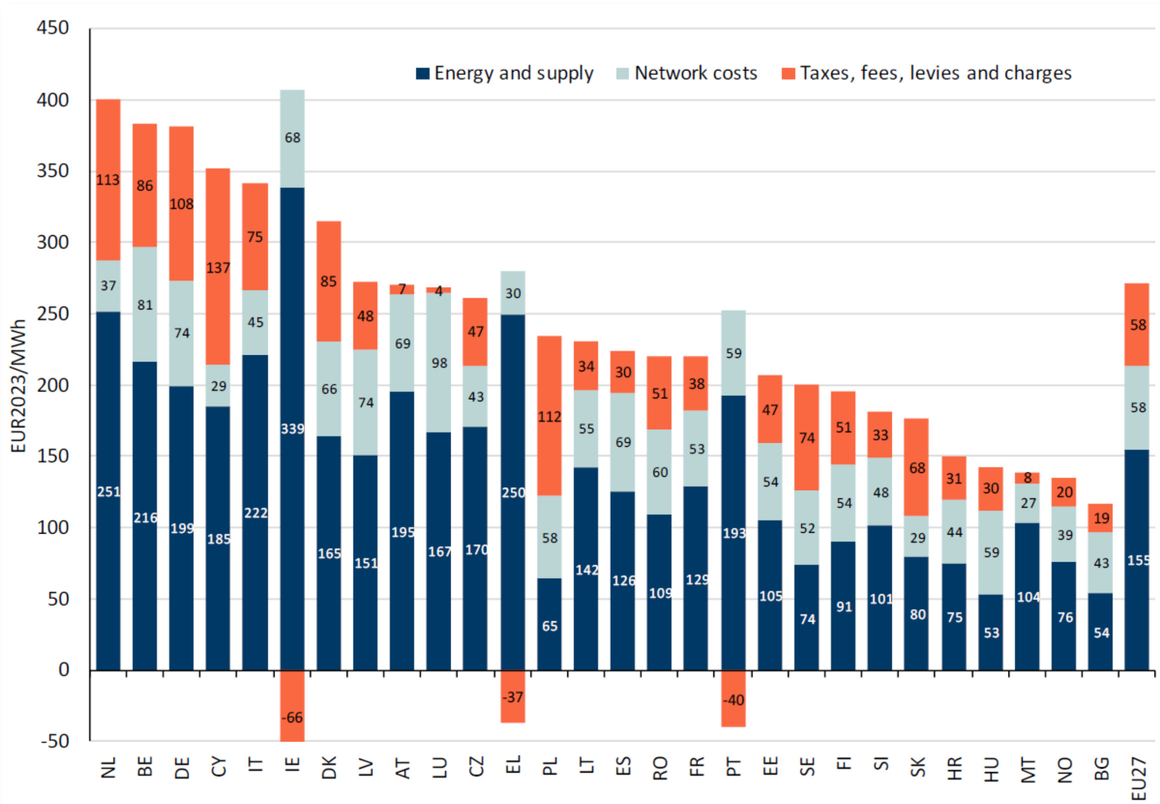
<u>Recent trends in the electricity bill:</u>

When looking at the graph above it is visible that network charges were not the main factor of the EU's electricity prices increase in 2021-2022 but that it was rather the energy price component resulting from an increase of wholesale prices.

- **Household electricity prices**: It is visible that the energy component of household retail prices increased significantly while the share of taxes and levies declined due to temporary national compensation measures to alleviate consumers from high electricity prices. Also, network charges stayed the same or even decreased slightly partly also due to temporarily introduced national compensation schemes.
- **Industrial electricity prices:** A similar trajectory is visible for industrial consumers but even more distinct since industrial electricity prices are more driven by wholesale market prices with bigger exposure to the energy price component. The report of the EC stated: "In 2023, the energy price component represented 63% of the overall electricity costs for medium industrial electricity

[9] European Commission (2025): Guidelines on future proof network charges for reduced energy system costs. C (2025) 4010. P. 2.

consumers, while *"network charges' share has shrunk to represent 14% of costs* (*from about 30% in prior years),* and taxes and levies in 2023 represented only 11% of overall costs. *»*[10]



Source: *Trinomics et al. (2024), based on data from Eurostat*

<u>To sum up:</u> When considering the evolution of electricity bills, one needs to consider the following:

- **Substitution effect**: Electricity will substitute other energy sources (e.g. petrol or gas) and consequently electricity bills might increase, but more due to an increase in consumption than an increase of the unit cost of electricity. Given this substitution effect it will be essential to consider the overall energy bill when comparing the costs of energy vectors.
- **Overall effect**: Affordability and competitiveness will be affected by the overall price of electricity and not only the grid component. As was shown above the grid component represents on average under 30% of the electricity bill which is again divided between TSOs and DSOs.

[10] European Commission, 2025, Study on energy prices and costs: evaluating impacts on households and industry – 2023 edition,p. 63. Available online.

Illustration: Explanation of reports which assume a stark increase of network tariffs

In contrast to other publications[11], two recent studies[12] assume significant increases in network tariffs as a result of the necessary investments required by the energy transition.

The first of those publications was published by **ACER[13]** and indicated a risk that the unit costs (and associated network tariffs) will increase by around 50-100% by 2050 and proposed measures to mitigate this spike. However, a closer look at the analysis of ACER shows that the robustness and accuracy of some of the assumptions are questionable.

• The calculations are based on a total investment scenario (for DSO and TSO) assuming high levels of investment for electrification in relation to a low demand scenario, i.e. low levels of electrification. This misalignment of assumptions must result in significant increase in unit cost accordingly. This misalignment of assumptions is equivalent to assuming a strong overinvestment in European electricity grids that has been going on for more than two decades and is left unchallenged by regulators.

• Furthermore, ACER's analysis fails to consider that in practice if growth in generation and demand were to develop slower than anticipated, the investment path would surely be adjusted downward.

Given this misalignment of assumptions further commenting on the recommendations in the report seems unnecessary.

The second study is an interdepartmental policy research that has been published by the **Dutch Ministry of Climate Policy and Green Growth[14]**, and it similarly warns against a significant rise in tariffs for consumers due to the need to double grid investment to decarbonise and leverage the benefits of market integration. The study assumes that (off-shore) wind capacity in the Netherlands will double, and solar capacity will nearly triple by 2030. So, for the Dutch case, the expected increase in unit costs mainly derives from policy decisions – i.e. large costs increase from connecting RES.

In fact, about half of the extra investments and therefore extra costs are driven by TSO for connecting offshore wind. In addition, another significant increase will come from ensuring operating a system with additional RES. Therefore, remedies to moderate these cost increases should be targeted at the political choices about offshore (the amount of offshore generally necessary as well as the cost sharing between wind farm proprietors and the Dutch network users) and the operating costs (mainly driven by TSOs operations and not DSOs). If anything, DSOs should be supported to facilitate the TSO can have access to flexibility instead of additional investments. Besides that, DSOs' unit costs can be reduced by improving the utilisation (e.g. flexibility) and efficiency (energy plans with environment, improvement process of permits) of the DSO grid.

The analysis of these two reports shows that, even in those cases where unit costs could increase, the underpinning cause can differ strongly from increase in specific cost drivers to potential misalignments in the analysis. Therefore, it is crucial that any potential measure aimed at addressing these issues are correctly targeted to the causing factors.

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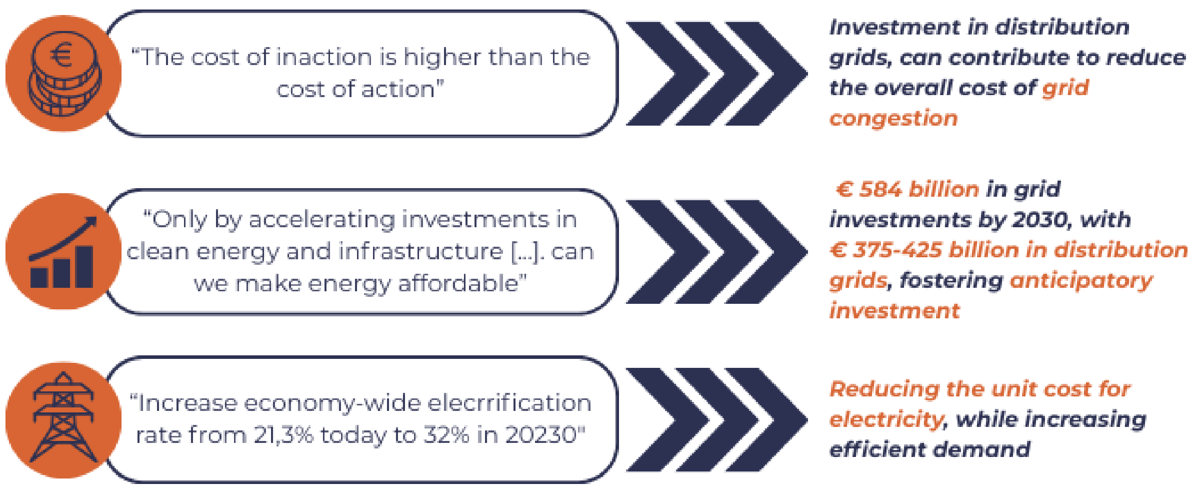
[11] Eurelectric (2024): Grids for speed. Available online.
[12] ACER (2024): Electricity infrastructure development to support a competitive and sustainable energy system. Available online. Dutch Government (2025): IBO Bekostiging Elektriciteitsinfrastructuur. Available online.
[13] Ibidem.
[14] Ibidem.

3. Measures linked to grids to ensure affordable electricity

Grid investments as a non-regret option to lower electricity prices in the long run

Since the transition of the energy system primarily takes place in the distribution grid, unprecedented investments in grid expansion, renewal and smartening are required, estimated at € 55-67 bn per year on average until 2050. These investments are vital to integrate RES, new demand and to prevent higher costs through the curtailment of RES or increasing redispatch costs as well as to ensure the smartening and build-in of sufficient resilience (climate adaptation). As illustrated in the first chapter, **grid investments drive value for society at large** by accelerating the energy transition, contributing to employment and economic growth, thereby, enhancing the EU's competitiveness. The Action Plan for affordable energy highlighted the need for sufficient grid investments to ensure the fast deployment and connection of renewables to accelerate decarbonisation and thus, imports of costly fossil fuels. (see depiction below).



Already now billions of Euros are expended on **congestion-related costs** with the UK spending over €1 billion a year and Germany nearly twice as much. Also, redispatch volumes are expected to surge with estimates for the EU to rise from 50 TWh in 2023 to 374 TWh by 2030, potentially costing an additional €100 billion.[15] A recently conducted case study in Austria of Frontier Economics let them to arrive at the following conclusion: "***overinvestment is suboptimal, [but] underinvestment is catastrophic".*** Therefore, they argue for a twofold shift: in mindset to recognise the asymmetric risk that the cost of delay far outweighs the cost of some surplus capacity and in the set of regulatory instruments highlighting the need for an embrace of anticipatory investments, improved system planning and others. [16]

[15] Frontier economics (2025) Europe's great grid gamble. Available online
[16] Ibidem.

Similar to this assessment a recent Allianz report[17] also argued that “without timely upgrades, grid inefficiencies lead to rising congestion, increased reliance on countertrading and redispatching and ultimately higher electricity prices” all of this with a negative impact on production prices, i.e. the EU’s competitiveness.

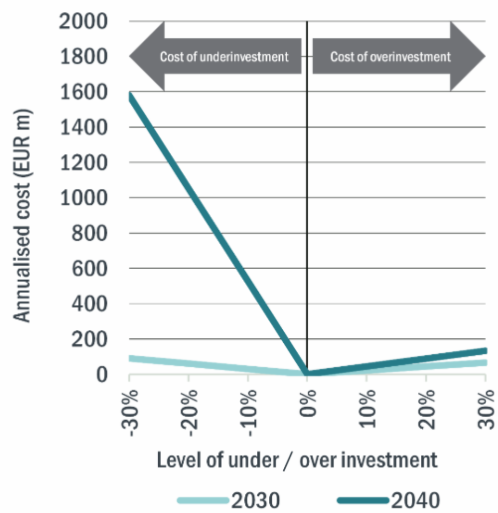


Figure I Costs of over- vs. under-investment in distribution grids, Austria

Source: *Frontier economics (2025) Europe’s great grid gamble*

Even if the network component was to increase, studies of the European Commission expect the electricity prices to remain rather stable in the long term given the connection of an increasing number of cheaper renewables that are substituting expensive fossil fuels[18]. **This shows the positive effect of sufficient investments in grids to connect renewables to bring the energy component of the electricity bill down which is vividly illustrated in the Greek example below.**

To sum up: Investments in the expansion, renewal and smartening of the grids mean connecting more RES/DER and additional demand, enabling flexibility providing for less curtailment, less re-dispatch costs and less RES stranded investments. It also means connecting industrial plants and businesses (demand) without delays that contribute to the EU’s **overall competitiveness.** Besides the positive effect on the financial costs and economy grid investments actively increases the **EU’s strategic autonomy** by reducing its dependency on imported and costly fossil fuels. Therefore, investing in grids is a non-regret option to arrive at a sustainable, affordable and reliable energy system.

[17] Allianz (2025): Plug, baby, plug: unlocking Europe’s electricity market. 11 March 2025, 11, 14.

[18] European Commission’s Staff Working Document (2024) 63, Securing our future: Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society. Part 3, tables 36, 37 and 47. Available online.

Current grid congestion costs outweigh the cost of grid investments [19]

The Netherlands' electrification is accelerating rapidly, driven by the rise of electric vehicles and a 118% increase in renewable energy generation between 2016 and 2021. This growth has pushed large parts of the Dutch grid to full capacity, leading to severe congestion.

A 2024 BCG study estimated the economic and social costs of this congestion:

Economic impact: The Netherlands is missing out on €10–35 billion annually due to constraints on business creation and expansion. Revenue losses are estimated at €1,200–4,000 per unused MWh, with 9 million MWh currently awaiting connection.

Social impact: Delays in renewable energy projects—over 3 GW currently stalled—could cost €1–1.5 billion annually, with up to €120 per MWh in costs due CO_2 emissions from 'grey' energy sources that have yet to be phased out and are still used to meet the electricity demand.

Additionally, infrastructure development is also affected. Delays in connecting new homes and associated facilities could result in losses of €0.1–2.5 billion annually.

In total, congestion could cost the Dutch economy €10–40 billion per year—far exceeding the planned €6–9 billion annual investment in grid upgrades.

Additionally, the study identifies multiple solutions to support investments while keeping energy affordable for citizens and industry alike, such as market-based solutions in the form of regional and time-based price differentiation, state subsidies to offset temporary cost increases, and extending tariff recovery periods, supported by state-backed loans or capital injections towards grid operators.

Sweden: Cost of underinvesting in grids [20]

A Swedish study conducted in 2023 provided further context to the impact of underinvesting into the national grid, offering tangible estimation of the socio-economic losses it would entail. The study concluded that delayed network investment could result in up to 7 million tCO2 annual emissions, an annual 8 billion SEK in lost contribution to GDP per every billion not invested in the grid, the loss of between 50.000 and 100.000 jobs. Further impact assessed included hindered knowledge development and innovation, persistent price differences between electricity price areas, and unchanged or reduced electricity grid charges for end customers in the short term, with a risk of delayed negative effects.

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[19] Boston Consulting Group (2024) "Solving the gridlock – Six interventions to accelerate congestion relief on the Dutch electricity grid. Available online.

[20] AFRY Management Consulting (2023) Balanskommissionen – Elektrifiering utan elnät? Available online.

Greece: Lower prices at the electricity market due to new RES-connections of DSO

The Greek DSO, HEDNO, conducted a quantitative study evaluating the direct benefit on the society and national economy from the expedited connection of new renewable energy sources (RES) generation units to the distribution grid. **The benefit is defined in terms of reduction in electricity prices and CO2 emissions**. The estimation is based on the rationale that the electricity generated by the new RES connections usually replaces natural gas-fired generation (at least in Greece), leading to lower electricity prices, also including the avoidance of CO2 emissions. The benefit estimation approach considers: (a) the monthly generation by the installed capacity per RES technology for a considered timeframe and (b) the difference between the actual RES compensation for the energy produced and the theoretical cost of replacing the RES generation with gas-fired generation (at minimum natural gas and CO2 emission costs considering reasonable assumptions for relevant consumptions)

The study showed that due to the increase in new RES connections, **consumers have saved €1.2 billion on energy costs from 01/2021 to 07/2023** compared to what they would have paid if these RES connections had not been implemented. [21]

Anticipatory investments as enabler for a cost-efficient transition[22]

Changes in the energy system resulting in higher investment needs for DSOs require DSOs to plan longer ahead and to ensure the efficiency of different investment decisions. When planning DSOs decisions are usually based on four types of considerations: investment needs, costs, delivery and recovery. Due to higher uncertainty and significant changes in the sector, the complexity of the consideration increases (e.g. speed of roll-out of EVs).

Therefore, regulation should encompass a framework to manage uncertainties associated with longer forecast periods. The use of the long-term forecasting comes with an anticipatory investment approach which means to focus on longer term developments that go beyond the current needs (demand) but assume with sufficient level of certainty that new generation and/or demand will materialise, even if potentially with low utilisation in the short term and calculate in potential impacts of delaying decarbonisation processes. **Efficiency analysis should consider that investing in stages could be less efficient than undertaking the full investment in one single step**, e.g. it could be more efficient to lay multiple underground cables than opening the streets several times[23].

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[21] Declaration of Anastasios Manos, CEO of HEDNO, at the Delphi Economic Forum (April 2024). Available online.
[22] For more information on anticipatory investments refer to: DSO Entity (2025) \ Anticipatory investments – An initial Regulatory discussion. Available online.
[23] Additional examples: the preparation for swift future capacity increases by putting down extra tubes or buying an extra-large plot of land when preparing for a substation, the installation of larger pylons or investing in higher capacity assets, e.g. choosing components with more capacity what is needed today or foreseeing future resilience challenges of grids.

The guidance of the EC on anticipatory investments arrives at a similar conclusion when it states: "In many locations, underinvesting in grid infrastructure may become costlier to society in the medium term than making anticipatory investment under controlled scrutiny and risk management processes."[24]

In most member states, regulatory frameworks have not yet adapted to this new approach. They were designed for stable energy systems with a focus towards incentivising cost efficiency, resulting in cautious investment processes. However, in some countries a more proactive approach in regulation was applied in the past that led to dynamic efficiency and ultimately lower tariffs. One case in point is Italy where proactive investments in digitalisation led to lower tariffs given a low RAB per customer (k€/customer) as described in the illustration below. This shows that network charges do not necessarily have to increase in every country in the time to come but that their future trajectory also depends on the past regulatory practices.

Italy: The benefits of forward-looking investments

Anticipating investment in digitalised and flexible assets is a win-win for DSOs and the society as a whole as visible in the Italian example. DSOs need to invest first with a long-term vision to ensure consumer benefits for decades (dynamic efficiency).

Italy started investing in grid digitalisation and automation in 2001 and already completed the deployment of the second generation of smart meters. Roughly 30 billion euro (38,2 in 2023 prices) of investment during the last 20 years that has now led to improvements in the quality of the service (e.g. reduction of 70% of SAIDI index and of 40% of operating cost per customer). Thanks to proactive investment in digitalising the grid and other forward-looking investments, Italians are now profiting from one of the lowest tariffs due to a grid that is smart and can be operated more efficiently.

This has been possible through an adequate regulatory framework to guarantee the right investment-friendly environment which is key as delayed investments would have a negative financial and environmental impact (e.g. curtailment of RES, suboptimal use of resources, higher energy prices, etc.) for society at large.

Poland: Committed investments to support effective connections

In 2021, DSOs in Poland developed the KET programme (Charter for Effective Transformation of the Distribution Systems of the Polish Energy Sector). In this program they commit to intensively invest to enable the efficient connection of RES and energy storage, to support the development of local energy and the use of flexibility services at distribution system level, therefore improving energy efficiency. **In the Network Developments Plans agreed on by the Polish NRA for the 2023 to 2028 period, grid investments expenditure increased by more than 70% compared to the plans for 2020-2025 (from 42 billion to 72 billion PLN).** Further increase in capital expenditure can also be expected in the development plans for DSOs to be approved this year

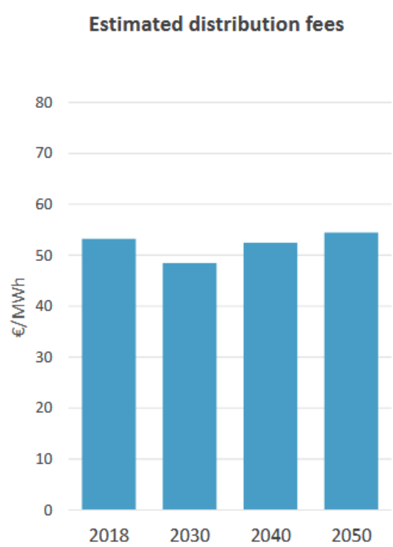
[24] European Commission (2025): Commission Notice on a guidance on anticipatory investments for developing forward-looking electricity networks. C(2025) 3291. P. 5.

The positive effect of electrification on the unit cost of electricity

As briefly discussed in other chapters, a higher volume of grid investments does not necessarily have to lead to an increase in the unit costs of electricity, especially when the demand for electricity is rising.

Since the level of distribution fees is connected to consumption levels an increase in demand for electricity connections will positively affect consumer fees as the costs are distributed among more users. Eurelectric's report Grids for Speed (G4S)[25] showed that in the long term, the increase of electricity demand could allow to keep network unit costs around current levels.

"Eurelectrics' […] analysis finds that electricity distribution fees are expected to remain flat to 2050, as the increase in allowable revenue from higher grid investment is offset by the increase in electricity consumption" (p. 54). However, this is certainly dependent on the level and speed of electrification in the respective country.



Source: *Eurelectric (2024) Grids for speed*

Despite a general increase in electrification - with more decentralised generation and self-consumption - the amount of electricity fed into the grid is declining in some Member States. This can affect the cost recovery of the grid since – although grid costs remain as grids are build based on capacity demand – a smaller number of people contributes to the network charges. Therefore, when designing network charges the right cost drivers must be selected that ensure that tariffs reflect the relevant costs of the DSO. In this respect the principles of **cost reflectivity, cost recovery and non-discrimination** need to be applied to ensure the price paid covers the costs being generated for the provision of services by the consumer and every consumer should face similar tariffs for similar services.

[25] Eurelectric (2024) Grids for speed. Available online.

The usage of public funding to alleviate potential negative effects on customer bills[26]

While a forward-looking regulatory framework with an anticipatory investment approach is core for enabling grids to efficiently connect renewables and (pro)consumers on time (see chapter 3.2.), public funds can also mitigate potential negative effects on consumers. Public funds – European or national – could be used to protect consumers from (short-term) price increases and to smoothen the effect that large investments might have on tariffs[27].

Different usage of public funds can be considered:

- Public funds could be used to **keep costs contained for consumers** which is also mentioned in the Action Plan for affordable energy (p. 7) and the Guidelines on anticipatory investments which suggests concretely that "Member states could also consider the option to use congestion income to finance anticipatory investments to alleviate the overall burden on the tariff system" (p. 11). The plan states that Member States could make use of their public budget to lower network charges to cover the additional costs resulting from measures to accelerate decarbonisation and market integration.
- More indirectly, public funds could also be used to **increase the demand for electricity**, for example by directly funding the electrification of residential customers, services or industries, which is expected to bring units prices down (see chapter 3.3). However, to fully realise the benefits of electrification, public funding should also support the necessary grid-enabling infrastructure - such as network upgrades, smart grid technologies, and digitalisation—that allows the distribution grids to reliably accommodate increased electricity demand. DSOs are essential in facilitating the integration of renewables and the connection of new electrified loads. Increasing public funding and accelerating investments in electrification and grid infrastructure will be important to bring unit prices down (see chapter 3.3).
- Lastly, public funds could be used to more directly to **facilitate the access to efficient sources of finances for DSOs** thereby also alleviating the burden from consumers / tariffs. In a recent Commission study this dimension was highlighted by stating that "additional financial support may be needed to reduce the cost burden on grid users, shifting the cost from households and businesses to taxpayers or another large group"[28]. The report stresses the need for additional funding support and states: "EU funding support, particularly in the form of grants or blended finance mechanisms, could play a temporary role in alleviating the financial burden on consumers and business" (165) Also, de-risking instruments in the form of guarantees are stressed.

[26] For a more detailed read, please refer to the following publication: EU DSO Entity (2025): Public Funding for DSOs. Findings of a questionnaire launched by EU DSO Entity. June 2025. Available online.

[27] While this chapter focuses soley on the positive impact of public funding for lowering network charges, the positive effects from public funding for DSOs are much larger, e.g. grants acting as investment catalysts, risk mitigators and support in mitigating financial costs and relieving debt cpacity.

[28] European Commission (2025): Investment needs of European energy infrastructure to enable a decarbonsied economy. P. 6. Available online.

Regarding the last point with a focus on European funding a recent study of DSO Entity discovered the **lack adequate opportunities** to address their needs[29]. Despite the critical need for investments in distribution grids to facilitate the energy transition, only €1.3 billion (245 projects) of the €33 billion (52 000 projects) allocated to all energy-related projects in the EU's regional funds (2014–2020) was directed toward distribution and smart grid projects.[30] From the CEF-funded energy infrastructure projects worth €5.324 million, only €237 million was allocated to smart grid projects for DSOs.[31]

Given the relevance also for the consumer bill, DSOs should be considered better in the EU budget since also the EC'S report stressed that "EU financial support will be significantly important especially in the newer technologies and the cross-border activities where developments are (much) harder to predict.[32]" and that "[…] larger-scale investments in smart grids and digitalisation may require additional national funding or EU support to address the substantial capital demands" (190).

Poland: Mobilising European, national, and regional funding for DSOs

The Polish Ministry of Climate and Environment, which coordinates the process of preparing investment subsidy rules for the sector, indicating their priority treatment, has announced that it will make over PLN 15 billion available to operators in various support programmes, including cohesion policy programmes, i.e. European Funds for Infrastructure, Climate and Environment 2021-2027 and European Funds for Eastern Poland 2021-2027, as well as in the National Recovery and Resilience Plan. The Modernisation Fund is also an important source of financing for investments in the sector.

DSO projects that are eligible for co-financing cover a wide range of investments aimed at increasing the security and quality of electricity supply, increasing the capacity to connect renewable energy sources to the grid, electric vehicle charging infrastructure, energy communities, and, above all, those aimed at building a flexible, automated, intelligent power system that meets the needs of a wide range of stakeholders in the era of building a modern low-carbon economy.

[29] DSO Entity (2025), Findings of the questionnaire launched by EU DSO Entity on 'EU funding and other funding instruments for European DSOs'.

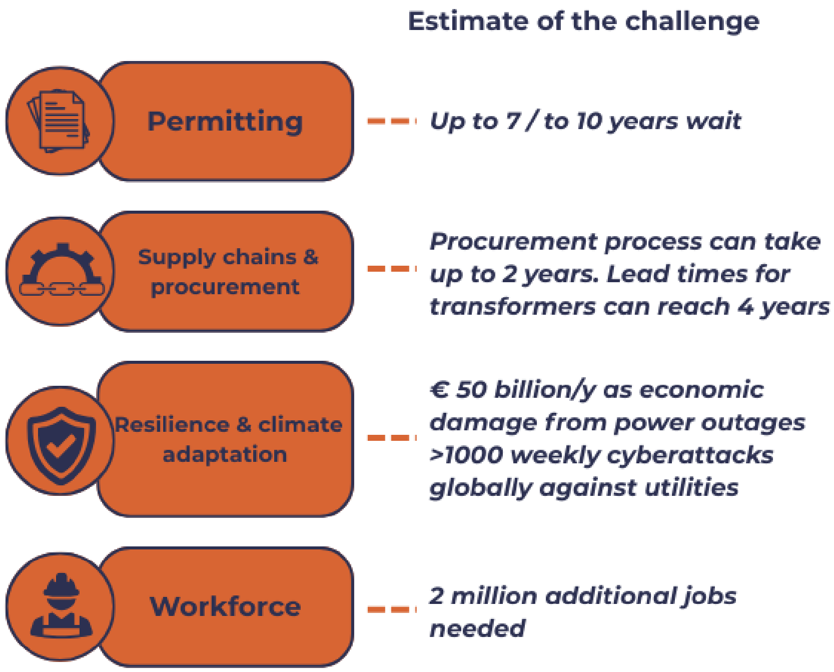
[30] DG ENER (2024), presentation at the 19th meeting of the Energy and Managing Authorities Network (EMA) on 13 June 2024, Brussels. The EMA Network offers a collaborative forum for authorities across the EU who implement energy-related programmes within the framework of the Cohesion Fund.

[31] Investors Dialogue WG 2, Available online.

[32] European Commission (2025): Investment needs of European energy infrastructure to enable a decarbonsied economy. P. 5. Available online.

External factors influencing efficient grid build-out

Apart from the measures mentioned before there are several more external factors that can hamper a successful grid build-out and have the potential to increase costs of grids operators, therefore negatively affecting the EU's competitiveness. The most concerning external factors are lengthy and protracted permitting procedures, interrupted supply chains, complex procurement procedures, shortages in staff and skills. Also, an increase of external threats to the cyber and physical integrity of grids as well as more extreme weather events are rising external challenges faced by DSOs.



Permitting[33]:

Permitting has developed into a growing challenge for the achievement of EU's Green Deal objectives, and especially the EU's 42.5% RES target by 2030. DSOs are facing a massive increase in requests to connect distributed generation capacities to the power network, which often entail the expansion or reinforcement of their infrastructure. To do this, DSOs must apply for grid infrastructure building permits that can take up to 8 to 10 years for medium- and high-voltage networks. New positive provisions were adopted under the revised Renewable Energy Directive (EU) 2023/2413 (RED III), but their implementation is lagging behind at national level with infringement procedures launched against 26 Member States. Implementation should be accelerated and the EC should encourage Member States to designate dedicated grid infrastructure areas as provided by Article 15(e) of the revised RED III considering their potential benefits to simplify permitting procedures.

[33] For more information on the topic, see also: DSO Entity (2025), Guidance on EU permitting-related provisions on grid and renewable energy projects. Available online.

Good practices can be found in several Member States such as in Portugal where the Portuguese DSO, E-Redes, has joint efforts with the national authority to develop and implement a single digital platform that allows the total dematerialisation of the complex permitting process ("zero paper" needed). The platform will enter into force in December providing all the necessary tools to guarantee interaction and control of response deadlines for all interested entities, as well as the possibility for the responsible permit-granting authority to impose a response deadline or a tacit approval.

Supply chains and (public) procurement[34]

Efforts to increase decarbonisation and electrification have escalated the demand for equipment on the whole electricity value chain. DSOs, who are connecting more than 70% of the renewable capacity, are at the forefront of this development. Consequently, more DSOs are encountering a growing challenge in sourcing essential equipment and key-components, driven by factors like strained supply chains, manufacturing shortages or cross-sector competition for certain components such as chips or (affordable) raw material. DSO Entity's member survey on supply chain challenges identified three categories of critical and hard to procure components: Transformers, cables and switchgear for all voltage levels as well as other IT- and telecommunication equipment. With more than 40,000 different components, technical complexity and differences in equipment are higher for DSOs than TSOs. This often entails more complex, tailor-made equipment needs for DSOs and long procurement procedures. Technical legacies from the past still exist leading to high fragmentation, not only between countries but sometimes even within the same company when operating in different regions.

However, several initiatives exist in which DSOs have started a practical work of self-alignment on technical components or certification procedures, submitting themselves to voluntary interoperability of their assets with other DSOs. Those initiatives have been taking the form of joint-procurement initiatives and platforms, alliances and consortiums, pre-qualification systems for procurement processes, proactive alignment between DSOs, and between system operators. These initiatives have derived from national associations, trans-national DSOs, within large-scale or national DSOs, and at cross-border level, and would be an apt starting point to identify clearly the need reported by DSOs themselves for harmonisation and interoperability, while respecting their diversity, synergies with the manufacturing industry's needs, and overcoming the criticality of the supply chain challenge.

Despite measures developed by DSOs among themselves and beyond their sector and recently announced activities at the EU level greater support will be needed on all levels to solve the issues in the interest of a sustainable and reliable energy transition. This includes the alignment DSOs with suppliers over technical requirements for distribution strategic assets as to simplify their procurement, and for DSO to provide increased visibility through their DNDPs. Further, EU-level initiatives will be central in providing a "fit for purpose framework", including future-proof procurement frameworks balancing sustainability and cost-efficiency, and equal market access for all distribution system operators, especially the small ones.

[34] For more information on the topic, see also: DSO Entity and E.DSO (2025) Joint paper – Distribution System Operators and the Supply Chain challenge. Available online.

Staffing and skills[35]

DSOs are especially challenged by labour shortages mainly caused by the increase of staff needed to facilitate the energy transition, (i.e., connecting increasing numbers of DERs), the transformation of jobs due to the continuous digitalisation of the sector (i.e., smart grid, cybersecurity), but also the high competition for workers in the energy sector in general. The most affected labour shortages in 2022 were in the STEM (science, technology, engineering, and mathematics), and particularly ICT sector[36], which explains why DSOs, who are at the core of delivering the green and digital twin-transition, are especially challenged by labour shortages.

Good practices from France (Enedis), the Czech Republic (CEZ group) and Spain (Iberdrola) show how DSOs with the support of public organisations and/or in close cooperation with the educational system attempt to proactively tackle staff shortages. The depicted practices highlighted that managing external factors, such staffing shortages, must be a collective effort with sufficient support from governmental organisations. Also, initiatives at the EU level, such as the European Net-Zero Academies, can support DSOs to address the challenge.

[35] For more information on the topic, see also: DSO Entity (2023) DSOs fit for 55? Challenges, practices and lessons learnt on connecting renewables to the grid. Available online.

[36] European Commission (2023): Employment and Social Developments in Europe. Addressing labor shortages and skills gaps. Available online.

4. Conclusions

The report showed the **relevance of DSOs for the EU economy and society** and highlighted that sufficient investment in grids in an anticipatory manner is key to avoid negative consequences for the EU's long-term competitiveness and energy resilience. It was demonstrated that the current share of network tariffs (DSOs and TSOs) in an average electricity bill in the EU amounts to around 1/3 of the costs and that fears of unprecedented increases in network tariffs and their potential negative effects on households and industries are often overstated and can be alleviated with certain measures (e.g. usage of public funds).

Moreover, the report showed the high costs of not investing enough in grids leading to long connection queues with negative effects for businesses and industries, to fewer RES being fed-in, thus, entailing economic losses and lower employment rates. The report also demonstrated that **regulation can no longer only focus on short-term cost-efficiency** and lower electricity prices for consumers but must ensure a long-term stable electricity system that is equipped against potential threats and crisis to ensure a reliable supply to industry and households. Customer protection does not mean the lowest costs in all situations, but also the reliable availability of assets and services when needed, including a fast handling of connection requests.

Recommendations:

To ensure DSOs can live up to their role they need **the right framework in place at the EU and national level**. Given the local and national character of DSOs the right balance between direct EU-action and national solutions will be central. Therefore, it will be important to 1) ensure **implementation of existing EU legislation** (e.g. anticipatory investments) **and strengthen EU guidance** for the national level and 2) **improve alignment** between the different levels and foster cooperation and exchange on good practices. DSO Entity will be a key-actor in actively supporting and facilitating such exchanges.

<u>In general, the following points for more EU support can be mentioned:</u>

- **Clearer EU guidance for NRAs to guarantee the right investment climate for grids at the national level:** The EU-level should give clearer guidance to NRAs to ensure that grid investments are aligned with the European Climate and Energy objectives as well as prepared for increasing needs for climate adaptation and prevention of physical and cyber-attacks. This can be done by either providing guidance(s) for implementation by the NRAs of Art. 18 of the Regulation 2024/1747/EU or by revising the article in itself.
- **Ensure the implementation of European rules** (e.g. anticipatory investments): Regulatory frameworks need to adapt towards a more long-term, forward-looking and anticipatory approach and ensure predictability and competitive remuneration.
- **Greater focus on DSOs in EU funding and financing (MFF):** 2/3 of the needed grid investments will be at the DSO-level which has not been in the focus of dedicated EU funding support. Given the relevance of DSOs for the delivery of the EU's objectives, greater focus should be put on DSOs as a strategic sector in a potential EU Competitiveness Fund, in the CEF-E and/or ear-marked funds for DSOs in funding projects[37].

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[37] EU DSO Entity (2025): Public Funding for DSOs. Findings of a questionnaire launched by EU DSO Entity. June 2025. Availalbe online.

- **EU leadership and support on strategic topics with geopolitical relevance:** Strategic and complex topics such as reliable supply chains, accessible raw materials, or simplified EU public procurement rules are areas where active EU-action and support are needed to ensure the right conditions for DSOs on the ground. EU-support on the topic of skills and staffing should also be provided as targeted strategic sector identified in the Union of Skills by launching a European Grid Skills Academy within the framework of the EU's Net-Zero Industry Academies.