DSO ENTITY
DSOs FOR EUROPE

Anticipatory Investments

AN INITIAL REGULATORY DISCUSSION

TASK FORCE IN INVESTMENT FUNDING AND FINANCE

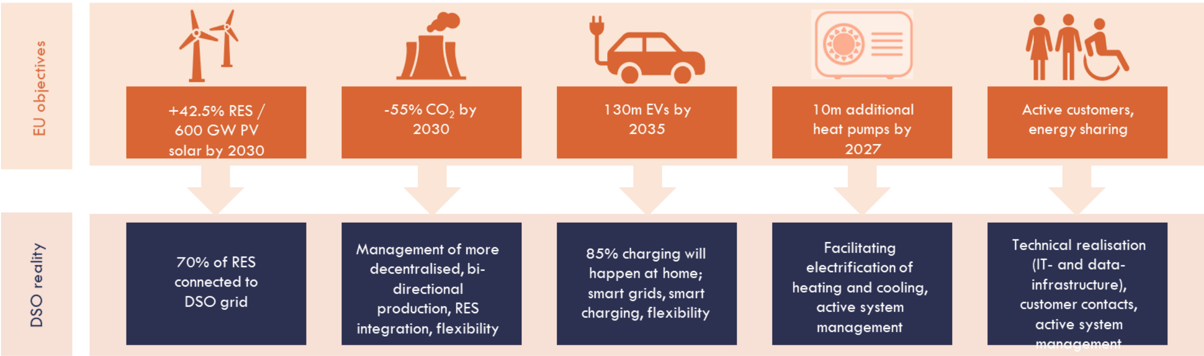
February 2025

Contents

Editorial note: This paper was developed by Task Force in Investment Funding and Finance to support the European Commission in the delivery of guidance identifying conditions under which the approval of anticipatory investments should be expected as requested in Task 4 of the GAP. Paper submitted to the European Commission on the 20 December 2024.

Setting the background

The next few years will be crucial to ensure that the EU countries will be able to reach the ambitious net-zero goals set out by the European institutions. The invasion of Ukraine by Russia has underscored the urgent need of accelerating the energy transition, for reaching carbon neutrality and ensuring strategic independence for the continent. To achieve this objective, a few targets have been introduced:



By 2030, with a 42.5% increase in Renewable Energy Resources (RES) and 70% of total RES connected to Distribution System Operator grids, DSOs face a transformative challenge. This "generation" challenge is further amplified by a surge in demand for electricity coming, among other from the electrification of transport (with an estimate 130 million electric vehicles, with 85% of charging occurring at home and a surge on electric busses and trucks) of heating (with additional 10 million heat pumps by 2027) and large industrial process including data centres[1], all presenting an invigorating opportunity for DSOs to innovate and adapt.

To obtain these objectives, estimates suggest that between now and 2050, around € 55-67 billion/year of investments will be required to make the European distribution grid fit for the exponential increase in demand of electricity.[2] Therefore, forward looking planning, able to trigger investments in the right direction, will be of utmost importance.

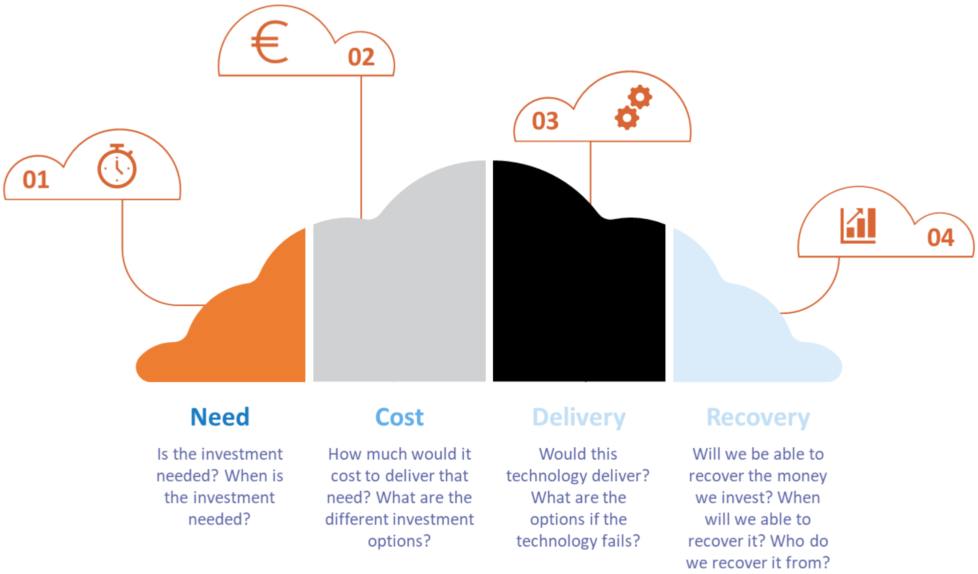
This planning is one the legal requirements faced by DSOs at a European level. Furthermore, consistently with the proposals put forward by ACER in its 2024 Monitoring Report,[3] when doing this planning, it will be important DSOs face regulatory models with incentives for efficient investment levels.

---

[1] Data centers represented between 1.8% and 2.6% of the total EU electricity use in 2022. Estimate providing in, Kamiya, G. and Bertoldi, P., Energy Consumption in Data Centers and Broadband Communication Networks in the EU, Publications Office of the European Union, Luxembourg, 2024, doi:10.2760/706491, JRC135926

[2] Eurelectric, 2024 Grids for speed. Available in https://powersummit2024.eurelectric.org/wp-content/uploads/2024/07/Grids-for-Speed_Report_FINAL_Clean.pdf

[3] ACER, 2024, Electricity infrastructure development to support a competitive and sustainable energy system: 2024 Monitoring report. Available in https://www.acer.europa.eu/monitoring/MMR/electricity_infrastructure_2024



When planning their investments ahead, above all in a long-term time horizon, DSOs decisions are based on four main types of considerations: 1) those related to whether there is a need for the outcomes the investment (e.g. new assets and/or modification of previous assets) could deliver 2) those related to the overall cost of the investment (i.e. selection of the most efficient approach to deliver those needs (e.g. provide capacity, increase efficiency, use of flexibility or new investment requirements) 3) those related to whether the outcome of the investment is the expected (e.g. the investment was expected to reduce losses in a 10% using a new technology but in practice it only reduces it in 8%) 4) those related to the recovery of the investment over time (including all aspects of renumeration like WACC; depreciation schedule etc.).

The significant changes in the sector discussed above will increase the complexity of these considerations as it will require to consider the evolution of a more uncertain future. Therefore, the objective of this paper is to identify how an anticipatory approach to investment made by DSOs could be implemented with the goal of sketching a scenario where DSOs are put in the conditions of taking the efficient decisions that safeguard consumers as well as the competitiveness of the European industry.

Finally, this paper would also stress the important relationship between the anticipatory investments approach and the transition to net-zero while maintaining the competitiveness of the European industry. Sufficient power grid capacity is identified as the enabler of the energy system, renewable power generation to clean mobility, heating and cooling, the electrification of the industry and the innovation concerning new business ideas (e.g. new solutions for the provision of flexibility to the system). The Grid Action Plan (GAP) states that electricity production & consumption is expected to increase 60% between 2023 and 2030. As noted in the GAP, the shift of gear necessary to achieve an accelerated transition is so significant that dedicated policy makers' attention is required to ensure that grids are an enabler and not a bottleneck of the transition. The development of the power grids needs to happen as soon as possible to be in place and ready for the energy transition.

Definition of anticipatory investments

The EU objectives and goals for the future send a simple yet powerful message with the GAP: there is a need to rapidly expand and upgrade our power grids. In this context the concept of **anticipatory investments** has emerged as a simple solution to the complex energy challenge.

There is no set definition for anticipatory investments and, as a result, different stakeholders have interpreted this concept differently. Therefore, this section introduces DSO Entity's definition of anticipatory investments:

> *Anticipatory investments are those resulting from a process aimed at identifying and executing investments that proactively address expected developments, looking beyond immediate needs of generation or demand into the mid and long-term while assuming with sufficient level of certainty that new generation and/or demand will materialise, even if potential low utilisation could arise in the short term, and considering the negative impacts of delaying the decarbonisation process due to a lack of grid capacity as well as the increased costs of expanding in several stages.*

In this context, the successful implementation of an approach to planning and execution of investments based on this approach can generate positive scale economies and externalities in the investment process and towards various stakeholders that will be enabled to transition to net-zero making use of the additional capacity provided.

This definition builds on the one proposed by Eurelectric[4] but it is modified to highlight some additional aspects to further capture the full essence of the concept:

- This definition puts emphasis on the process necessary to identify and deliver investment needs, rather than the investment projects in themselves. Anticipatory investments are not a new class of investments. This is rather an approach to identify and execute investment needs resulting from a process proactively focusing on the optimal delivery of a faster transition to decarbonised energy systems. This process has a long-term perspective of the expansion needs of the grid and involves the requirements for the energy transition.
- The introduction of this approach to planning and execution of investment will also facilitate the planning of other parties in the sector. For example, some new service providers could identify more easily whether future grids will be able to support their new business model. As a result, they can reduce the uncertainty they face and, potentially, help them to obtain the funding they will require.

To provide more context on the planning activities it should be borne in mind that, any DSO that performs its task in a prudent manner will include some anticipation in its investment decisions. Any new asset is not "tailor-made" to the current needs only, but certain reserves are being built-in to cater also to future developments and in general to ensure network security and resilience even under outage.

However, prudence and a "natural" headroom in investment decisions alone might not be enough considering the challenge ahead. Therefore, in some cases, a broader approach should be considered.

However, before identifying requirements (ideally using scenarios about the future), it will also be important to identify different types of investments when taking an anticipatory investment approach.

[4] Eurelectric (2024) "How can DSOs rise to the investments challenge?" Available in https://eurelectric.org/wp-content/uploads/2024/06/how-can-dsos-rise-to-the-investments-challenge-implementing-anticipatory-investments.pdf

The table below shows a non-exhaustive list of project categories that could have an anticipatory investment component.

#	Example	Examples of typica investments
A	Preparing for swift future capacity increases	Putting down extra tubes in ditches, buying an extra-large plot of land[5] when preparing for a substation, installation of larger pylons, etc.
B	(Re-)Investing with higher capacity assets	Typically choosing a component (cable or transformer) with X% more capacity vs. what is needed "today" to build for the future
C	Adding additional assets in existing grid	Enforcing the existing grid (in existing geography) with more assets that will not be critical for operations today – but as they are taken into operation – they will be used since it's a grid etc.
D	Adding additional assets in non-existing grid / geography.	When taken into operation, these assets will not be used since no customers/producers are on the other end. For example, when new population centres are expected in an area, DSOs could start building the basic grid to facilitate a fast deployment when necessary.
E	Reinforcing the resilience of power networks	Delivering grid reinforcements aimed at facing and mitigating the impact of climate change of infrastructure or increase cybersecurity.

These examples illustrate different actions that DSOs can perform that enable producers or consumers to access grid capacity when required. These examples have different attributes and therefore they serve as good starting points for identifying minimum requirements:

- The (A) type illustrates cases when DSO brings forward investments leveraging current opportunities such that it can reduce long-term costs and/or construction time. The opportunity will probably not come back (the road/ditch is closed, and the plot of land is no longer available). Therefore, flexible requirements are needed to facilitate that DSOs can use these opportunities when delivering the efficient long-term solution for consumers.
- The (B) type takes the discussion a step further and has an impact on the capacity of the chosen component. One must keep in mind that the lifetimes of traditional power grid assets typically range from 35-60 years and that it is not always possible (due to operations and/or space aspects) or economically sound to return and re-do an investment when only half of its age has passed. Therefore, DSOs' investment should be developed with a requirement to achieve a long-term view to ensure overall efficiency.
- The (C) type could be needed as a complement to (A) and/or (B) depending on the redundancy and operations situations. If the existing grid is relatively new and the assets have a remaining lifetime, it might not be optimal to re-invest. Given an expected future need it could instead be suitable to solve the situation with another component and at the same time increase system redundancy allowing existing assets to be less critical for the system.
- Type (D) brings examples where investments are required to ensure future connections or grid features are available when required. The consumers to use that grid/feature are still not connected to the grid and, as a result, will not be paying for the development of the assets. However, given the long process required to develop these assets, investments need to start in

[5] This is also why "grid mainstreaming" should be considered. In a society that is more dependent on electricity all stakeholders must consider their future electricity needs in their regional and spatial planning activities.

those areas potentially subject to renewable, urban or industrial development, before there is a concrete and current demand for them.

- Type (E) includes investments required to ensure grid resilience. These are investments that are undertaken to ensure that the grid adapts to new climate challenges. Therefore, by definition, they should be developed before they are required and with limited relation to demands from the consumer.

As a result, an approach using anticipatory investments needs to be understood in a way that leaves room for a DSO-oriented implementation, i.e. an approach that leaves DSOs the capacity to invest when the right approaches are identified. This form of implementation would facilitate that investments plans are modified when new information becomes available. As a result, if new information becomes available showing that demand is higher/lower than initially expected, DSOs can modify their investment plans to ensure their costs remain efficient (i.e. costs are only incurred if, according to the most recent information, they remain necessary.)

Usually, a good starting point for this is the DSO (longer term) planning as provided for in the Directive (EU) 2019/944. In case such planning exercises are not available, anticipatory investments could still make sense considering the avoidance of the negative impacts resulting from delaying the decarbonisation process due to a lack of grid capacity reducing congestions and curtailments, achieving the potential efficiencies of economies of scale (e.g., components standardisation and larger production scale, etc.) or other kind of "externalities" (e.g. technology developments, increased options for time optimisation of actions, reduction of future Redispatch costs etc.). In such cases, grid investments have "an option value" that can justify their construction.

Keep all investments competitive

While it is important to adapt national regulatory frameworks to use an approach considering anticipatory investments, it is also important to take the time to develop the right changes. From an investors' perspective the overall return the DSO can generate is decisive for the attractiveness of a possible investment. DSOs do not use regularly "project finance" (i.e., a direct connecting between a group of investors and an identifiable asset). Therefore, investors will consider the profitability of the DSO.

When evaluating the potential changes to the current regulatory frameworks to adapt it to an anticipatory investment approach, NRAs should consider that all investments (past and new) need a competitive remuneration and security/predictability about future earnings to facilitate that DSOs can have efficient access to financial markets to obtain the funds they require for their investments. Furthermore, when considering these potential changes, one also need to consider that, especially in the first 5 to 10 years of higher investments (i.e., clearly above depreciation), the current RAB will remain larger than the investments that are being added. Implying that the return that is being generated on the current RAB is decisive for the DSO's financial performance and health also going forward.

The situation might be different for individual DSO but with regards to the European industry on average Eurelectric's Grids4Speed results suggest that the overall cost base (after depreciation) will less than double of its current size until 2050[6].

---

[6] Eurelectric, 2024 Grids for speed, p. 54.

In addition, to ensure that DSOs can have access to enough funds, a balanced regulatory framework that provide the right incentives as well as a competitive interest rate (WACC, RoE), is needed. Such funds should cover at least:

- all investments of the past (the non-depreciated stock of capital in the RAB)
- all replacement investments; and
- all new investments (simple expansion or anticipatory).

Of course, the differentiation between those types of investments is not always clear cut as (especially when strategic oversizing takes place) many replacement investments will also include some expansion/anticipation.

In this context, to ensure that DSOs are in a position to deliver consumers' needs while managing effects on competitiveness and affordability, de-risking anticipatory investments (or any investment) is a necessary task but de-risking investments by itself would not be sufficient for DSO to continue its investments but the overall solvency of the company should be considered as the capital market expects earnings for the whole RAB that back up the growing debt.

Main challenges with anticipatory investments

To deliver the outcomes required by consumers, companies need to consider the current state of the grid and then identify a range of alternative solutions (including also no new investment solutions). To select among projects that deliver their objectives (e.g. fewer outages or higher resilience), companies (both regulated and unregulated) compare the costs (including financial costs) of delivering them with the revenues they can expect to obtain in return. Only in those cases when companies face a suitable and predictable regulatory framework that would allow them to recover all its costs, they will have incentives to invest.

For regulated companies, the regulated framework set by the NRA will have a strong impact on the revenues DSOs can expect to recover. When considering these revenues, NRAs need to define regulatory frameworks that balance two different effects:

- They should facilitate that DSOs can obtain the resources that allow the deployment of the infrastructure to obtain the energy transition (i.e. the return on capital is sufficient to obtain these resources). Only if companies can obtain these resources, they will be able to deliver the outcomes required by consumers; and
- They should avoid the excessive impact on the consumers (i.e. they should ensure efficient cost expenditure as well as a return on capital that compensate investors for the risks and opportunity costs of their investment).

When designing their regulatory framework, NRAs would need to consider the effect the structure could have on the investment decisions. These decisions could be affected in, at least, two different ways:

- Different regulatory treatment of different types of expenditure (e.g. capex vs opex or new investment vs maintenance) could distort the decision-making process by affecting the revenues that companies can obtain; and
- Different risk allocation between different types of expenditure (e.g. different sharing factors overexpenditure in opex vs capex or new connections vs historical grid) could also distort the investment decisions of the companies. For example, if certain types of expenditure are perceived as having a higher risk, companies could require a higher cost of capital.

Therefore, it is important that the regulatory framework aims to provide equal treatment of all types of comparable investments to avoid biases in the decision-making process as well as ensure a correct balance between risks and cost of capital.[7] Once the core objective is to ensure that consumers satisfy their needs at the lowest possible cost, it will be important that companies can obtain the funds they require with a low cost of equity.

When considering a framework that facilitate the delivery of anticipatory investments for consumers, this paper recognises that NRAs will need to identify modifications required in their tools to ensure their framework still deliver the outcome required by consumers by keeping the balance between efficiency investments and operations and the capacity of the companies to invest in the necessary assets to provide the services demanded by consumers.[8]

Finland: Obstacles to a HV built-out due to regulation

To illustrate the importance of a setting a clear framework at the outset can be found in Finland, where the NRA's interpretation of the current legislation states that a connection line includes all grid components serving only one customer. If there is clear potential for additional customers, Finish HV grids can be seen as part of the DSO business upon ex-post approval from NRA. Therefore, when building a HV grid for just one initial customer, there is a risk that it to be seen as a connection line and excluded from RAB, i.e. the consumer could face the option of paying for the whole reinforcement (including the HV component) or reconsider its location. If the DSO wants to avoid this risk the first customer is connected to the MV grid and only when more customers want to connect and the area cannot be served efficiently with MV grid, the DSO builds the HV grid and a 110/20 kV substation. From an anticipatory investment perspective, it is obvious that in many cases the best solution would be to build the HV grid and 110/20kV substation directly if the DSO estimates the potential for new customers to be high enough. There is a legislative development ongoing to address the connecting line definition, estimated to be ready by end of 2025.

Potential conflicts between traditional (efficiency driven) regulation and anticipatory investments

The use of the long-term forecasting horizon coming with an anticipatory investment approach is important in a situation where significant changes are being introduced in the sector. Considering the stability of power systems for the past decades, NRAs have turned economic regulations towards incentivizing cost efficiency, resulting in cautious investment processes and stable tariff development. However, regulatory frameworks designed for stable energy systems need to adapt to fast expanding electricity networks with mid- to long-term objectives. Therefore, the introduction of an approach to investment needs identification and implementation based on anticipatory investments would require a re-consideration of the tools being used by NRAs to ensure that they are still appropriate to guarantee DSOs have access to the resources necessary for the delivery of these new investments.

This, however, should not imply an elimination of the need and legal prerequisite to give (efficiency) incentives but it should ensure that the regulatory tools are adapted to recognise the new conditions of the sector.

[7] Contrary to ACER 2024 Monitoring Report, the introduction of biases towards non-wire alternatives seems inappropriate in a system that is aiming to achieve the most efficient long-term solution for the overall system.
[8] This is consistent with ACER 2024 Monitoring Report

When considering the potential changes required to facilitate the creation of a framework that facilitates anticipatory investments, regulatory frameworks could be divided into three large areas: cost evaluation, transformation of costs into revenues and provision of incentives. Additionally, potential changes to tariffs structures (e.g. connection charges) should be considered to ensure that there are no barriers for those investment.

Cost evaluation

Multiple stakeholders identify anticipatory investments as the most cost-effective strategy for future distribution growth, due to the related cost reduction and the scale economics and externalities it generates. However, a number of potential regulatory barriers have been identified for the introduction of these costs into the regulatory framework.

Time delays in cost recognition

As the CEER regulatory report[9] and Eurelectric[10] show, a considerable number of DSOs still face a delay between the moment they perform an action that will change their costs (e.g., an investment in an asset) and the moment this action is reflected in their revenues. Once these adjustments are not done in a NPV neutral way, they will be in a disadvantage for the DSOs in a situation where the grid needs to grow (heavily). This time delays can apply both to opex and capex and can have negative effects on investments independent of the cost dimension they occur in. These effects are discussed in the following sections.

Issues in Capex

One example of time delays in the cost recognition of capex can be found in Spain. There, the Directive 2019/444 provisions on distribution network planning, is based on a short-term cost recognition basis. In addition, the current regulation forces an annual investment cap (based on a percentage of GDP) that prevents investments other than urgent and vital grid renewal and reinforcements to connect customers with firm requests according to the NRA's assessment.

Another example is when the regulatory framework requires that investments are fully delivered before they can be included in the RAB. Financing work in progress can result in significant costs for the company specially when developing long-lasting, complex projects.

This is perhaps less problematic if a grid is stagnating or shrinking but becomes an issue if the grid grows. A grid that needs to grow physically, as it is the case of distribution networks in the next decades, will most probably also need to grow economically (i.e., a growing grid length or rising numbers of transformers will be reflected in a growing RAB). For the RAB to grow, one condition must be met: The amount of money that is being invested is larger than the cumulated depreciation the DSO receives from the RAB through its revenues (Invest>Depreciation).[11]

---

[9] CEER, Report on regulatory frameworks for European energy networks 2023, available in https://www.ceer.eu/wp-content/uploads/2024/04/RFR23-Main-report.pdf

[10] Eurelectric, 2024 Grids for speed page 64

[11] In the language of the accounting or controlling department the business is "cash negative".

If that condition is met the amount of capital the DSO needs to finance the investments can only be funded if:

- the DSO uses part of the interest rate payments that is in the regulated revenues to finance the investments (it lowers its real return);
- the DSO's owner(s) provide fresh (equity) capital every period where Invest > Depreciation holds[12];
- the DSO can borrow additional funds;[13] or
- any suitable combination of the above.

If the regulatory regime the DSO operates in now entails a time-delay in the recognition of investments (ongoing and finalised) this time delay implies that investments do not create any additional revenues immediately which, if not done in a NPV neutral way, will affect the capacity of the company to recover its costs (including the financial costs). Especially if the RAB is growing this is problematic as a larger amount of revenues will not be recovered and/or funded. Furthermore, this will have other adverse effects such as:

- key financial indicators, such as the relation between EBITDA and debt, deteriorates with every investment undertaken (and will only return to more normal levels after the next round of cost audit/recognition);
- the return from the single investment is zero until the asset is included in the RAB (as adjustments are not NPV neutral);
- the return per unit of RAB deteriorates too; and
- in some regulatory regimes the "loss" that is being incurred between the moment of investment and the next cost audit will not be made up 100% later as the net present value (NPV) of a payment in 35 to 40 years' time is smaller than the NPV of a payment that will occur in the next 5 years.

Therefore, because of these effects, investments might be undertaken on a suboptimal level as DSOs cannot cover their financial costs. Recognising that decisions to incorporate into the RAB could take time, one option would be to ensure that any delay does not affect to the capacity to recover efficient costs from consumers. To achieve this, regulators could include in the RAB the financial costs companies had to face while waiting to start recovering these costs (i.e. before they are included in the RAB) and / or allow for the ongoing work to be incorporated into the RAB (without ex-post reviews).

Recognising this effect, many regulatory regimes have been working in the past 10 to 15 years to shorten or abolish any time delays in investment recognition. Quite a few solutions[14] exist do so and they are being discussed in TF FIN's regulatory paper. However, this issue is not being addressed in all countries. For example, data assembled by Eurelectric[15] identifies two countries[16] out of 17 where the DSO are still facing time delays[17].

In addition, and contrary to the data assembled by Eurelectric there is at least one more major member state where time delays in CAPEX recognition continue to be a problem but is listed as adjusting CAPEX.

---

[12] B) therefore resembles A) much more than one might think at first instance because B) implies that the owners are willing to give part of their dividends/profits back into the business. Any kind of equity increase can also be sub-ordinated to category B).

[13] To be able to do that the amount of debt already accumulated and the relation between e.g., EBITDA (equity before interest, taxes and depreciation) and debt becomes relevant (i.e. debt ceiling)

[14] Using planned cost on a t+0 horizon plus an ex-post control of actual investments is an obvious choice.

[15] Eurelectric, 2024, Grid for speed

[16] The countries according to Eurelectric are, Sweden and Portugal. At the time of writing, regulatory reform is being discussed in Sweden and has mostly been agreed in Italy that should solve these issues. Grids4Speed, p. 63.

[17] Another example is in one country where in 2024, the regulator is considering the 2020 remuneration that will aim at recovering investments in 2018.

Issues in OPEX

Any asset that is put onto the system will also require OPEX going forward once that it needs to be operated, supervised and maintained. If the DSO was supposed to carry that burden alone, the "missing" OPEX might already be enough of a disincentive causing DSO to refrain from specific investments. This effect could be exacerbated for innovative solutions once they have the tendency to be more "OPEX-heavy" than traditional solutions (e.g. use of flexibility to avoid specific investment).[18]

Efficiency considerations

With the objective to protect consumers, NRAs need to ensure (now and in the future) that the expenditure of the companies is efficient. This analysis should not only apply to operational and capital expenditure, but it would also apply to the financial costs of the company.

When evaluating whether these costs are efficient, NRAs have developed different methodologies. Most of these methodologies use historical information to extrapolate what an efficient level of expenditure should be for a company. For example, an NRA could decide that certain unit costs should not increase in real terms. When the industry is undertaking a fast-growing process, however, this approach fails to consider that these costs could increase in the short term as they will include investment to accommodate future outcomes. Therefore, by not accounting for these outcomes, they could classify costs resulting from anticipatory investments as inefficient. These methodologies assume a high level of stability in the industry which results in historical information being an indicator of future performance.

This effect, however, could also apply to a common tool used when estimating financial costs: the Weighted Average Cost of Capital (WACC). When evaluating some of the components of the WACC, regulators consider past performance of the sector which would only work if the financial needs of the sector and the risk it faces are not affected by changes in the sector (i.e. if the financial needs and/or the risk level faced by DSOs is affected by changes in the regulatory framework, NRAs should be consistent and evaluate their WACC calculations).

Efficiency benchmarking as a possible obstacle to anticipatory investments

As described above it is the task of the NRA (and it should remain) to ensure the efficiency of the DSO's behaviour and spending. The way NRA go about this task is different across Europe and the differences reflect the different industry structures (e.g., one major DSO vs. many) and other regulatory considerations. If the NRA has more than one DSO (or more technically speaking decision making unit) to regulate comparisons between different companies become possible and are usually part of the regulator's toolbox.[19] These comparisons come in different forms and can be based on different technologies which have been subject to extensive scientific research in the past.[20] The literature cannot be reviewed here and does not need to be as the underlying problem can be described in more general terms.

It is the aim of the regulatory innovation to incentivise system operators to engage in investments early on the transition to net zero as this behaviour is expected to achieve long-term efficiency (i.e., its efficiency will prove only later).

---

[18] One obvious example for this is the ICT cost that come with more smart solutions and that will increase external spending e.g., for (broadband) connectivity.

[19] One might describe the logic as follows. By using an ex post benchmarking approach the NRA pushes part of the uncertainty about the efficient cost level back to the regulated entities. Any single DSO cannot be sure about the behavior of its competitors in the last period (did their costs move faster or slower?) and therefore has an incentive to develop its own costs in an efficient manner.

[20] For example, Coelli et al. (2005): An Introduction to Efficiency and Productivity Analysis; Agrell, P. and Bogetoft, P. (2017), "Regulatory Benchmarking: Models, Analyses and Applications", Data Envelopment Analysis Journal: Vol. 3: No. 1–2, pp 49-91

If the regulatory innovation is successful, this implies that, all things being equal, at least some system operators will undertake more investments at any given moment in time than otherwise. More investments also imply more capital costs (at least depreciation and interest) – especially as it was argued here that any time delay between the moment of investment and the recognition of the corresponding cost needs to be avoided.[21]

If system operators engage in anticipatory investments in a different manner, which is highly probable considering their different challenges and supply tasks in the energy transition, they will be subject to a changing profile in terms of costs (e.g. more anticipatory investments imply, all things being equal, more investment in the short term and capital costs). Therefore, if two otherwise identical DSO were compared in terms of cost the one that has engaged in more anticipatory investments will potentially be considered as inefficient.

The situation is made more complicated by the fact that most efficiency benchmark methods analyse cost levels by setting them in relation to certain pre-agreed (endogenous) cost drivers (e.g., maximum load, maximum feed-in, kWh transported etc.). This constitutes a problem if the comparison undertaken by the NRA also analyses capital costs as it will be the nature of any anticipatory investment that the demand or feed-in that is intended to be fostered by the anticipatory investment will only arrive later i.e., the additional capital costs are neither justified by observed additional kWh on the system or additional loads (kW).

Therefore, the following should hold true independent of the actual benchmarking technology used by the NRA: If any comparisons/benchmarks also include capital costs and if DSO engage in anticipatory investments in a differentiated manner, then the anticipatory investments will potentially have a negative influence on the efficiency score/relative performance of any DSO engaging in anticipatory investments. This creates a negative incentive for DSO to engage in anticipatory and needs be avoided.

The relevance/magnitude of any disincentive that might occur cannot be described ex ante as it depends on the number of DSO that are being benchmarked, the number of parameters (cost drivers) that are being used in the comparison, the velocity with which any new infrastructure is used, the question whether actual or normalized costs are being benchmarked etc. It is however highly advisable that in markets where an efficiency comparison or benchmark is a (major) part of the regulatory toolbox, an analysis of potential (adverse) effects is undertaken before the first anticipatory investments happen and the next comparison is being run by the NRA.

In addition to the issues discussed above, efficiency benchmarking methodologies could constitute a barrier to investment if they do not provide consistent results over time. However, entering in detail in discussion on these methodologies is outside of the scope of this paper.

[21] One might conjecture that a "comparison problem" should only exist with regards to capital costs or should be irrelevant if benchmarking only operational expenditure. This will only be true if the anticipatory investments to not drive operational expenditure in a manner that is also able to disturb the cost observations made by the NRA.

Transformation of costs into revenues

One component of that methodology will be mechanism to transform efficient costs into regulatory revenues. If that mechanism results in situation where the company faces a risk of not recovering some of these costs (e.g. investment above the regulatory caps in Spain), this could affect the overall decision and capacity to finance the activities without increases in the financial remuneration required to compensate for that risk.

Taking the longer forecasting period resulting for using an anticipatory investment approach and the longer time of the assets, it is not possible to exclude uncertainty about the forecasts. This uncertainty could be coming from technological, economic or geopolitical reasons which could affect the demand forecast, even if the general trend is clearly a sustained growth in electricity consumption in the coming decades. The allocation of these risks will have important implications in the capacity to invest of the companies. For example, if the NRA introduces all investments in the RAB (using a NPV neutral methodology), the effects of any error in forecasts reside on consumers. However, if, for example, investments would only enter the RAB once the demand has materialised, the risk would reside on the DSO which would either require a higher compensation or it could decide to change the timing of its investment.

Incentives

Introducing incentives for anticipatory investments would be difficult for two reasons. First, as indicated above, anticipatory does not define a new investment class, and must be borne in mind that the frontier between anticipatory investments and regular investments is not, and will never be, a clear-cut easy-to-spot characteristic. Second, specific plans/investments are not always approved by the regulator, as a result, it would be difficult to link incentives and/or penalties to specific projects.

To avoid the reasons in the previous paragraph, all investments (over a certain threshold) could be assigned a continuous spectrum of anticipatory quality ranging from investments that are urgent and unavoidable and others that may be more contingent or with fewer consequences if delayed.

At that point, the introduction of incentives mechanism should be evaluated case-by-case, considering specific types of investment (e.g. incentives dedicated to enhancing grid resilience).

For those projects that have a high anticipatory quality, NRAs could face difficulties in identifying whether the plan was not successful due to factors such as mis-planning, mis-building, lack of information at the moment of approving the project or even force majeure (e.g. flooding or heavy inflation). In addition, these incentives should aim to account for this uncertainty. For example, if it is not possible to separate in between these effects, incentives could be designed with caps and collars that allow for a range of potential performances instead of providing penalties/rewards for every single deviation.

Connection charges

In some cases connection chargers could also constitute a barrier to anticipatory investments. For example, in Spain, the full actual cost of the distribution connection and reinforcement are paid by the individual user (i.e. deep connection based on actual costs). As a result, if the DSO were to use an anticipatory investment approach for these reinforcements, the new connection should pay for all those additional costs which could result in prohibitive charges.

Furthermore, in Spain costs associated with transmission reinforcement are socialized as those costs are introduced into the RAB. As a result, there could be in a distortion as large consumers could ask for a high voltage connection directly from the TSO even if it would be more efficient to connect to the medium or low voltage grids.

Hence, anticipatory investment requires either the socialisation of grid reinforcement costs through shallow connection charges or, as it is the case in Denmark the use of deep charges but based on standard costs (opposite to actual cost) connection charges. The latter has the advantage of keeping cost reflectivity while removing the “first mover disadvantage” that can be observed with real costs.

Potential ways of reaching the right level of investment

Given that anticipatory investments are identified as the most cost-effective developing grid strategy, the benefits of developing economically efficient, transparent and proportionate regulatory treatments of anticipatory investment will be a vital and necessary requirement for DSOs to deliver the required grid capability for decarbonisation, decentralisation and digitisation of distribution networks.

To achieve this objective, it is important that the regulatory framework evolves from controlling risks to managing uncertainties. In other words, regulatory frameworks should evolve to facilitate that DSOs can manage the uncertainties arising when delivering the efficiently the investment required by consumers and companies as part of the delivery of the energy transition. Among other objectives, this would facilitate that DSOs can support in managing the risks unit costs increase/decrease if demand is over/under forecast.[22]

By facilitating that DSOs can manage the timing of its investments, it would be able to manage demand risks by avoiding investments that could be identified as unnecessary as new information becomes available.

In parallel, however, uncertainty should be managed by employing a number of measures including using governmental and European policy targets as one of the key inputs to enable societal decarbonisation and needs to be ready for consumer requirements. When setting these targets, it would be necessary to consider the potential effects the delivery of those targets could have on the competitiveness of the European industry.

Therefore, when considering potential ways of facilitating anticipatory investment, solutions could be grouped into three main areas:

[22] The risk of over-forecast of demand is identified as a major concern in ACER 2024 Monitoring Report.

- Removal of barriers;
- Reducing of uncertainty by improving information; and
- Introduction of a correct balance between risk and reward.

These options should be considered as a whole to ensure the anticipatory investments required to ensure a net zero energy system. Furthermore, it is important that NRAs work with DSOs and other stakeholders to ensure these measures will be effective in the delivery of the investment necessary.

For clarity, each option will be discussed in more detailed in the following sections, but they are not mutually exclusive, and they should be considered in combination.

Removal of barriers to introduce anticipatory investments

As discussed above, in some Member States there could be some potential mechanisms that provide disincentives to the development of anticipatory investments. The objective would be to adapt these mechanisms to facilitate the introduction of this long-term view to investments. Therefore, each NRA could consider which one of these barriers exists in their regulatory framework and how they could be addressed.

Once said that, achieving the assessment of the maturity/certainty of investment should be the result of an evolving regulatory framework. As said above, anticipatory investments do not constitute a new type of investment and, as a result, they should be treated as any other investment (e.g. incorporated into the RAB in the same condition as other investments).

However, this does not mean that no changes are required to the way that expenses are considered in the planned/allowed revenues. Economic regulation will need to evolve to facilitate this approach, and as previously explained, recognize the “option value” of anticipatory investments to facilitate energy transition, or the achievement of scale economies or other “externalities”. For example, when considering the need for an investment, it would be necessary to take a longer-term vision. Furthermore, efficiency evaluations will also need to consider the opportunity costs of not undertaking the said investment. For example, 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).

When necessary, NRAs could need to consider the possibility of introducing additional uncertainty mechanisms, i.e. regulatory tools that allow the better management of risks inside of a regulatory framework. There is a large range of such tools regulators could implement.

When implementing these mechanisms, regulators should tailor them to the relevant needs of the case.

A detailed discussion of relevant approaches to changes in the regulatory framework to address the barriers identified above is outside of the scope of this paper and it could be considered in future documents. However, when considering these modifications, it is important to find a balance between complexity and accuracy. For example, when considering how to identify the relevant opex to be included in the regulatory allowance, instead of a detailed analysis of these costs, it would be possible to just include a surcharge to the capex investment in the following years.

Germany: Investment measures

This was the case in Germany where, before the so called "capital surcharge model" was introduced for the German TSO too, their investments and eligible DSO high voltage (110 kV investments) were financed via a mechanism that was called "Investment measures". Like the name implies it was concentrated on identifying individual measures of enhancements needed on a project level. Identified measures were "allowed" and financed via additional revenues by the German NRA under certain restrictions. As a standard the additional cost allowance included a surcharge of 0.8% of the capital costs incurred to cover additional OPEX (c.f., § 23 1a of the old German Anreizregulierungsverordnung) that is albeit not used any longer.

Any such surcharge would need to be granted until the DSO applies and gets the next cost allowance that would include the actual additional OPEX. Another option would be to identify "projects" and create costs allowances for those projects that would also include a prognosis on the additional OPEX (in this case an ex-post-control of the actual values against the prognosis is warranted).

Reducing of uncertainty by improving information

Increase in uncertainty is one of the main effects of the introduction of longer-term forecast horizons. Therefore, one of the options to facilitate the management of these uncertainties is to develop robust assessment of these future needs based on the best information available.

For a start, it will be important that DSOs ensure the use of a data driven approach to asset management to optimise utilisation of existing assets (e.g. asset health index). This information will constitute the base of any process that is used to identify future needs in the grid.

Detailed long term load forecasting by DSOs is required to predict anticipatory investment requirements and facilitate regulatory monitoring. When modelling information to identify future needs, it is necessary to tailor it to the actual expected investments as the information and data available to inform the investment decision process can differ significantly when it comes to, for example, aggregated growth from many small customers versus large capacity requirements from new large customers. The expected location of new consumers can be difficult to forecast (especially if we consider a 15 to 20 years horizon) but their requirements can be forecast with a relatively deal of certainty which makes it is possible to detect the cables and secondary substations that need to be replaced or supplemented before it becomes critical. This is sensibly different from large customers (e.g. a 50MW a district heating plant or a 10 MW a charging station). In such a situation existing data cannot be used to predict whether the charging station will be situated at a truck stop on location A or the next truck stop 50 km further down the road.

Here the DSO depend on market dialogue with the relevant players to be able to identify both potential growth and location of that growth in advance.

France : 'Schémas Régionaux de Raccordement au Réseau des Renouvelables

This is the French regional Framework to connect renewables (S3RENR). This framework allows for a global optimization instead of a series of local optimization at each connection application. It provides to project developers an even playing field and visibility with respect to the connection costs. Moreover, the S3RENR framework provides a solid basis for the implementation of an approach based on anticipatory investment as it facilitates that investments on new connections can start as soon as the need is identified.

To achieve this planning, the analysis is done in stages. In a first step, TSO localises all potential projects over an entire region and over the medium-long term while ensuring consistency with the National Energy and Climate Plan (NECP). Then, TSO and DSO jointly optimise the HV network and HV/MV primary substations (including flexibility capacity) to connect the entire pool of projects as defined in step 1. This step yields a list of reinforcements, their overall cost and enables to define a regional proportionate connection cost (k€/MW).

As a result of these differences, these forecasts will need to consider a large range of potential information, in addition to direct information from stakeholders. For example, load forecasting will be informed by European and governmental policy requirements, economic growth (both regional and national), new housing requirements and population growth as well as the load growth required to enable low carbon technology adoption and renewable energy capacity increases.

DSO will need to incorporate a myriad of input factors to develop granular load growth models which form the basis of determining anticipatory investment requirements.

Factors such as but not limited to the uptake of low carbon technologies over a long-time horizon, customer behaviour and economic growth are not in the control or remit of DSOs and so the associated uncertainty of load forecasting over a longer period, contains more inherent uncertainty for DSOs than the shorter forecasting periods typically studied by DSOs.

The main potential tool to identify these investments and their associated needs/risk would be the Distribution Network Development Plans (DNDP). The DNDP is defined as a transparent and collaborative process, with participation of stakeholders, coordination among system operators and monitoring by authorities. Even if these documents should not be legally binding, they should constitute the best available information to identify the investment needs. However with accelerated electrification a much more continuous and ongoing monitoring of our grid data and interaction, especially with large customers, is needed to reflect the changes in demand and to adapt the investments decisions to these requirements as swiftly as possible.

Many DSOs are required to regularly develop these plans to identify their investment needs over a long-term horizon. Their provisions and projections should be adequately supported for all kinds of investments above a relevant threshold, independently of their planning horizon, following the methodologies in place by NRAs. Hence there should be no difference between “ordinary” and anticipatory investments regarding their inclusion in the RAB.

In all instances, these plans should build based on the NECP hypothesis to ensure they are consistent with the national objectives. Equally, governments should also recognize and consider the needs of the DSOs in a sufficient way which is not always the case.

The accuracy of any assessment of mid- and long-term needs depends on the degree of engagement from stakeholders with the decarbonisation / electrification process – i.e., assuming mid- and long-term objectives and producing the corresponding planning. Therefore, it is important that this engagement is robust.

Even for those projects that the DNDP identify as future needs, anticipatory investments could still make sense considering the avoidance of the negative impacts resulting from delaying the decarbonisation process due to a lack of grid capacity, losing the opportunity to develop green technologies, reducing congestions and curtailments, reducing the potential of economies of scale, etc. (i.e., grid investments have an option value that can justify their construction).

The development of these regulatory tools would alleviate most concerns identified in ACER 2024 Monitoring Report but creating consistent data which is easy to find by regulators and other stakeholders.

One note of caution, however, is that DNDPs will present the best information at a set point but regulatory frameworks should still be flexible to be able to incorporate new information as it becomes available to avoid inefficiencies to update the investment pipeline.

Introduction of a correct balance between risk and reward

We would like to start this section by indicating that the decision on where and how to invest should remain for the system operators to take. Investment decisions should be flexible as new information becomes available, and they should be rewarded according to the risk they take when investing. In those cases where system operators are required to deliver specific investments, it should not be made responsible for the efficiency of those investments once the requirements were imposed by third parties (e.g. local governments) that decided about the requirements unilaterally.

Uncertainty could result in a case of underinvestment (forecast demand is lower than actual demand) that could require additional investments to deliver the actual demand. On the contrary, if the demand estimate would be above the actual demand, it would result in an over investment (which has a low probability given the size of the investment needs) or stranded assets. In that case there could be three potential solutions:

- Modifying depreciation and other regulatory mechanisms and providing (public) financial tools to support the stability of the tariffs (the government assumes the risk);
- Increase the tariffs (the NRA/consumers take the risk); or
- Clear part of the assets (the company takes the risk).

These alternatives should be considered, in each Member State, at the beginning of the process for the application of the of the anticipatory investments as they are not neutral when it comes to setting the cost of capital.[23] Furthermore, once an investment decision is made, there should be no change in the risk conditions that were defined at the time of the investment. In that sense, accurate forecasting tools play an important role to ensure the accurate sizing of the network considering future evolutions, in a context of increased uncertainty due to new demand-production patterns.

In addition, the development of a regulatory framework when large investments are expected in extension and digitalisation of the grid with a medium/long term should focus on internalising the cost of the reinforcement paid by consumers through network tariffs. There are different approaches in the EU about these tariffs and, specially, about the design of these tariffs. In the context of anticipatory investments would be complex to justify the anticipatory contribution of clients for reinforcements (increase in line capacity, substations, etc) that would not be necessary to satisfy its capacity needs in its own planning horizon.

[23] It is a well stablished fact that the calculation of the WACC by regulators should reflect the level of risk faced by the regulated company.

Once no common approach exists for all members of the DSO Entity, there is a need to rely on specific examples. A first example would be coming from the Netherlands where all investments are included in the RAB even those that are identified after applying an anticipatory investment approach. Other examples are presented in the boxes below:

Denmark: The Green supplement

An official definition for anticipatory investments does not exist, though a political agreement was settled in June 2024 and effective from January 2025, on what is known as the "Green supplement" (in Danish: "Grønt tillæg"). The purpose of the agreement is to facilitate an increment in the revenue cap in three different ways to allow the DSOs to make the large investment decisions necessary for the electrification and the decarbonisation process:

1) by the use of automatic indicators increasing the revenue cap proportionally but only when the electrification occurs (hence the DSOs bear part of the risk of the investments);
2) application-based increment for additional costs related to electrification in the high-voltage grid; and
3) a standard amount allocated to grid companies when they connect medium-sized consumers or when existing medium-sized consumers increase their connection capacity.

The agreement specifically addresses that it should strengthen the possibilities for the DSOs to invest in forward-looking comprehensive solutions that handle current as well as expected future electricity consumption.

Finland: Local interactions

As an example of an area where we recognize improvement potential is the coordination between municipal planning and DSO grid development. When a new housing or industrial estate is being planned, coordination with the DSO should be made at a very early stage. The coordination should include not only the local grid for the plan area but also include an overall view of what is needed as a total. This includes HV connectors, placement of primary and secondary substations and needed MV and LV grid. Often these are handled as separate processes by the municipalities. As a development area for the regulatory model regarding this kind of action should be evaluated to see what kind of time lag might arise between the actual investment cost and the recognition of the asset in RAB. We see that the risk of delays in the completion of the planned housing project might be a barrier for the DSO to build the grid early in the process. The cost associated with the delays could be corrected for in the regulatory model to support this.

Recommendations

DSO Entity has identified a preliminary list of possible good practices to make the level of risk/maturity/certainty of anticipatory investments acceptable:

- **Treat all comparable investments alike**: DSO Entity considers that it is important that regulatory frameworks ensure an equal treatment of all investment possibilities to avoid biases. As a result, all investments i.e., old and new, need to earn an adequate rate of return. However, this is not to say that all regulatory tools are equally effective for all investments (e.g. different techniques could be applied to consider the efficiency of opex, maintenance or forward-looking investments).
- **Regulatory frameworks should be predictable, supportive and provide stability of long-term investments:** This would facilitate investment once that it reduces the risks perceived by external investors. Furthermore, it also facilitates DSOs can take efficient investment decisions that are not biased towards short-term solutions instead of using an anticipatory investment approach.
- **Public funding could be used as a means of supporting the energy transition**: As arisen by the report Grids for Speed by Eurelectric, in the long term, the increase of electricity demand could allow to keep network unit costs around current levels. With the objective of managing affordability considerations,[24] public funding could be used in different ways:
    1) to support on the costs of electrification of residential customers, services and industries. This contributes to increasing the electricity demand and flattens the higher network costs among larger consumption;
    2) to stabilise network unit costs thus minimising the effect of the inclusion in the RAB of the increased investment through anticipatory criteria; and
    3) Synchronise the time of the investment with the time of the increase in consumption. Investments identified using anticipatory criteria could have a low demand in the short-term. Public funds could be used to postpone the effect of these investments on customers' bills.
- **Use the DNDP as a mechanism to develop robust (long-term) information:** The planning horizon drives the amount of uncertainty. The extent to which DNDP identifies future needs dependent on the time frame in focus (the longer the time frame the more prognosis about the future and therefore anticipation is contained). DNDP are not legally binding either for the DSO nor for the NRA (with the notable exemption of Poland). The DNDP serves as a tool for information exchange between NRA, the DSO community and the public. The DNDP therefore clarifies the probable investment needs in some transition scenarios. However, it should not be understood as precise instruction for action especially with regards to timing (when exactly is the gas grid in city A going to be shut down, which renewable acceleration area will open first?). Making the plans more legally binding, especially in the longer term, will create more bureaucratic obstacles than benefits but ensuring they constitute the most robust information available could facilitate the management of uncertainty and risks.
- **Regulation needs to be clearly defined at the outset and balance risk and reward:** Investing in an anticipatory manner implies that there could be a mismatch between planning and actual development. The regulatory framework needs to define at the outset clearly and unambiguously how deviations (underinvestment or overinvestment) are going to be taken care of and that it evolves from facilitate the management of uncertainties that arise from the energy transition. The crucial component is that there is a recognition between the funding costs of the company and the risk it faces.

[24] A well stablished economic regulate is that it is more efficient that affordability considerations are addressed outside of the tariff system via, for example, subsidies for specific consumers. Otherwise, there is the risk that the effects on optimizing grid capacity identified by ACER 2024 Monitoring Report would be watered down and that the incentives of certain consumers are distorted.

- **Planning management mechanisms could be put in place:** When managing higher levels of uncertainty, DSO can revisit the investment being developed and adjust for newer information. These adjustments could support the efficient development of investment projects by facilitating the re-allocation of risks to those parties more able to hold them.
- **Avoiding artificial regulatory barriers to the required investment:** for example, limits to the investments in a certain year. The economic benefits of investing in advance are much higher than the short-term impact on sectoral costs that these policy measures try to address.

About DSO Entity

DSO Entity is a technical expert body mandated by the Electricity Market Regulation (2019/943/EU) to promote the functioning of the electricity market and to facilitate the energy transition. DSO Entity represents around 830 diverse Distribution System Operators (DSOs) connecting 250 million households to the electricity grid in 27 Member States. Among DSO Entity's core tasks are the development of technical rules for the electricity system in the form of Network Codes together with the mandated organisation of the Transmission System Operators (ENTSO-E), the facilitation of renewables integration and the promotion of the digitalisation and smartening of the grid as well as sharing knowledge and best practices.

This paper was developed within DSO Entity's Task Force in Investment Funding and Finance and approved by DSO Entity's Board of Directors (BoD) during the meeting held in December 2024. Once approved, the paper was ready for distribution to the general public in February 2025.