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Commission notice

Guidance on efficient and timely grid connections

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1. Introduction

Electricity grids are the backbone of the electricity system, powering European households, services and industries. They are key for our competitiveness, resilience, security and decarbonisation.

Achieving climate neutrality of our economy requires increasing the adoption of clean energy and the electrification of all sectors, as outlined in the Action Plan for Affordable Energy[1]. On the demand side, while the electrification rate has been relatively stable at 23% of total energy consumption for the past decade, this rate is expected to increase due to digitalisation and electrification of transport, heating and cooling, and industry, with the Clean Industrial Deal aiming to reach a 32 % electrification rate by 2030.

The increase in demand and deployment of clean energy sources put strong pressure on network needs. This is already evidenced by rising grid connection requests[2] resulting in queues. According to a recent study[3], at least 16 Member States face grid connection queues as of mid-2025. Delays in grid connections slow down the clean transition and European economic growth. **Timely connection to the electricity grid is crucial for the competitiveness and decarbonisation of the European industry, including digital, data and AI, industry, automotive and transport sectors, and a pivotal condition for fulfilling the goals of the Clean Industrial Deal and achieving climate neutrality by 2050.** This is why tackling grid connection queues is becoming increasingly urgent throughout the EU.

While the solution to the longer-term challenge of constraints on grid availability is the accelerated build out of grids in a forward-looking manner, more short-term solutions can be advanced in parallel to ensure timely grid connection of clean energy generation and electrified loads through a more efficient use of grids.

This Guidance aims to **provide Member States, national regulatory authorities (NRAs), transmission system operators (TSOs), and distribution system operators (DSOs), as relevant, with a toolbox of measures to prevent, optimise and tackle lengthy grid connection queues**. The toolbox, summarized in Annex I, strives to address the root causes of the problem at hand in a horizontal and coherent manner across sectors, guiding Member States, NRAs, TSOs and DSOs through issues related to grid hosting capacity and future network development, administrative processes related to grid connection requests as well as

[1] COM(2025) 79 final

[2] Based on Eurelectric data, in 2024, 450 000 RES requested grid connection in 12 countries, which represent +133 % growth in comparison to 2021.

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

on handling of speculative and immature applications and measures if the grid capacity is scarce. The **role of Member States and NRAs** is especially crucial in the set-up of grid connection procedures, as they should **ensure that a national framework is in place and is non-discriminatory, transparent and aligned with the requirements for third-party access** as required by the Electricity Directive.[4]

This Guidance draws on best practices available in Europe[5] and is based on extensive consultations, including a targeted stakeholder consultation running between June and July 2025, targeting Member States, NRAs, network operators, generators and consumers (industry, transport, digital, households, etc.).

1.1 Root causes of the grid connection backlog

There are multiple root causes leading to situations in which grid users must wait several months or even years to get a grid connection, ranging from process-related and organisational constraints, to regulatory, supply chains and technical difficulties. These root causes can be grouped in three main areas.

1. *Inadequate grid planning and development*

Lack of physical grid capacity (grid congestion) has been quoted as a prominent reason behind grid connection queues. This is primarily due to the difference between construction times of new infrastructure (4-10 years) and demand or generation connection (2-3 years). Such differences are caused by inefficient planning (for instance not sufficiently accounting for future demand and supply), not considering alternatives to physical grid development, lengthy permit-granting procedures and extensive grid development times because of construction complexities, including delays in the delivery of key components due to shortages of components and the lack of a skilled workforce. Accelerating grid deployment and solving these issues are among the main goals of the European grids package of which this Guidance is part.

As set out in the anticipatory investment guidance[6], overcoming the usual reactive practice of grid investment based largely on existing grid connection requests, and instead basing network development on plans and future forecasts, could help mitigate grid connection backlogs and ensure the grids are ready for future loads.

2. *Lack of transparency on available capacity and of locational signals for grid users*

The slow speed of grid deployment is compounded by a lack of transparency over where the grid connection would be feasible within the timeframe that market participants need for their connection, as well as missing incentives for placing the connection in areas where grid capacity is sufficient or could be sufficient soon. Recent changes to the electricity market

[4] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity

[5] DSO study.

[6] Commission Notice on a guidance on anticipatory investments for developing forward-looking electricity networks, C/2025/3291, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52025XC03179&qid=1750695420666

regulation require transparency over available grid hosting capacity (see chapter 1.2 below). However, practical implementation differs greatly across Europe. Incentives such as locationally differentiated connection charges or network tariffs incentivising connection in locations where the grid capacity is available, efficient use of allocated grid capacity and its reallocation back to the system are also missing in most Member States[7]. This leads to connection requests being placed in congested areas, rather than being directed to where capacity is available, resulting in a grid connection backlog but also inefficient grid operation and a need for greater investment. This, in turn, leads to higher total electricity system costs.

3. Grid connection procedures

The existence of speculative connection requests, non-maturing applications as well as organisational constraints in administering the grid connection requests (due to a lack of workforce or of digitalised processes) are the third main driver for the existing queues. In some Member States, speculative applications reserve grid capacity for projects that do not materialise, blocking viable ones from access; for instance, in Slovakia, estimates show some 50% of the reserved capacity remains unused[8].

Sequential processing of grid connection requests, such as the 'first-come, first-served' approach that fails to consider applicants' readiness to connect to the grid can lead to inefficient allocation of hosting capacity and overall delays and inefficiencies in network planning. Similarly, when grid operators do not have a mandate from a national regulatory framework to filter projects which are not progressing or significantly delayed, the risk of creating a backlog increases.

The other element in this respect is the management of grid connections. While all countries in Europe offer some kind of digital connection request, only 11 have fully digitalised procedures, allowing them to combine internal grid information systems with a customer interface system to ensure automatic and intelligent processing of connection requests, bringing time and cost savings.[9] A lack of digitalisation combined with steady growth of connection requests may lead to applications becoming stuck due to an administrative inability to process requests on time.[10]

1.2 Legal context

Requirements on grid access, grid connections and transparency about grid hosting capacities, and flexible connection agreements are specified in the Electricity Directive[11] and the

[7] Commission Notice on Guidelines on future proof network charges for reduced system costs, https://energy.ec.europa.eu/publications/communication-future-proof-network-charges-reduced-energy-system-costs_en
8 Gridlock to grid growth: tackling connection queues for a smoother energy transition – Eurelectric, 2025.
[9] DSO study.
[10] There are no consistent data across Europe on total amount of connection requests. Recent DSO entity study "Digital Solutions for Handling Connection Requests" collected data across 11 countries, which pointed to steady growth of around 53 % annually since 2021 (i.e., annual growth between 2021-2022 was 53.6 %, between 2022 and 2023 53.1 % and 52.96 % between 2023 and 2024).
[11] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity; articles 6, 6a and 31.

Electricity Regulation[12]. The fundamental principle for grid access is enshrined in the Electricity Directive, which requires that **Member States or regulatory authorities, as relevant, ensure that access to grids is applied objectively and without discrimination between system users (**Article 6). Importantly, the option of refusing access to the network is only possible under clearly defined conditions, namely if the grid lacks the necessary capacity, or, as specified by the Renewable Energy Directive[13], on justified grounds of safety concerns or technical incompatibility of the system components. Such a refusal must be based on objective and technically and economically justified criteria. In this case, information on the measures necessary to reinforce the network need to be provided by grid operators. The Electricity Directive hence provides a general obligation on DSOs and TSOs to ensure non-discriminatory third-party access to their networks while leaving flexibility to Member States and regulatory authorities to design details of their connection procedure to reflect specificities of their respective systems. Notably, the Electricity Directive does not prescribe the application of the 'first come, first served' principle in dealing with connection requests.

Provisions were included under the 2024 Electricity Market Design reform[14], to tackle rising grid connection queues:

- Regulatory authorities or other competent authorities shall set up a framework for flexible connection agreements in areas where there is a lack of grid capacity or where network development is not found to be efficient (Article 6a of the Electricity Directive).
- Grid operators shall ensure transparency on grid hosting capacities and handling of grid connection requests (Electricity Directive (Article 31) and Electricity Regulation (Article 50)). DSOs are obliged to provide information on available grid hosting capacity, including capacities under connection request, at least quarterly. TSOs are obliged to update information at least monthly. They are also obliged to coordinate the provision of information on grid hosting capacity in a consistent manner. Grid users have a right to information on the state of play of their connection request within three months of the request and for regular information provision thereafter. System operators also need to provide the option of a fully digital connection procedure.

Finally, the Renewable Energy Directive ("RED")[15] stipulates specific maximum time limits for permit-granting procedures for renewable energy projects, which includes also the grid connection (but not grid reinforcements). The RED additionally introduces a specific framework for expedited treatment for the assessment of connection requests, for the grid

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[12] Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity; articles 50 and 57.
[13] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources
[14] Directive (EU) 2024/1711 of the European Parliament and of the Council of 13 June 2024 amending Directives (EU) 2018/2001 and (EU) 2019/944 as regards improving the Union's electricity market design. Regulation (EU) 2024/1747 of the European Parliament and of the Council of 13 June 2024 amending Regulations (EU) 2019/942 and (EU) 2019/943 as regards improving the Union's electricity market design.
[15] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources, Articles 16, 16a, 16b, 16c, 16d, 16e, 16f and 17.

connections of certain renewable energy installations such as certain cases of repowering, small-scale solar equipment, and heat pumps.

2. Existing practice and solutions

2.1 Grid planning and development

Network planning serves several purposes, with the ultimate aim to ensure access for consumers and producers to the electricity grid while keeping its operation safe. Network planning is inevitably linked to grid connection processes, as network development plans are in part based on grid connection requests, as well as on predictions of plausible future via scenarios or data collection processes. Without robust network planning, there is a risk that the time gap between network development and project development will never be closed and hence connection queues will effectively become a *status quo* situation.

To be able to provide seamless grid connection in the future, grid operators must be aware of grid users' future needs on both the demand and generation side, as well as consider planned policies linked to fulfilment of climate and energy targets. As highlighted by the Anticipatory investment guidance, planning of grids should be based on robust scenarios nurtured by information collection on planned projects, and a clear national regulatory framework must anchor risk-assessment schemes that allow such investment to materialise.

Project-related information (such as on renewable energy, recharging points, heat pumps, storage, etc.) may provide locational information necessary to further specify concrete grid reinforcement, as such information may be difficult to obtain only from nation-wide common scenarios of future energy system development due to insufficient granularity. Local level planning, such as the national building renovation plans or local heating and cooling plans[16], can for instance provide information on how heating and cooling demand and supply will evolve locally, creating grid development needs but also opportunities for flexible grid operation and thermal storage. The same applies to the deployment of recharging infrastructure in urban areas where bus depots and logistic centres will need to be equipped with recharging points and TEN-T maritime ports with shore side electricity supply. Recent ACER-CEER guidance on electricity distribution planning provided recommendations for stakeholder engagement and transparency on a distribution level.[17]

Policies on strengthening industrial manufacturing capacities and developing industrial hubs should also provide higher certainty of the maturity of the projects and hence feed into anticipatory grid planning. Injection of public funds, to be done in a non-discriminatory way and in compliance with the current legislation as well as competition law, can also alleviate the

[16] Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the energy performance of buildings
Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast)

[17] ACER-CEER Guidance on electricity distribution network planning, July 2025, Future-ready grids: ACER and CEER set out blueprint for distribution planning | www.acer.europa.eu

risk and financial burden related to forward-looking development of grid capacities, bringing a positive impact on the overall economy competitiveness.[18]

The set-up of the grid connection procedure is closely linked to network planning, as connection requests directly provide information relevant to consider in grid build-out. If the requests are speculative, imprecise or become outdated, they provide wrong signals for grid planning, potentially diverting grid development investment from areas most needed.

The following table sets out good practice across EU Member States on user participation in the planning process, to sufficiently cater for their future needs. It also covers the transparency of network development plans (NDPs).

Table 1: Existing practices for network planning allowing for timely grid connection[19]

Country	Practice
France	Coordinated planning among the TSO and the DSO is accompanied by a collaboration between national and regional actors through the establishment of S3RenR and S2RenR (Regional Renewable Energies Connection Master Plans schemes) as well as industrial zones. They provide information on renewable energy and industrial development to model grid constraints over the coming 10 to 15 years for each region and consequently allow for reservation of connection capacities over a 10-year period. This is accompanied by sharing some of the actual grid integration costs among producers (via uniform fee per MW in the given region, to ensure affordability of total network tariffs).[20] Firm grid access to 400 MW – 1 GW industrial consumers under HTB3 connection is guaranteed within 4 years if a project is located in predefined industrial zone close to the 400 kV network and is successful in a tender.
Germany	Distribution network development plans (DNDPs) investments are feeding into detailed grid hosting capacity maps and providing investment overview of up to 2045, published on a single web portal digital platform www.vnbdigital.de.
Hungary	Development of a common TSO-DSO network development plan, which performs common calculations and outlines joint infrastructure projects needed for electrification, particularly in concentrated demand areas, like the Göd Industrial Park.
Netherlands	Inclusion of congestion relief (management) measures in the DNDP (such as plans for cable pooling/hybridisation, flexible connection agreements, group capacity limitation contracts).

[18] Commission Notice on Guidelines on future proof network charges for reduced energy system costs explains conditions under which public funds can be used to support overall network costs.
[19] DSO study.
[20] https://www.services-rte.com/en/news/mapping-of-consumption-pooling-areas.html, La CRE approuve la convention de raccordement "fast track" au réseau très haute tension (400 kV) de RTE pour les sites de consommation de grande puissance | CRE

Lastly, grid deployment is often delayed not because of how it was planned, but due to other factors such as supply chain constraints, lack of skilled workforce or the administrative capacity to pursue all projects in parallel that would be required to satisfy the growing number of connection requests. The European grids package aims to tackle most of these issues via non-legislative actions, continuing existing initiatives like the Action 13 of the EU Action Plan for Grids[21] and further strengthening them. To accelerate grid connection in case where system operators face issues related to too many projects being pursued in parallel, project promoters, especially those planning to conclude physical power purchase agreements, could consider greater development of direct lines between the production and consumption of electricity in line with Article 7 of the Electricity Directive, to proceed with needed connection faster, on condition of existence of the necessary national framework. While development of direct lines can accelerate grid connection between generators and users, such infrastructure would usually be fully financed by and for the exclusive use of the parties involved, which can increase the project cost and potentially generate inefficiencies.

More broadly, given the limited workforce capacities on both the grid operators and suppliers' side, grid planning must consider prioritising which infrastructure projects are to be built. Ultimately, this is linked with treatment of incoming connection requests, especially the ones with higher requested connection capacities leading to greater need of grid expansion. A first-come, first-served approach in treating incoming connection requests, as elaborated on below, leads to setting a factual sequence of grid development for these users, while other approaches may be more beneficial and efficient, also ensuring each sector gets a fair access to the grid. For instance, one of the avenues could be postponing grid refurbishment in certain areas by means of broader use of non-fossil flexibility, use of digital and grid enhancing technologies, and flexible connection agreements accompanied by incentives, while prioritising physical grid development in more congested areas where these solutions are not available to temporarily substitute grid development. Any solution must however account for specific local conditions and dedicated research must be conducted on the strategies to ensure grid planning is correctly linked to grid connection procedures.

Actions and recommendations	
NRA	Ensure that network development is done in an anticipatory way, in line with recommendations of the Guidance on anticipatory investments.
Commission	Commission to set up a working group with transmission and distribution system operators, as well as national regulatory authorities, on best practices and strategies for sequencing grid build-out (i.e. strategies how to transform grid connection requests into grid development in case of insufficient resources), ensuring fair grid access to all user groups.
Member States, NRA,	Grid operators to establish national cooperation with grid users to feed into network planning, both on the demand and supply side, to ensure sufficient

[21] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Grids, the missing link – an EU Action Plan for Grids, COM(2023) 757 final

TSO, DSO, grid users	locational information exchange on future generation and loads between system operators and users of the network, in particular generators, storage operators and consumers, including industrial, transport and data sectors. Such working groups should regularly consult Member State authorities as well as the NRA to ensure alignment with the overall energy policy and other local policies, such as on heating and cooling or industrial hubs and acceleration areas, as well as to inform regulatory framework. The result of such cooperation could be, for instance, delineation of certain grid acceleration areas, for accelerated connection of clean energy sources, electrification of heating and cooling or industry, including the data industry.
NRA DSO, TSO	Ensure the follow-up (actionability) of network development plans by enforcing the inclusion of detailed investment plans and development of forward-looking capacity maps, considering results of the investment plan in terms of network development to provide transparency of future grid capacity.
Member States, NRA	Explore options for greater deployment of direct lines, where allowing for accelerated generation and loads connection.

2.2 Transparency and incentives for grid connection

Grid users decide on the location for their connection requests based on multiple criteria, including location of their existing demand or generation sources, proximity to the existing grid, proximity to main economic activity, or incentives provided for an efficient use of the grid. The latter is crucial to ensuring that the existing grid is used as efficiently as possible and hence allows the connection of higher number of applicants, without imminent need for grid upgrades and the lowest cost for system users and overall EU system. Therefore, the transparent information on available and planned grid capacity goes hand in hand with incentives to place future generation or demand where the capacity is or will be available.

2.2.1 Transparency on grid hosting capacities

Detailed but customer friendly grid hosting capacity portals bring transparency and, therefore, can support stakeholders in their investment planning decisions and in mitigating the need of new network development. Increased visibility and grid access can also increase a Member State's attractiveness as a business location and enhance their competitiveness. For grid users, it can drive smart location decision resulting in reducing time to be connected and costs.

Grid hosting capacity maps are already available in 22 countries at DSO level.[22] Although the responsibility lies with the system operators, some Member States or NRAs have taken initiatives at national level to provide transparency over a single digital platform. However, the level of detail varies greatly. Most European countries provide grid capacity maps that display the medium-voltage network, typically including transformer stations operating at or around

[22] State of play as of August 2025, based on DSO study results.

110 kV. Denmark offers more granularity by including data down to 50 kV, while the Czech Republic is using colour indicators to represent low-voltage grid capacity.[23]

Table 2: Existing practice on grid capacities transparency across EU Member States[24]

Country	Practice
Estonia	Customers have access to a web application on connection capacity potential called e-Gridmap, which is based on a nation-wide monitoring system covering both TSO and DSO levels. Capacity calculations are voltage-level specific and take into account both in-service and pending connection commitments.
France	Current and future connection capacities for existing and planned stations, substations and connection lines are published on the public platform www.capareseau.fr, which displays the total connection capacity (including for RES projects) categorised in terms of available, reserved and used capacity across all of France, in a close-to-real-time resolution.
Germany	A grid connection tool SNAP with extended functionalities for potential developers, offering simulations and monitoring functions for planners of installations with capacities between 135 kW – 10 MW. The platform uses the project address and requested power to automatically identify the nearest connection point and calculate the shortest route.
Ireland	Interactive heatmap tool showing available transformer capacity at substations across different voltage levels (LV, MV, HV),) with separate views for demand and generation. Includes filtering by voltage level, capacity range, and other parameters.
Italy	Grid hosting capacity map shows available and requested capacity for load as well as generation, updated on a monthly basis, as well as future expected development of grid hosting capacities both for generation and demand in the upcoming three years.

Reported capacities generally do not fully reflect the situation at the lowest voltage levels. The reason cited for this is often the low observability of the low-voltage grid, with smart metering roll-out lagging in several EU countries[25], and also the enormous amount of data points at low voltage. This situation represents a significant hurdle for transparency needed not only for renewables deployment, but also for e-mobility roll-out or further electrification. Establishing a consistent framework for assessing and publishing available grid hosting capacity, both for load and generation across grid operators is essential to enabling efficient project planning and reducing uncertainty for developers. The integration of AI-assisted analytics into capacity maps

[23] DSO study.
[24] DSO study.
[25] ACER-CEER 2024 Market Monitoring Report on Energy Retail and Consumer Protection

could also improve their accuracy and update frequency, enhancing transparency and decision-making for both operators and users.

The need for better transparency on grid hosting capacities was also recognised on a European level, not only by legal framework, but also via the Action plan for grids ("GAP") and its implementation. As part of Action 6 of the GAP on grid hosting capacities, ENTSO-E and the EU DSO Entity are working on definitions of grid capacity with harmonised parameters (known as "Capacitypaedia") and on the establishment of a user-oriented information portal to make grid capacities transparent (i.e. a map with links to respective national grid hosting capacity maps but also providing explanations on how this was derived). This platform is currently in the stage of stakeholder consultation and expected to go live in early 2026 with the objective of providing a pan-European overview[26].

Actions and recommendations	
TSO, DSO	Ensure that grid hosting capacity maps also cover all voltage levels and are regularly updated, ideally at least every month also on lower voltage levels, including DSO grids.
TSO, DSO	Ensure that grid hosting capacity maps not only indicate the present state of the grid but also planned grid development and grid connection queue capacities and, accordingly, grid hosting capacities expected to be available in the following years.
NRA, TSO, DSO	Ensure grid operators have sufficient incentives to reach adequate levels of grid observability, to transparently provide granular data on available hosting capacities and to provide digitalised processes enabling quicker grid connection.
NRA	NRAs should consider creating or requiring single national platforms for grid hosting capacities, to improve the user experience. Methodologies applied to assess capacity should be made more transparent and harmonised at least on a TSO and DSO level within Member States.

2.2.2 Incentives for efficient grid connection and use

Efficient utilisation of the existing grid may significantly decrease the need for grid reinforcement in certain areas or postpone such need, while efficiently allowing connection of new generation and loads. There are several ways to achieve greater grid utilisation, starting from regular revision of existing connection capacity contracts and their actual utilisation (i.e. ensuring there is no systematic over-reservation of contracted capacities, which may happen for older contracts where the customer has already implemented energy efficiency measures but has not renegotiated a lower connection agreement in parallel). Incentives can be provided for example through the use of locational signals in connection charges as well as dynamic or time-differentiated network tariffs. On the network side, efficiency can be increased by physical strengthening of the grid using non-wired solutions, such as grid enhancing

[26] DSO entity presentation in 2025 Energy Infrastructure forum, available at https://energy.ec.europa.eu/events/11th-energy-infrastructure-forum-2025-06-02_en

technologies like the dynamic or ambient line rating, or the use of digitalised solutions such as advanced energy management systems and power flow controls that allow a more efficient use of the existing grid assets. AI-based forecasting and optimisation tools can further support these solutions by improving predictions and optimising operations.[27]

As explained in the Guidelines on future-proof network charges[28], regulatory authorities should promote the use of locational signals in network tariffs as they provide signals for more useful siting of necessary generation and consumption on the grid. This may be done via use of deep and shallow connection charges, yet should be done with caution, since if they are not set correctly and do not reflect directly related costs only, they may disincentivise first movers and present entry barriers to connection.[29] Deep connection charges may be used in regions in which grid reinforcement would be needed, while on the other hand, shallow connection charges may incentivise users in areas where the grid is sufficiently developed or planned to be developed in the near future.[30] Deep connection charges may also prevent the socialisation of some of the network development costs but as mentioned previously, if not set up carefully, can also disincentivise electrification. Delineation between shallow and deep connection costs could be linked to capacity maps, providing clear and updated information for grid users on available capacities and potential capacity increases in the foreseeable future allowing grid users to account for expected costs already when planning their connection. Incentivising grid-friendly location can also be done under a shallow charging regime, with varying connection charges based on the state of grid capacity in respective locations. Regulatory authorities should transparently report on the different locational connection charging regimes to guide grid users' decisions towards cost-efficient locations for overall energy system benefits.

Network tariffs can significantly impact system users' behaviour and hence provide incentives for decreasing the peak capacity by shifting consumption in time. This reduces overall investment needs due to the fact that power grids are built to cover the peak demand, hence any decrease also leads to lowering total system costs and enabling the provision of more grid hosting capacity without the need to reinforce the network for this purpose. A tariff reform in Spain, introducing differentiated time of use (block) tariffs, resulted in a decrease in the average capacity for the morning peak on winter working days of around 3.5 GW from 2018 to 2023. A similar reform was also introduced by Slovenia in 2024 in reaction to insufficient grid hosting capacity, linked to a high smart meter roll-out and regular assessment based on predetermined key performance indicators. Within three months of implementation, the system observed over

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[27] Apply AI Strategy, https://digital-strategy.ec.europa.eu/en/policies/apply-ai

[28] Commission Notice on Guidelines on future proof network charges for reduced system costs

[29] Negative examples comprise for instance full financing of superior network via a corresponding setup of deep connection charge, for instance of a whole transmission line by few connected users to adjacent substation on a distribution level.

[30] Shallow connection charges mean the network users pay for the infrastructure connecting their installation to the transmission or distribution grid (cable and other necessary equipment), while deep connection charges mean the network users (additionally) pay for the costs of other reinforcements/extensions required in the existing transmission or distribution grid to enable grid users' connection. Source: ACER report on network tariff practices, March 2025.

50 MW in load relief, which corresponds to about 2.4% of the average national peak in January.[31]

Despite the huge potential for system benefits, as highlighted by ACER 2025 tariffs report, grid tariffs in Europe are still relatively flat when it comes to applying time-of-use elements or locational signals. In this respect, the European Commission put forward recommendations on grid tariffs in the Commission Notice on Guidelines on future proof network charges for reduced energy system costs, published in July 2025.

<table>
<tr><th colspan="2">Actions and recommendations</th></tr>
<tr><td>NRA</td><td>Implement the recommendations under the Commission Guidelines on future proof network charges, on:

1. Including more granular calculation methods in network tariffs and capacity elements (locational and time-of-use signals), to financially incentivise grid users to adjust their energy use and lower peak load, hence freeing part of allocated grid connection capacity and introducing locationally differentiated connection charges, to incentivise connections in locations where the grid is ready or will be upgraded in the nearest period, ensuring a cost-efficient system.
2. Ensure that the regulatory framework incentivises grid operators to invest in a cost-effective manner, allowing for flexibility and optimal use of the grid, including digital and AI solutions and grid enhancing technologies[32], and to ensure sufficient grid observability.</td></tr>
<tr><td>NRA, TSO, DSO</td><td>Conduct an audit of existing connection agreements to calculate if there is an underutilisation of capacity in connection agreements and reallocate if so. Regularly calculate the efficiency of the allocated grid capacity to prevent systematic over-reservation and introduce mechanisms for its reallocation. Consider introducing efficiency clause in connection agreements that would allow unused capacity allocations to be withdrawn and reassigned to other applicants.</td></tr>
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2.3 Grid connection procedures

The design of procedures to process connection requests has gained more attention with the increasing pressure on available grid hosting capacity. An efficient set-up of grid connection procedures ensures that requests are processed as quickly as possible and provide important feedback to applicants on the feasibility and expected timeline of physical grid connection. This was acknowledged by recent changes to electricity market legislation, requiring timely

[31] DSO study.

[32] Also in line with Article 59.1(l) of Directive (EU) 2019/944 on common rules for the internal market for electricity.

replies to all applicants, as well as regular information on the progress of their application.[33] Efficient grid procedures also ensure simple applications are tackled automatically, hence freeing the capacity of system operators to tackle more complex requests. Finally, they also deter speculative applicants, which, together with providing sufficient transparency on grid hosting capacity, as required by the existing EU legal framework[34], reduces the risk of blocking capacity for other users.

The following chapter tackles grid connection procedures from two main perspectives and explains possible alternatives to the first-come, first-served approach which remains most commonly applied today:

1. How they are designed from an efficiency perspective, i.e. their ability to filter immature and speculative requests.
2. How they process requests in case of grid congestion – how they allocate available capacity if it is already scarce.

2.3.1 Set-up of the grid connection procedure

Getting the grid connection procedure right is a no-regret measure even in cases where grid capacity is abundant, as it improves overall user satisfaction and attractiveness for businesses, enhancing competitiveness. It may also improve industry's acceptance and acceleration of electrification and the energy transition in general. Procedures should provide a seamless customer experience, for instance by digitalising and centralising processes. At the same time, system operators should be able to identify connection requests which risk blocking the queue by their speculative, immature or non-maturing character.

Digitalisation of grid connection requests procedures

Legal provisions introduced by the 2024 Electricity Market Design reform require offering the option to process grid connections exclusively in a digital form. While almost all Member States have some digital solutions, only 11 have fully digitalised processes through solutions like fully interactive platforms.[35] These have proven to significantly reduce time lag and backlog, through the more efficient handling of grid connection requests, especially in cases where they are fully integrated into grid information systems. Digital twins and AI optimisation can accelerate processing for routine applications, while optimising and integrating several grid processes. The table below shows best practices currently used by DSOs in Europe.[36]

Table 3 Existing practices in grid connection digitalisation within EU DSOs

Area	**Concrete solution**

[33] Article 50 of Regulation (EU) 2019/943 on the internal market for electricity and Article 31 of Directive (EU) 2019/944 on common rules for the internal market for electricity.
[34] Article 50 of Regulation (EU) 2019/943 on the internal market for electricity and Article 31 of Directive (EU) 2019/944 on common rules for the internal market for electricity.
[35] DSO study.
[36] DSO entity report "Digital Solutions for Handling Connection Requests" (October 2025), https://eudsoentity.eu/news/dso-entity-published-a-new-report-on-digital-solutions-for-handling-connection-requests/

Front-End services and customer engagement	Customer self-service portals, enabling automatic data pre-validation, documents checks and pre-verification with the use of artificial intelligence
	Digital touchpoints, to keep applicants informed about the state of connection request and respective stages
Efficiency and operational intelligence	Workflow automation, end-to-end digitalisation – reducing manual interventions into connection process
	Advanced data management – support of algorithms to decrypt false or incomplete data
	Integrated internal data management and grid information system with the customer interface, enabling significant time savings by automatically calculating available capacities (90 % reduction of processing time for low and middle voltage connection requests reported in Germany)
	Digital twins of networks[37]
Institutional coordination and system integration	Collaborative planning platforms (with municipalities, permitting authorities).
	Centralised connection request systems

Filtering based on maturity of requests and handling of speculative connections

The hoarding of grid connection capacity can also be a significant issue when developers secure grid connection approvals but delay or never proceed with project construction, or where they make multiple connection applications for a single project in order to keep as much flexibility as possible on where to locate a project, thereby blocking access for other users, who may be ready to build. Therefore, they exacerbate existing and perceived connection challenges leading to inefficient grid development planning. Regulatory authorities and system operators should implement mechanisms to prevent speculative behaviour where capacity is locked in early for immature projects, often with the aim of selling the connection rights or keeping several options available for the location of the asset. While those practices are often a result of a lack of sufficient and granular transparency of grid hosting capacities and therefore partly understandable from a business development perspective, such practices make connection delays worse for all users in the area, reduce the effectiveness of anticipatory investments and can artificially inflate perceived grid expansion needs.

After experiencing lengthy connection requests queues, several countries have decided to change the treatment of incoming connection requests by filtering them based on their justification or maturity. Other countries established clear deadlines for project progression, which help them manage the queue and free up capacity for new users, or users further in the queue. Some countries have also strengthened their requirements for deposits guaranteeing the grid connection (reservation fee), to disincentivise speculative applicants. This reservation fee

[37] See the work of grid operators (https://www.entsoe.eu/technopedia/techsheets/digital-twin-dt/) and European-funded projects (https://twineu.net/ and https://eudsoentity.eu/dso4dt/)

would be lost if the project does not materialise, to deter speculative requests and should be specified in advance. This practice may however only be effective when a strict timeline is applied to providing proof of project progression and if there is no secondary market for capacity reservations. Such markets bring a significant risk of further promoting speculative approaches, hoarding connection capacities with no real projects behind and consequently reselling them, knowing that other applicants will come and pay significant amounts for the connection right. Hence, their introduction or allowing for such secondary trading is not recommended.

The following table provides an overview of existing practices in EU countries. Several of these measures were introduced only recently to tackle rising grid connection queues, hence their full effect and efficiency cannot be fully evaluated at this stage.

Table 4: Existing national grid connection procedures practices

Country	**Practice**
Czechia	Non-refundable deposit for grid connection applicants introduced as part of the Energy Law amendment since 2025.
Estonia	One-stop shop for grid connections, with fully digitalised processes, linked with the grid capacity map. Coordination with the TSO is clearly defined and systematically integrated into the workflow. Application status is available online in real time.
Italy	Batch processing takes place in highly saturated grid areas (country is divided into microzones), projects are collected over a three-month period and consequently evaluated and processed together.
Ireland	Applicant needs to have planning permission for the project before it can apply for a grid connection. The system follows the concept of batching: a one-month window for applications opens twice per year.
Netherlands	Applying a traffic light system to monitor progress and remove delayed projects. From 2023, NRA policy requires grid users to prove that reserved capacity will be used within two years, otherwise they risk losing it.
Poland	Draft reform[38] currently in the approval process suggests introducing clear milestones of project progression after connection rights are granted. Grid connection capacity is blocked for a maximum period of one year if the applicant does not fulfil conditions in the contract. Process should be fully digitised, with fewer documents required. The reform also introduced a non-refundable fee for processing the grid connection request (set per kW requested) and introduced a mandatory financial security in the form of a deposit or a bank guarantee.

[38] State of play as of October 2025, based on DSO study results and draft amendment of the Law, available at https://legislacja.rcl.gov.pl/projekt/12396003.

A system of batches (i.e., time windows for placing a grid connection request), applied from a certain installed capacity, can help not only to filter and rank mature and less mature projects, but also allows for joint calculation of multiple connection requests at one moment in time, hence may be useful in case of insufficient grid capacity. In this way, grid planning could be streamlined by having better overview of total amount of connection requests, the system can automatically calculate complementarities between projects or even create virtual hybrid connections if more advanced. A balance must be struck between amount of such submission windows in a year (from processing perspective) and expectations of grid users in terms of timely grid connection.

Maturity criteria have significant potential to disincentivise immature projects from applying. One such example is Ireland, which reported significant decrease in grid connection queues on certain levels after introducing a requirement to obtain a planning permission before applying for a grid connection.[39]

While applying for a grid connection only after the permit is obtained prevents speculative applications, it may also unnecessarily delay the execution of projects and prolong waiting times, as the grid operator receives the information on planned connection relatively late in the process. To prevent this, timetables for connections prioritising more mature projects can be introduced (while keeping less mature projects in the queue), or a pre-connection process, ensuring grid operator receives information on planned capacity of connections well in advance and may start with grid reinforcements in a timely manner. Maturity criteria should be adapted to specific local circumstances.

Regular checks on the performance of the projects in the queue (i.e. their progress in fulfilling the milestones) must also be implemented as part of the overall framework, as projects not progressing may effectively block hosting capacity, which could be offered to other participants or provide incorrect information for planning grid development.

Handling of existing connections and hybridisation

Despite existing rules on the repowering of renewable power plants under the RED, in several countries, there is no separate procedure for connection requests for repowering power plants or upwards adjustment for contracted capacity for loads, or for adding new sources under the existing connection point. In such cases, any additional capacity must apply for a new connection. Some countries also apply a requirement for an entirely new connection request where storage or new load is added into the same connection point, even if it does not go beyond the originally agreed connection capacity, risking hampering the further build-out of clean energy sources and loads.

When it comes to specific solutions, the approach differs according to the type of capacity increase and the related impact on the grid in case of repowering. This is acknowledged by the provisions of RED as well as the Requirements for Generators (RfG)[40] network code, which

[39] DSO study.
[40] Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators.

stipulate that technical conditions for connection of generators are applied to new or significantly modified assets (including repowering), keeping the door open for limited adjustments to existing connection points. A revision of the network code to clarify the scope of significant modernisation is currently underway.

A different way of processing connection requests that do not lead to an increase in the contracted capacity of the connection point (or that reduce it), could help with uptake of hybrid solutions. Physical hybridisation refers to combination of several generation and/or storage assets in the same plant (under a single connection point). This may be combined with loads. Introducing a framework for hybridisation can incentivise the further uptake of storage solutions (including recharging points, which allow for bidirectional charging), which may significantly help alleviating grid congestions, if they are able to react to signals provided by the system operator. Such framework can also lead to more efficient self-consumption, decreasing the volume of contracted grid capacity.

The objective is to use complementarities between generation sources and/or storage and to ensure efficient utilisation of the grid connection during all hours of the day and seasons. Hybridisation is sometimes linked to the existence of a flexible connection agreement. In any case, assets must meet necessary grid safety conditions to ensure secure grid operation (especially if assets with a different behaviour and hence impact on the grid are being included in existing connection point).

2.3.2 Procedures in case of scarce capacity

Flexible connection agreements

In line with the requirements of the Article 6a of the Electricity Directive (2019/944), NRAs shall create a framework that enables system operators to address grid capacity issues by offering non-firm connection agreements (flexible connection agreements, "FCA"), which allows system operators to restrict access to the network at certain times as for example peak generation. Those connections can be used to give grid access to more generators and new loads in the short term and as a temporary solution until a structural solution of the capacity problem is realised or as a long-term solution where grid reinforcements may not be an economical solution. FCAs can be linked to corresponding reduction in grid fees. Based on the characteristics of the FCA, one needs to carefully consider the interplay with tariffs and the services procured by system operators (SOs) to manage congestion in a market-based way.[41]

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[41] Both FCAs and service procurement serve the similar purpose to address congestion issues in grids but could be designed in ways that lead to a non-optimal use of the flexibility of the assets connected to the grid. In some instances, a system operator might not pay for the costs of the flexibility of assets under an FCA. In case of congestions, the system operator would then prioritise the flexibility provided by FCAs to alleviate grid congestions even if cheaper solutions for congestion management, for example through explicit demand response, are available to reduce overall system costs. For example, one could imagine that a SO, in some instances, has two options for solving a congestion issue: activating the FCA or using explicit flexibility, provided through a local market platform. From the SO's perspective, the FCA might be seen as free of charge, due to its design (e.g. through lower tariffs) while the provider of explicit flexibility would have to be remunerated for each activation. Even if from the provider's perspective, the explicit flexibility is cheaper than the FCA, the SO might always prefer to activate the FCA, leading to an inefficient use of the system's flexibility.

FCAs can be a useful tool to speed up the connection of new assets and reduce system costs but may require investments behind the meter to shift peak consumption to more grid friendly times. For example, a recharging station could benefit from an FCA if it limits the charging at peak load times and eventually also the discharging at peak generation times. Similarly, a company could connect to the grid without a grid reinforcement if it makes the appropriate investments (self-generation, storage) to cover its own consumption needs above the capacity of the available grid connection.

Based on the DSO study findings, 15 Member States have implemented some form of flexible connection agreement, with variations in the type and specific implementation. Some are already in operation (AT, BE, DE, FI, HR, HU, NL, PT, RO, SE), others are currently being tested or prepared through legal acts (CZ, ES, FR, SI, SK).[42] The table below aims to provide an overview of selected flexible connection agreements or hybrid systems, which are currently implemented in Europe.

Table 5: Existing practices on alternative connection agreements within the EU[43]

Country	Practice
Denmark	Large users can use two variants of a flexible connection agreement, indefinite with more than 50 % reduction in grid fees and accelerated connection, or temporary with the tariff discount being a weighted average of the standard and limited tariff, as per above.
France	Two connection regimes are available, ensuring the grid is utilised efficiently. Under the first regime, blocked capacity may be decreased if not efficiently utilised. Under the second, grid users may stage (ramp up) their contracted capacity based on estimated future needs, with concrete milestones and capacity values set in the initial connection contract. Battery grid access with pre-defined operational range combined with tariff regime allows connecting more storage as it ensures they do not inject electricity into the grid during the peak generation hours.
Lithuania	Grid capacity tool for prosumers, automatically calculating available capacity and providing alternative solutions and alternative grid connections in case of need. System is being expanded to offer “remote prosumer” option (i.e. buy a share in RES park instead of physical expansion of capacity, if not available).[44]
Netherlands	Offers three types of FCAs: fully flexible, minimal availability agreements, timeslot agreements, accompanied by specific arrangements for network tariffs (differentiated from firm connection agreement). FCAs on transmission level should unlock up to 9 GW of capacity by guaranteeing access to the grid 85% of the time, in exchange for a discount in grid fees.[45] NL also offers a group transport agreement in which a group

[42] DSO study, state of play as of August 2025.
[43] Source: DSO study, DSO digitalisation report, BCG Mind the queue report, September 2025.
[44] State of play as of September 2025, according to the DSO study results.
[45] https://www.ess-news.com/2025/10/24/6-gw-of-dutch-batteries-about-to-get-grid-access/

	of companies jointly uses an agreed grid capacity (such as an industrial area in which several companies have the opportunity to shift part of their electricity consumption in time).

Prioritisation frameworks

As explained before, **Member States and/or regulatory authorities must ensure that their national legal framework ensures access to their grids is granted in a non-discriminatory way, which does not, however, entail an obligation to apply the first-come, first-served principle** for grid connection. Member States or the NRAs may set other rules to be applied by grid operators (for instance 'first ready, first served' or 'milestone-based, milestone-enforced' approaches or other approaches as outlined further), provided they are non-discriminatory and transparent and follow objective and technically and economically justified criteria.[46]

As mentioned previously, in the context of Article 6 of the Electricity Directive, non-discriminatory practices are those that ensure equal treatment and access for all market participants, regardless of their status or location. This means that network operators and other entities involved in the electricity market must apply rules, charges and contractual terms consistently and objectively to all parties. Non-discrimination requires transparency in all procedures, including grid access, network tariffs and service provision, so that every market participant has the same opportunities to compete and engage in the market. For instance, access to the network should be based on clear, pre-established criteria applicable to all users, and any decisions affecting market participation should be made based on objective and justifiable grounds.

This should not be understood as preventing the possibility to prioritise certain uses based on their fulfilment of non-discriminatory and transparent criteria, as supported by recent case law. The Dutch Trade and Industry Appeals Tribunal ("CBb") established in a March 2025 ruling that the Dutch NRA has the independent power to set a prioritisation framework, if the criteria are properly assessed and well justified and if done in a sufficiently justified and non-discriminatory way.[47]

Still, the first-come, first-served principle is currently applied by the vast majority of Member States, either because connection queues are a relatively recent phenomenon, or because of uncertainty on what the legal framework allows.[48] Priority schemes, in a sense that a certain group of users is treated first during the allocation of scarce capacity (*prioritisation of capacity allocation*) are only being tested by Member States and are not broadly deployed.

[46] Note only European Court of Justice can provide full interpretation of the EU law, hence the summary is not supposed to present transposition check of proper implementation of the EU legal framework.
[47] https://www.acm.nl/en/publications/acm-working-new-decision-opportunities-prioritization-projects-contribute-major-social-objectives-getting-connected-grid
[48] DSO study.

Where prioritisation frameworks exist today, they differ from first-come, first-served in the following ways:

- Deviate in favour of investments beneficial for the efficiency of the power system or alleviating congestion in the electricity grid (known as grid-friendly uses)
- Deviate based on criteria related to social or national security purposes, or primary needs
- Economic prioritisation based on market-based frameworks

The proposal for the Dutch prioritisation framework from June 2025[49] uses principles of system benefits and social elements. "Congestion softeners", are given the first priority in treatment of connection request as this category concerns connections which help release capacity for other grid users. Furthermore, connections needed for national security reasons (such as police, water treatment facilities, public transport, hospitals, etc.) and basic household needs (social purposes) are prioritised. Within these queues, first-come, first-served principle applies, with clear milestone applied on the progress. The Dutch NRA chose multiple criteria for choosing concrete groups to be prioritised.

Grid-friendly uses are to be understood as projects aligned to system needs, mitigating new network expansion needs and lower system costs for all consumers. They are by their nature very local, as in each grid and region, congestion may be caused by different drivers (generation vs. demand, patterns on generation or consumption side – time differentiation, specific voltage issues). Examples include co-located storage if accompanied by limitation of injection in peak generation hours, new demand in generation-dense areas, if able to follow generation patterns (hence avoiding the need to build or strengthen existing lines), generation in demand-heavy areas, industrial electrification able to provide demand response, etc. While a universal solution at the EU level do not exist due to significance of local conditions, clear criteria should be defined at the national level, in regulatory or legislation framework, to align with the previously mentioned need for non-discriminatory treatment by system operators.

Besides the prioritisation frameworks mentioned before, some Member States have decided to allocate capacity in a market-based manner – via auctioning of grid connection rights, often on higher voltage levels. This approach enables economic prioritisation, without explicit legal ranking of sectors. However, if not carefully calibrated, auctions may unintentionally favour larger, well-resourced developers and undermine the inclusion of SMEs or innovation. Early access can also go simply to the highest ranked bidder, and to those ready for connection or projects valuable from social perspective. Besides economic prioritisation, some countries have decided to apply emission reduction impacts in auctions, which are linked to decarbonisation of generation but also of loads, including industry. In any case, ensuring a multi-criterion selection process adapted to the local situation of the grid as well as broad stakeholder engagement and embedding safeguards for smaller actors would be crucial before adoption of any such framework.

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[49] https://www.acm.nl/en/publications/acm-welcomes-opinions-about-its-new-draft-decision-opportunities-prioritization-projects-contribute-major-social-objectives-getting-connected-grid

While auctioning approaches can include non-price criteria and therefore lead to *de facto* prioritisation of certain user groups in a non-discriminatory manner, as shown above, it should be noted that there is as yet **no example of an explicit and direct prioritisation framework based on economic criteria** (*i.e.* contribution to certain economic goals) **or the contribution to certain policy objectives**, **such as electrification of transport, industry or the deployment of data centres**. Such prioritisation frameworks can, when duly justified and aligned with non-discriminatory and transparent treatment of network users, be implemented, but must ensure compliance with the principles of EU law governing network access. Moreover, any such framework should not be under the sole discretion of system operators but would require a clear and transparent national legal or regulatory framework under which it is applied. For smaller installations (such as those that will typically occur in a residential context and are deploying renewable sources, storage or recharging points) expediting the handling of related requests would be in line with the principles already enshrined in the RED (*cf.* above).

However, as explained previously, for large **connection requests in relation to electrification of industry, power-to-heat in district heating, high power EV recharging pools (typically for heavy duty vehicles) or data centres, a change in the grid connection procedure itself would not be sufficient as grid reinforcement is usually necessary**. For these purposes, the issue of sequencing of grid reinforcement and development is therefore more relevant than the question of how to allocate scarce existing grid capacity. Beyond the general imperative to accelerate grid deployment, discussions among the users concerned, grid operators, and national authorities is of particular importance to ensure the timely access of these users to the grid and on sequencing strategies.

Table 6 Existing practices differing from first-come-first-served within the EU[50]

Country	Framework different from first-come-first-served applied
France	Residential connections up to 36 kVA follow a simplified procedure, while commercial clients, including industrial customers and data centres and renewable energy operators use the S3RenR and fast-track process to speed up planning and consequent grid connection (see section on grid planning).
Hungary	The allocation of available grid connection capacity for producers at medium and high voltage levels through competitive national-level tenders is organised by the NRA. Applicants must submit bid guarantees, and winning bidders will need to provide performance guarantees as well. Limits on multiple bids from related entities and partial award declarations aim to prevent strategic overapplication. Preference should be given to projects that include above-minimum battery storage, hybrid integration, stronger financial guarantees, and lower environmental impact. Recultivation obligations after decommissioning also factor into the evaluation.
Netherlands	A prioritisation framework in operation since 2024 for social and national security purposes – grid connection for schools, hospitals, police centres and similar uses are processed in a separate accelerated grid connection queue.

[50] Source: DSO study, state of play as of August 2025. Netherland framework is not included as currently under reform. BCG Mind the queue report, September 2025.

	The prioritisation framework will be reformed from 2026 to better delineate the criteria for inclusion in the accelerated procedure, which should include also grid friendly uses (congestion softeners) next to social objectives, national security purposes and basic needs purposes (housing).[51]
Romania	Available grid capacity will be allocated based on auctions for connection exceeding 5 MW of installed capacity starting in 2026, together for high-voltage DSO and TSO network in designated areas. Actions are organised for Y+2, to account for future developments.

A legal question linked to application of a prioritisation framework (but also to new rules on filtering immature and non-progressing connections) is whether such rules can be applied to existing connection requests, or whether they have retroactive effects exposing authorities or grid operators to litigation from affected parties. The legal interpretation applied to similar cases notes that if such changes are applied in the general public interest and are accompanied by a transitional period, they may be seen as only having legal effects in the future, thus not having retroactive effect. In any case, such approach needs to be carefully balanced to avoid undermining investor confidence, and to be fully transparent and communicated well in advance. For instance, projects which are well advanced and to be connected in the next one to two years should not be affected by new changes.

Actions and recommendations	
NRA, TSO, DSO	NRAs should ensure the use of fully digitalised solutions with customer-centric design for processing grid connection requests, ensuring a timely response, transparency and easy collaboration among parties concerned.
NRA, TSO, DSO	Reaching a sufficient degree of grid observability is a necessary precondition for applying of digital solutions. Smart meter deployment is a key factor to achieve that observability.
Member States, NRA	Introduce **entry criteria for filtering immature or speculative grid connection** requests at the beginning of the grid connection procedure, while ensuring grid operators get information on planned connection sufficiently in advance.
Member States, NRA TSO, DSO	Consider introducing **reservation fees proportionate to project size and the project applicant**, which would be used to cover connection costs and/or credited when the project is realised.
Member States, NRA	Consider moving towards a **first-ready, first-served** system, which takes into account the maturity of grid connection request. Readiness to connect can refer to obtaining land rights, proof of financing, final investment decision or certain progress in planning or permitting. Nevertheless, a full sequencing of procedures should be avoided, since it would lead to unnecessarily long procedures for projects. Likewise, ensure projects with

[51] https://www.acm.nl/en/publications/acm-welcomes-opinions-about-its-new-draft-decision-opportunities-prioritization-projects-contribute-major-social-objectives-getting-connected-grid

	longer lead times and more complex permit-granting procedures (such as industrial electrification) are not disproportionately impacted.
Member States, NRA TSO, DSO ENTSO-E EU DSO entity on monitoring	Introduce clear and regular milestones for **filtering projects during their presence in the grid connection queue – milestone-based approach together with the "use it or lose it" principle**, while taking into account reasons outside of requester's control. Regularly monitor the development in the queue and whether the milestones as set for project developers in the draft connection contract are met. These milestones may refer to further progress in planning, permits, land-rights or construction. If not, a project should be put on hold (i.e. put at the end of the queue, not to block other projects waiting in the queue) or cancelled (with the deposit and blocked capacity being lost). At the same time, also introduce clear connection waiting-time benchmarks, milestones and efficiency criteria for the grid operators with penalties in case these are not met, while accounting for reasons outside of grid operator control.
Member States, NRA	In areas with long waiting times for grid connection, the first-come, first-served principle should be abandoned in favour of a prioritisation framework based on objective non-discriminatory criteria that would contribute to alleviating the congestion, and always together with a first-ready, first-served and milestone-based approach (see above). Other options include prioritisation for grid friendly uses, climate friendly uses, social value, security interest, basic needs or economic criteria, as relevant and appropriate in a given national context. All of these should be applied in a non-discriminatory way that does not foreclose access to the grid for specific user groups or technologies.
Member States, NRA	Ensure any introduction of a prioritisation framework is accompanied by a clear transitional period and that other users are fully included in grid development discussions, being able to provide early information on their planned grid capacity.
Member States, NRA, TSO, DSO	Consider introducing clear criteria for grid connection allowing hybridisation so that the existing network capacity is used efficiently. This concerns the grid connection procedure itself, but also specification of technical criteria for connecting to the grid in case of multiple sources being connected to one single connection point.
Member States, NRA	Consider introducing clear timelines for full use of reserved capacity for new connections and criteria for return capacity to other projects in the queue in case contracted utilisation of the grid is not met.
Member States, NRA, TSO, DSO	Ensure not only the framework, but also enabling conditions are in place to fully use flexible connection agreements (FCAs) in line with Article 6a of the Electricity Directive. For the sake of greater uptake of FCAs, their time character (temporary or permanent) should always be clarified in advance, together with accompanying conditions on tariffication and grid access. Consider combination of FCAs with hybridisation / cable pooling.

3. Conclusions

The evidence gathered plainly indicates the need to set up clear rules and procedures for addressing grid connections in the three main problem areas (grid planning and development, transparency and incentives, and connection procedures) at the level of a national legal framework. Even in the absence of queues, Member States have tools to act and prevent future connection capacity backlog or further streamline handling of requests.

Numerous no-regret measures could be implemented very quickly, while keeping the balance between regulatory simplicity, public acceptability and benefits of the changes in mind. These concern **criteria for maturity and progress of grid connection requests, with clear milestones, penalties and monitoring of the queue,** to deter speculative and non-progressing connections. Where there is not sufficient capacity to address existing connection queues, Member States and NRAs, as relevant, have the possibility to decide on a prioritisation framework for grid access as long as it is based on transparent and non-discriminatory criteria. Criteria for prioritisation need to be set at the national level to account for the varying scales of the problem across Member States and regions, as well as to respect national subsidiarity.

From a broader perspective, in line with applicable EU legal framework, national regulatory framework needs to ensure the **grid is planned sufficiently in advance, in an integrated manner with other energy-related planning with grid users' needs being properly reflected**. This needs to be followed up by setting incentives for efficient grid utilisation (e.g. locational and time-of-use incentives as put forward in the Guidelines on future-proof network charges for reduced system costs). Information provision and awareness about the level of connection are prerequisites for making the most of existing grid capacity.

Lastly, **grid observability** is necessary for the implementation and combination of many advanced solutions. Efforts need to be pursued to make sure TSOs and DSOs have both sufficient obligations and also incentives to use digital and smart solutions, including AI tools, ensuring sufficient grid observability.

The Commission will continue to **closely monitor the evolution of connection queues** across the European Union, as well as the uptake of measures mentioned below. If necessary, the Commission may **propose additional legal measures to further facilitate efficient and timely grid connections**.

ANNEX I: Summary of recommendations and impacts: a toolbox for timely grid connection

Entity	Problem area	Measures	Impacts
Commission	Grid planning and development Grid connection procedures	Set up of a dialogue that includes TSOs and DSOs, as well as national regulatory authorities, on best practice and strategies for sequence of grid build-out, ensuring fair grid access to all user groups and respect for the energy efficiency first principle.	Sharing of best practice on how to ensure fair and non-discriminatory grid build-out in the most efficient manner, accounting for limited capacities in terms of supply chains and components, but also system operators' capacities. The aim is also to identify strategies how to ensure grid users get access when needed while impact on prices is minimised. Positive impact stemming from broader application of these strategies and hence less time needed for grid connection.
Member States, NRA, TSO, DSO, grid users	Grid planning and development	Creating working groups between TSOs, DSOs and grid users (such as associations representing generators and consumers, including industry, data and transport sector, and district heating and cooling system operators) to ensure grid users' needs are reflected in grid planning sufficiently in advance and to fully use their flexibility potential for a more efficient grid operation. Create a mechanism to duly consider grid user needs and local policies including on industrial hubs and acceleration areas in grid planning, before the grid connection materialises. Link lead times of planned connection requests with network development planning.	Better informing of system operators of future expected development on grid users' side, leading to less uncertainty over future connection requests (hence less uncertainty for anticipatory investment). Positive impact in terms of reduced connection time in future.

NRA	Grid planning and development	Fully allow for anticipatory investment in grid planning, in line with the Guidance on anticipatory investments.	Better aligning of grid development lead times and grid users construction times, hence allowing for quicker connection. Pooling of investment may have positive impacts in terms of procurement of components – shortening development time. For certain applications, dimensioning bigger assets may lead to cost savings per MW of grid capacity built. Using one permit-granting process for imminent as well as future needs, hence accelerating grid development and improving public acceptance.
DSO, TSO	Grid planning and development	Increase actionability (follow-up) of network development plans by better linking them to grid hosting capacity maps and by clearly outlining new infrastructure development in a simple and user-friendly manner.	Providing better visibility over future network development, hence incentivising users to connect in areas with development already planned. This is linked to a reduction in connection time, as the grid would be ready.
Member States, NRA	Grid planning and development	Explore options for greater deployment of direct lines, where more efficient for timely generation and loads connection.	Decreasing the need for investment in the main grid, hence potentially faster connection in certain cases.
NRA, TSO, DSO	Transparency and incentives for grid connection	Support grid observability and use of forecasting tools to be used for information on grid hosting capacity via capacity maps, as well as link to digital connection procedure itself.	Necessary enabler for system operators to be able to provide sufficiently granular information on grid hosting capacities, hence better informing customers. This may lead to more efficient connection requests (in places where capacity is available) and hence to decrease in connection time.
DSO	Transparency and incentives for grid connection	Ensure that grid hosting capacity maps also cover the low voltage level and are regularly updated, ideally at least every month. Ensure that grid hosting capacity maps show not only actual	This may lead to more efficient connection requests (in places where capacity is available) and hence to a reduction in connection time.

		state of the grid but also planned grid development.	
Member States, NRA	Transparency and incentives for grid connection	Consider creating single national platform for grid hosting capacities, to improve user experience. Methodologies applied to assess capacity should be made more transparent and harmonised on a national level.	This may lead to more efficient connection requests (in places where capacity is available) and hence to a reduction in connection time.
NRA	Transparency and incentives for grid connection	Provide incentives via locationally differentiated connection charges, to incentivise connections in locations where the grid is ready or will be upgraded in the nearest period.	Incentivising customers to connect in places where the grid is available or will be available in the neare future. Positive impact in terms of reduced connection time but also for grid development, as in some instances, this decreases the need for further grid upgrades.
NRA	Transparency and incentives for grid connection	Consider introducing more dynamic network tariffs to financially incentivise grid users to adjust their energy use and lower peak load, hence freeing part of allocated grid connection capacity, in line with the Guidelines on future proof network charges for reduced system costs.	Additional grid hosting capacity freed (typically peak capacity), leading to earlier connection of applicants in the queue. Positive benefits in terms of decreased need for grid development, hence cost savings for the overall electricity system.
NRA	Transparency and incentives for grid connection	Ensure regulatory framework incentivises grid operators to invest in cost-effective systems, which allow for flexibility and optimal use of grid, including digital solutions, energy storage, including thermal storage and grid enhancing technologies.	Increase of grid hosting capacity while minimising traditional grid development, hence bringing costs savings, with a positive impact on tariffs (minimising their increase). Acceleration of grid connection as some grid enhancing technologies are faster to deploy than traditional (wired) grid development.
NRA, TSO, DSO	Transparency and incentives for grid connection	Regularly calculate efficiency of allocated grid capacity to prevent systematic over-reservation and introduce mechanisms for its reallocation.	Additional grid hosting capacity freed, leading to earlier connection of applicants in the queue. Positive benefits in terms of decreased need for grid development, hence cost savings.

Member States, NRA	Grid connection procedures	Next to granular grid hosting capacities transparency, set clear entry criteria for grid connection requests to ensure projects that are ready-to-build are not disadvantaged (first-ready first-served), as well as clear milestones allowing for filtering the queue in case of future need (milestone-based approach). Introduce reservation fees proportionate to project size and the project applicant, which would be used to cover connection costs and/or credited when the project is realised.	Demotivating speculative and immature applicants from submitting a connection request leads to more efficient and timely processing of applicants that are ready to be connected in near future. Positive impact on overall length of the connection procedure and of the connection queue.
TSO, DSO	Grid connection procedures	Ensure regular information provision on the state of connection requests and impacts into grid hosting capacity, ideally via use of digital tools and in real-time.	Increased transparency for grid users, positively influencing the business case (more certainty of future connection estimate, hence an option to accommodate procurement strategy accordingly).
Member States, NRA	Grid connection procedures	Introduce clear timelines for full use of reserved capacity for new connections and criteria for return capacity to other projects in the queue if the contracted utilisation of the grid is not met.	Additional grid hosting capacity freed, leading to earlier connection of applicants in the queue. Positive benefits in terms of decreased need for grid development, hence cost savings.
NRA, TSO, DSO	Grid connection procedures	Ensure full digitalisation in handling the connection requests and provide related incentives allowing for a sufficient level of grid observability.	Accelerated processing of grid connection requests and minimised administrative burden for grid users and also for grid operators (option to process simple applications automatically, without the need for detailed manual checks, etc.).
TSO, DSO ENTSO-E EU DSO entity	Grid connection procedures	Regularly monitor situation in the connection queue (milestone-based approach) and apply filtering criteria in case of milestones not met (use-it or lose-it principle). Network operators should strive to regularly publish information on the duration of the	Additional grid hosting capacity freed, leading to earlier connection of applicants in the queue. Positive benefits in terms of decreased need for grid development, hence cost savings. Increased transparency for grid users, positively influencing the business case (more certainty of

		connection queue, in line with transparency requirements of the Electricity Directive, and ENTSO-E and EU DSO entity should strive to publish regular updates on a European level, to improve overall transparency.	future connection estimate, hence option an to accommodate procurement strategy accordingly).
Member States, NRA	Grid connection procedures	Introduce clear connection waiting-time benchmarks, milestones and efficiency criteria for grid operators with penalties in case these are not met, while accounting for reasons outside of grid operator control.	Ensuring proportionality between requirements for grid users and requirements for grid operators, ensuring efficient handling of connection requests, hence reducing connection lead time.
Member States, NRA, TSO, DSO	Grid connection procedures	Set-up rules allowing for hybridisation of assets in national legislation and regulatory framework, as well as in relevant national terms and conditions for grid access and operation.	Allowing for earlier connection of assets which can be hybridised, hence improving the business case, leading to greater competitiveness. Grid hosting capacity which would otherwise be required may be freed, leading to earlier connection of other applicants in the queue. Positive benefits in terms of decreased need for grid development, hence cost savings.
Member States, NRA, TSO, DSO	Grid connection procedures	Fully allow use of flexible connection agreements. Exploit use of complementary load profiles and consider economic incentives for grid users in return for their flexibility.	Allowing for earlier connection of assets, hence improving the business case, also leading to greater competitiveness.
Member States, NRA	Grid connection procedures	A prioritisation framework, if necessary, shall be based on objective non-discriminatory criteria, which can give priority on grid friendly uses (e.g. storage, non-fossil flexibility), climate friendly uses, social value, security interest, basic needs or economic criteria, as relevant and appropriate in a given national context. Consider impact on customers at several voltage levels and across customer groups and ensure	Allowing to prioritise based on national-specific situation and preferences in case grid hosting capacity is insufficient and there is an expectation this situation will last. It allows for earlier connection of most critical uses, hence bringing positive effects in terms of social, climate or economic impacts.

		framework does not foreclose access to the grid for specific user groups or technologies.	
Member States, NRA	Grid connection procedures	Ensure any introduction of a prioritisation framework is accompanied by clear transitional period and other users are fully included in grid development discussions, being able to provide early information on their planned grid capacity.	Ensuring stability and predictability of regulatory environment, with a positive impact on overall competitiveness of a given country.