ENTSO-E Assessment

What TSOs Propose to Accelerate Grid Connections



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CONNECTING EUROPE,
ELECTRIFYING THE FUTURE

Mission Statement

ENTSO-E – the European Network of Transmission System Operators for Electricity – brings together 40 electricity transmission system operators (TSOs) from 36 countries. ENTSO-E members are responsible for the secure and coordinated operation of Europe's electricity system. Together, they operate a system of around 500,000 km of power lines **– the largest interconnected electrical grid in the world –** and serve about 520 million citizens.

Electricity is not merely a market commodity; it is an essential service, and TSOs are fully regulated public service entities whose work is essential to powering Europe. The grid is the backbone of the electricity system and extends across the continent, beyond the borders of the EU. By working together, TSOs guarantee a functioning infrastructure that makes electricity trading possible, contributes to decarbonisation goals and ensures a reliable and efficient power supply for all members of society.

These shared public service responsibilities need close cooperation beyond national borders, which led to the creation of ENTSO-E. Today, the association serves two main complementary purposes:

1. Cooperation of European TSOs

The foundations of this cooperation date back to the 1950s, with the creation of electrical -synchronous areas and interconnections that laid the groundwork for today's interconnected European power system. TSOs established associations to work together on their own mandates and missions; these associations came together to form what is now ENTSO-E. The European electricity system is one of the most stable and reliable grids in the world, supported by cooperation and coordination among TSOs within the European Union and in closely interconnected European countries. ENTSO-E strives to build consensus for decision-making amongst its member TSOs, as this forms the strongest foundation for cooperation.

2. Fulfilling EU legal mandates

With the adoption of the Third Energy Package in 2009, ENTSO-E's role was formally recognised by European institutions. ENTSO-E was granted legally mandated tasks to further develop the European interconnected grid and to facilitate the integration of European electricity markets. These mandates cover a large spectrum of tasks, including system operation, system development, market integration, information technologies, R&D and innovation.

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Executive Summary

Electrification depends on timely grid connections. The Electrification Action Plan adopted by the European Commission on 17 July 2026 aims to double the share of electricity in final energy consumption, to 46 % by 2040. Industry, transport and buildings can only switch to electricity, and new renewable and storage projects can only deliver, once they are connected to the grid. Connection requests now arrive at a volume and pace that network plans did not assume a few years ago, and transmission system operators (TSOs) are changing how they handle them.

TSOs are already speeding up access to the grid. This paper draws on TSO practice in 18 countries. Many of the measures in the Commission's Guidance on efficient and timely grid connections are already in place and working:

- Milestone-based queues and use-it-or-lose-it rules release capacity held by projects that do not progress.
- Maturity requirements and financial guarantees filter out speculative requests. In several countries, requested capacity exceeds national targets several times over.
- Flexible connection agreements, hybridisation, cable pooling and repowering get more out of the existing grid while reinforcements are built.
- Cluster studies and digital connection portals shorten processing and let applicants follow their requests.
- Capacity maps and queue data guide investors to locations where the grid can host them. Capacitypedia, launched by ENTSO-E and the EU DSO Entity in May 2026, links national hosting capacity information across Europe.

Policymakers and regulators can scale up these results. In the negotiations on the Grids Package and on the proposal to future-proof electricity bills, and in national implementation, ENTSO-E calls for:

1. **Clear tools to manage connection queues.** National frameworks should set maturity criteria, financial commitments and milestones under regulatory oversight, so that capacity goes to projects that are ready to build.
2. **Transparent prioritisation where capacity is scarce.** Policymakers and regulators should define objective criteria linked to societal objectives such as electrification and security of supply. TSOs apply them through transparent and non-discriminatory procedures.
3. **Better use of the existing grid.** Flexible connection agreements, hybridisation and locational connection charges should be enabled and designed for national grid conditions. They complement grid reinforcement and do not replace it.
4. **Investment ahead of demand.** Regulation should recognise anticipatory investment where credible demand signals exist, and network planning and connection processes should be linked more closely.
5. **Action on bottlenecks outside connection procedures.** More than half of the transmission projects needed by 2030 are still awaiting permits. Faster permitting, spatial planning that identifies sites for new generation and demand, adequately staffed authorities and resilient supply chains will do more for connection times than procedural change alone.
6. **Fair sharing of obligations.** Developers should provide reliable data and realistic timelines and keep their projects on track. System operators, in return, provide predictable and transparent procedures.

Some proposals would not speed up connections. Fixed legal deadlines and penalties for connection works would add administrative burden without shortening permitting, delivery or construction. Direct lines are useful in specific cases such as co-location, but as a default they would fragment grid development and leave lines without a system operator. New mandatory coordination bodies would duplicate national network development plans and the TYNDP, which already involve stakeholders.

System operational security underpins every new connection. TSOs assess each request so that the interconnected system stays secure as new types of users connect, from large data centres to battery storage. ENTSO-E and its members are ready to work with the European institutions, Member States, regulators and industry to put these measures into practice.



1 The Growing Challenge of Grid Connections in Europe

Europe is facing an unprecedented surge in grid connection requests across generation, storage, and demand, including from new large consumers such as data centres, driven by the expected increase in electrification and the growing connection of renewable energy sources across Europe. This surge is occurring at a pace and scale that significantly exceeds the assumptions under existing Network Development Plans (NDPs).

Accelerating electrification is essential to Europe's decarbonisation, competitiveness and energy security objectives. By reducing dependence on imported fossil fuels and enabling greater use of domestic renewable energy, electrification can contribute to a more resilient energy system. ENTSO-E supports this transition, which requires timely grid development, efficient use of existing network capacity and faster grid connections, while safeguarding system security. Addressing connection challenges is therefore a key enabler of Europe's wider energy and industrial ambitions.

The European Commission's (EC's) Guidance on efficient and timely grid connections (C/2025/6703[1]), issued as part of the "European Grids Package", seeks to address growing delays and unlock faster connections.

Since then, the Commission has adopted the Electrification Action Plan (July 2026) together with a proposal to future-proof electricity bills (COM(2026) 600), now in co-decision.[2] Its proposed new Article 18d of the Electricity Regulation addresses connection queues, the maturity of requests, prioritisation and flexible connection agreements where grid capacity is scarce. These initiatives are consistent with what TSOs have called for: prioritising mature projects, strategic electrification investments and efficient network use, in line with network development plans and with flexibility for national circumstances.[3] The TSO experience set out in this paper is intended to inform both the application of the Guidance and the co-legislators' work on the proposal.

ENTSO-E fully supports the objective of accelerating grid connections. However, while every effort should be made to speed up connection processes, in some cases, delivery timelines and available capacities are constrained by the technical realities and development needs of the electricity grid.

The experiences of transmission system operators (TSOs) across Europe show that not all acceleration measures are equally feasible, scalable, or compatible with system security and long-term network planning, particularly where they do not sufficiently reflect national specificities and the legislative environment. Consequently, some of the measures proposed in the EC's Guidance may have limited effectiveness under the current legislative framework.

In addition, efficient and timely grid connections are strongly influenced by several structural factors beyond the connection procedures themselves. These include the ability of TSOs to anticipate supply chain constraints and the willingness of a few National Regulatory Authorities (NRAs) to recognise and support anticipatory investments by system operators. Appropriate and effective mechanisms for the efficient use of existing system capacities are also essential, benefiting not only TSOs and distribution system operators (DSOs), but also consumers and society as a whole by enabling flexible solutions while ensuring transparency and non-discriminatory access.

1 European Commission, *Commission Notice – Guidance on efficient and timely grid connections*, OJ C, C/2025/6703, 19 December 2025, CELEX: 52025XC06703, available at: **https://eur-lex.europa.eu/legal-content/EN/TXT/**.

2 European Commission, Electrification Action Plan, 17 July 2026; European Commission, Proposal for a Regulation amending Regulation (EU) 2019/943 as regards future-proofing electricity bills in the Union, COM(2026) 600 final, 2026/0203(COD), 17 July 2026, available **here**.

3 ENTSO-E, Position on the Electrification Action Plan, 15 September 2026, available **here**; ENTSO-E, Position on the European Commission Proposal for a Regulation on Future-proofing Electricity Bills in the Union, September 2026, available **here**; ENTSO-E and DSO Entity, Key Recommendations on the Regulation for Future-Proofing Electricity Bills, 3 November 2026, available **here**.

Efficient and timely connections are also affected by the pace of technological development, which in many cases evolves faster than the legislative and regulatory framework. The ongoing revision of the Connection Network Codes (CNC 2.0) aims to update the technical requirements applicable to new technologies and system needs; however, the adoption process is still ongoing. In the meantime, TSOs are increasingly required to connect new types of generation and consumption patterns, such as large data centres, hybrid assets, or advanced storage technologies, while the applicable regulatory and technical frameworks are still evolving.

In this context, TSOs must conduct additional studies and analyses to ensure system security and resilience and to verify the technical capabilities and security policies of power-generating modules and other connected assets. At the same time, investors may be reluctant to accept additional technical requirements or operational conditions that were not clearly defined upon submission of the connection application or that relate to assets or functionalities not yet fully regulated. This situation can create uncertainty for both system operators and project developers and may lead to delays in the connection process. These uncertainties highlight the importance of good strategic planning and timely regulation, including realistic assumptions regarding network development and connection demand.

Furthermore, spatial and land-use planning decisions by Member States play a key role in enabling efficient grid development and connection processes. The availability of clear regional planning frameworks – including appropriate zoning or mapping for renewable generation, storage facilities, and large consumers, including grid infrastructure – is critical for both TSOs' network planning and investors' project development. The absence of such frameworks, or restrictive national legislation governing project locations, can create additional bottlenecks for grid expansion and connection.

Environmental assessment, permitting procedures, other required authorisations, and certificates for grid infrastructure projects across Europe, depending on national or local standards, may also cause significant delays.

This paper sets out a TSO-based contribution to the subject, identifying:

- Measures that can be effectively implemented
- Areas requiring careful redesign
- The need to better align connection procedures with network planning and societal priorities, including examples of national good practice that build on the measures introduced in the EU Grids Package, without prejudice to TSOs' ability to conduct impact studies to ensure system security and stability.

2 The Core Challenge: Volume, Speed, and Misalignment

Political targets do not always fully reflect the pace at which grid expansion can realistically be delivered. This underlines the importance of closer coordination between political targets, network planning, and connection procedures to ensure a secure and cost-efficient electricity system.

In this context, a key challenge is the growing misalignment between the volume and timing of connection requests, the pace of grid reinforcement and expansion, and the planning assumptions used in network development processes.

Connection requests increasingly reflect market signals and investor behaviour, while NDPs are based on validated scenarios, system needs, and realistic construction timelines. This can lead to situations where large volumes of requests emerge in locations or time frames where grid capacity is not yet available or where grid development was not originally planned.

Aiming for a cost-efficient energy system could include connecting assets in regions where limited grid expansion would be required. At the same time, connecting new technologies or identifying alternative solutions requires further elaboration or TSO studies to ensure system security and stability. **The current grid connection challenge involves not only speed but also structural coordination between planning, market signals, and connection procedures.**

- Connection queues have expanded rapidly, in part due to speculative or immature requests that are often submitted early to secure a queue position rather than to reflect near-term project readiness. The Commission's Guidance on efficient and timely grid connections identifies such requests as one of the main drivers of existing queues, and European regulators likewise recognise that strategic enquiries can block connection capacity.[4] In several Member States, the volume of requested capacity now exceeds national targets or identified system needs several times over, which indicates that a substantial share of queued projects is unlikely to materialise.
- Connecting assets in customer-selected regions may require grid expansion or reinforcement, while other areas could connect a given asset at lower system cost (grid expansion, need for redispatch).
- National or EU-wide NDPs (TYNDP, etc.) are based on validated scenarios, while national energy and climate plans (NECPs) are based on ambitious national policy objectives and EU targets. Connection queues increasingly reflect short-term market signals that may not yet be fully aligned with technical feasibility, system needs, or the timelines of grid reinforcement.
- While network planning aims to develop the grid in an efficient manner, considering both current and future system needs and connection requests, some technologies may submit connection requests earlier than others. This may lead to grid capacity being used primarily by a limited number of technologies (currently, batteries, data centres, and electrolysers) while others that are also essential for the energy transition may face longer waiting times. Such developments can also affect grid operation if the resulting generation or demand patterns differ significantly from those assumed in network development scenarios.
- In some countries, the prevailing first-come, first-served approach amplifies this misalignment by rewarding early applications regardless of maturity or system impact. Network development planning is typically based on long-term scenarios that reflect expected technology deployment and system needs. However, connection requests may materialise at a different pace or in a different technological composition than anticipated in these scenarios. As a result, grid capacity developed to accommodate a certain mix of technologies under energy transition goals may in practice be allocated to other projects that submit connection requests earlier. This can lead to situations where some technologies occupy available capacity sooner, while others that are also essential for the energy transition face longer waiting times. In this context, the traditional first-come, first-served principle, but also a "first-mature, first-served" principle, where applicable, increasingly reveals structural limitations when applied to the current scale and diversity of connection requests, and may require further reflection to ensure efficient use of grid capacity while maintaining transparency and non-discrimination.

4 CEER, *CEER Paper on Grid Connection Challenges*, Ref. C25-DS-100-06, 24 June 2026, pp. 6 and 25, https://www.ceer.eu/wp-content/uploads/2026/06/GridConnectionChallanges_CEER-paper-combined-1.pdf

- Administrative burdens and lack of public acceptance remain an obstacle when grid expansions and installations cross several land areas. Comprehensive national spatial planning tools, including country-level maps integrating geological, environmental, and spatial information based on robust scientific data (for example, regarding protected habitats or sensitive ecosystems), can mitigate grid development delays.
- Clear and easily accessible information about grid projects is essential to support decision-making by administrative authorities and foster a better understanding of how grid expansions, reinforcements, and new installations are key to achieving environmental and energy transition objectives.
- In addition, shortages of qualified staff within permitting and administrative authorities can significantly slow down grid expansion processes. The increasing number and complexity of infrastructure projects linked to the energy transition require specialised technical expertise, which is not always sufficiently available within public administrations. Limited staffing capacity and lack of specialised knowledge related to electricity infrastructure can therefore lead to longer assessment timelines and delays in permitting procedures.
- Appropriate incentives across the electricity system are important to avoid misalignment between political targets, regulatory decisions, and the actual pace at which grid infrastructure can be developed. Incentive structures affect several actors:

  1 // **TSOs and DSOs:** Regulatory frameworks should enable grid operators to manage allocated grid capacities to make optimal use of existing grid infrastructure, incentivise investments in cost-efficient solutions that optimise the use of the existing grid, and enable timely grid reinforcement where needed.

  2 // **Grid users and project developers:** Regulation should include incentives that encourage investment and connection requests that better reflect system needs and the availability of grid capacity.

At the same time, applicants and other stakeholders increasingly expect very fast or immediate connection procedures. However, ensuring system security and resilience within the interconnected transmission system requires compliance with common technical requirements applicable to power-generating modules and other system users.

These requirements are established in the EU Connection Codes, including the Requirements for Generators Regulation (RfG), which provide a harmonised legal framework for grid connections, support the integration of renewable electricity sources, and ensure the secure and efficient operation of the electricity system. System security depends in part on the technical capabilities of connected assets and adequate coordination between transmission and distribution networks. However, grid operators' main duty is to ensure grid stability and security by carefully assessing the impact of requested connection projects, and this responsibility must be preserved.

Furthermore, only a few TSOs can make anticipatory investments, especially as cost recovery is not guaranteed if the grid connection is not used. Therefore, connections are usually only realised once a request has been received.

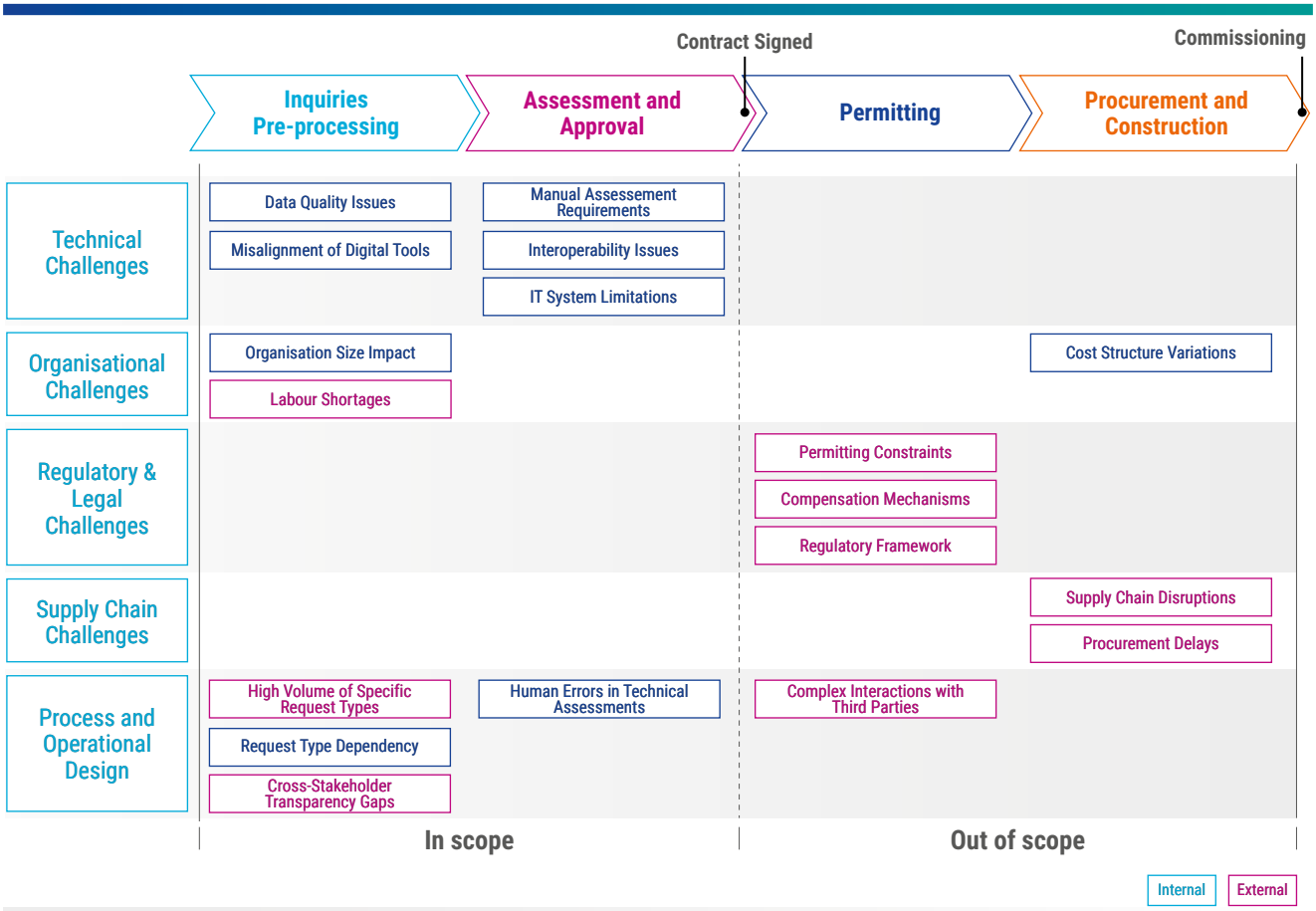
- Regulatory and legislative frameworks governing connection procedures should consider the technical complexity of grid connections, particularly at higher voltage levels such as 400 kV. Imposing strict procedural deadlines that do not reflect the specific requirements of these connections may risk compromising the quality of technical assessments and, ultimately, system security.

As a result, TSOs face growing difficulty in ensuring that scarce grid capacity is used efficiently to fulfil societal objectives, including the electrification of mobility, industry, and heating. This challenge is particularly visible in the surge of requests for data centres and large-scale batteries, which can significantly affect local and regional grid development paths.

3 Guiding Principles for Grid Connection Reform

The growing number and complexity of connection requests across Europe require a more structured and coordinated approach to managing grid access. Experience from system operators shows that delays in connection processes are rarely attributable to a single factor, but rather arise from a combination of technical, regulatory, organisational, and operational challenges occurring at different stages of the process.

A figure in DSO Entity's report *Digital Solutions for Handling Connection Requests* illustrates this complexity by mapping the primary challenges that can affect the grid connection process in the transmission system across various phases, from inquiries and pre-processing to assessment and approval, permitting, procurement, and construction. It also distinguishes between internal factors under the control of system operators and external factors linked to regulatory frameworks, permitting processes, supply chains, or interactions with third parties. While it was developed from a distribution perspective and not every aspect may be applicable to all countries, the figure aims to provide an overview of potential challenges.



DSO Entity (2025), *Digital Solutions for Handling Connection Requests*, Task Force Digitalisation of the Energy System, October 2025, section 5 "Challenges", **p. 15. Available here**.

Figure 1: Mapping Internal and External Challenges to Grid Connection Processing

Figure 1 highlights that a significant share of bottlenecks occurs beyond the core connection request handling stage and is not in the hands of system operators (contrary to the phase prior to the connection request and during its assessment), particularly during the permitting and project implementation phases. This confirms that improving the efficiency of grid connection procedures and speeding up connection to the grid requires coordinated actions not only from system operators, but also from regulators, permitting authorities, policymakers, and project developers.

Against this background, and based on practical operational experience as well as legislative and regulatory obligations at both the national and EU levels, TSOs converge on a set of guiding principles for improving grid connection processes:

- System security, reliability, and operational feasibility must remain non-negotiable. Transparency is essential, but it must respect infrastructure security and confidentiality constraints.
- Technology neutrality and non-discrimination must be preserved. At the same time, connection processes should allow objective connection request differentiation where justified by system considerations, such as the location of projects, their impact on network operation, feed-in patterns, or project readiness. Such differentiation should follow explicit regulatory or legislative frameworks and reflect national energy system priorities based on societal needs and priorities, while ensuring transparency and fair treatment of applicants.
- Alignment between planning and connections is critical to avoid inefficient or contradictory outcomes.
- Efficient use of the existing grid infrastructure, including the possibility of managing existing unused grid-allocated capacities where they exist, may speed up the connection process.
- To that end, stakeholders should participate in public consultations on NDPs and development scenarios and be provided with accurate, reliable information, including details on potentially duplicate connection requests. However, the engagement of local or national stakeholders in other processes during the connection procedure, such as grid infrastructure permitting (spatial planning, environmental permitting, etc.), is also important and should be taken into consideration.
- National specificities regarding technologies and system needs should also be considered. The rising number of fast-acting inverter-based production facilities, including battery energy storage systems (BESS) and AI-focused data centres, forces TSOs to establish new technical conditions for grid connections to avoid rapid power fluctuations that could cause instability. The national power grids differ, and therefore technical conditions will differ depending on the specifics of each regional grid.
- The proportionality of obligations should be ensured. The responsibility for enabling timely grid connections should not fall solely on TSOs, but should also involve investors and project developers, network users, regulators, and permit-granting authorities.
- TSOs should have the right to exclude applications from the connection process when they do not meet specified criteria. This right must be guided by regulatory or legislative standards and based on clear, publicly available, and non-discriminatory criteria. This would enable grid operators to prioritise mature projects and use their time and human resources more effectively.
- A stable, clear, and supportive legislative and regulatory environment at the European, national, and local levels is a prerequisite for all players in this field. Continuity in political decision-making and stability and consistency in the regulatory framework both have a fundamental impact on decisions made by TSOs and investors.

These principles provide the foundation for assessing proposed reforms.



4 Measures that are Workable and Scalable

TSOs broadly support several measures included in the EC's Guidance. Many of the measures listed in the Guidance are already applied in some Member States and have demonstrated effectiveness.

4.1 Milestone-Based Queue Management and Use-It-or-Lose-It

TSOs support milestone-based queue management, use-it-or-lose-it approaches, and transparency about queue duration.

Regular proof-of-progress requirements, such as periodic investor reports and project milestone deadlines, and use-it-or-lose-it mechanisms help prevent inactive projects from blocking long-term capacity. Such approaches have already been implemented in some Member States, improving queue credibility and freeing capacity for mature projects.

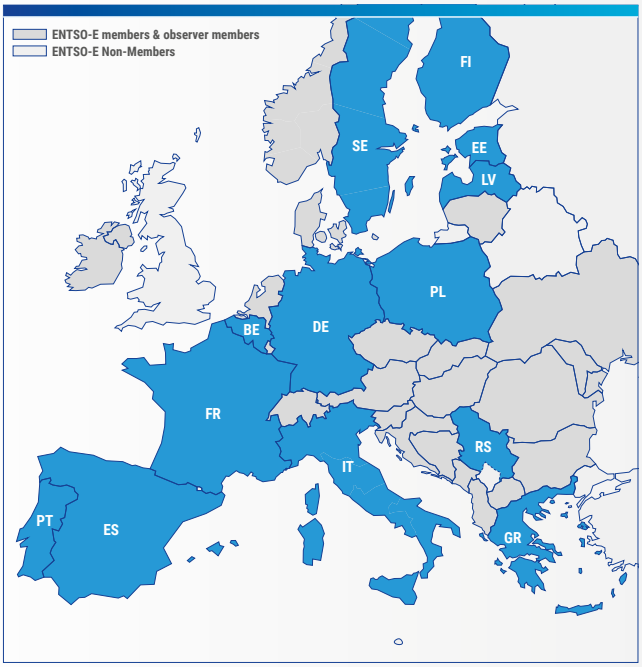
TSOs support clearing inactive requests or those that fail to meet established milestones by specified deadlines, but emphasise the significant legal complexities involved and the need for regulatory oversight of any mechanism to reduce contracted capacity. The benefit of this approach is that it increases connection capacity without requiring new grid assets and can be considered a type of "non-wire solution". However, capacity freed up at one grid node cannot be transferred elsewhere, limiting its system-wide impact.

Directive (EU) 2023/2413 introduced provisions affecting the treatment and prioritisation of renewable connection requests and provided a basis for addressing outdated requests or production licences that are no longer in force. In this context, NRAs should provide timely guidance to TSOs, while a mature regulatory framework – including tariff structures that incentivise TSOs to use flexibility, optimise the use of existing assets, and mitigate the risks associated with unused anticipatory investments – remains essential.

Proposal

The use of digital platforms, along with deadlines, provides an easy way to evaluate each project's progress.

Examples



- **Belgium:** The use-it-or-lose-it approach is now formally included in the federal regulation. In 2027, this should lead to a proposal for a new template connection contract implementing this approach.
- **Estonia:** A use-it-or-lose-it mechanism is applied, whereby developers must use their grid capacity within defined deadlines. If the project does not advance according to the agreed timeline, the allocated capacity may be released unless delays can be justified by external circumstances.
- **Finland:** The whole connection process is now digitalised, having been implemented gradually over time. It will be consolidated into a single, better-integrated system by the end of this year. Maturity requirements apply (legally binding zoning, as well as a construction permit and the expropriation process started for connection lines). After commissioning, the use-it-or-lose-it principle is applied through a "clawback" clause in the connection agreement, with the rate of usage checked annually. If the customer does not follow its own plan, Fingrid has the right to reallocate the difference to a third party.
- **France:** A stronger milestone-based process has been introduced in the connection procedure. Developers must provide proof of project maturity to remain in the queue; otherwise, they lose their reserved capacity.
- **Germany:** Under the new milestone-driven connection process (*Reifegradverfahren*), TSOs assess projects against predefined maturity criteria, including permitting, land rights, technical development, procurement readiness, and financial capability. Following capacity reservation, the TSO and the customer agree on an implementation roadmap with project milestones. If the agreed milestones are not met, project parameters change materially, or implementation progress falls behind schedule, the TSO may withdraw the capacity reservation.
- **Greece:** The national legal framework sets deadlines for applicants to accept connection offers. Before these deadlines expire, project promoters may request a six-month extension from the NRA by providing a financial guarantee to keep their requests valid.
- **Italy:** All phases of the connection process are digitalised and managed through the dedicated platform, from the submission of the connection request to the issuance of the contract. Applicants can monitor, in real time, the progress of their application and the deadlines established by the Grid Code for each step of the connection procedure.
- **Latvia:** The milestones are defined in the regulator's connection regulations and in the executed agreements.
- **Poland:** Milestones include building permits. Failure to submit a milestone notification results in termination of the connection agreement, as required by national law.
- **Portugal:** Portuguese law now includes a use-it-or-lose-it mechanism. If the demand connection developer does not use grid capacity within the defined timeline, it loses its reserved capacity.
- **Serbia:** The connection process is milestone-driven. Deadlines are defined in the connection procedure and regulations.
- **Spain:** All stages of the connection process, from the submission of the connection request to the issuance of the contract, are fully digitalised and handled through a dedicated platform. The national regulatory framework establishes clear deadlines for applicants to accept a connection offer. A use-it-or-lose-it principle also applies, requiring developers to utilise their allocated grid capacity within specified time frames. If a project fails to progress in line with the agreed schedule, the assigned capacity may be withdrawn and made available to others.
- **Sweden:** The TSO regularly follows up on applicant project timelines and milestones to ensure that stated deadlines are met, and that allocated capacity is used in accordance with stipulated requirements.

4.2 Clear Entry Criteria and Maturity Requirements

TSOs widely support stronger entry filters and reservation fees to discourage speculative projects and make the queue manageable.

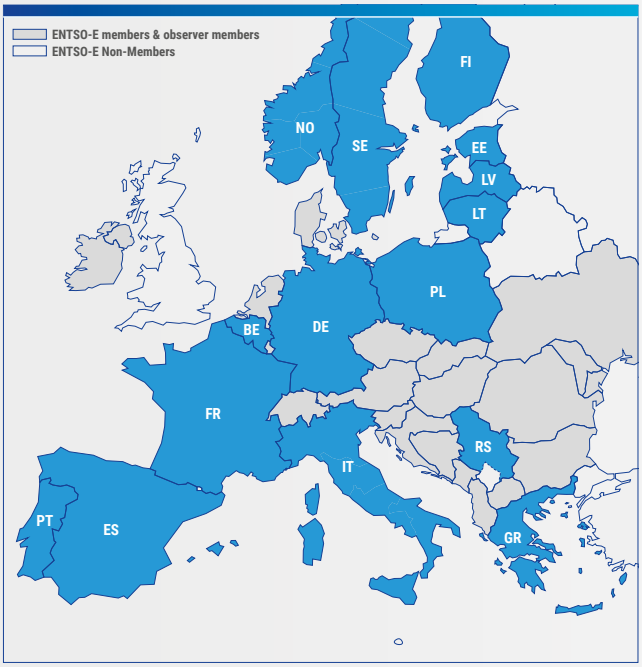
Requiring applicants to demonstrate technical, commercial, and financial maturity at the beginning of the connection procedure helps reduce speculative requests and improves planning certainty. This must be carried out in accordance with the applicable national or local legislation, taking into account Member States' or regional energy and environmental targets and ambitions, while upholding the principles of transparency and non-discrimination. NRA oversight helps ensure a transparent and non-discriminatory approach.

In many Member States, financial commitments are used as part of the maturity assessment process. While the initial application fee is often relatively limited and primarily intended to cover connection-related costs, more substantial financial guarantees or fixed payments are frequently required at later stages of the connection process, particularly upon signature of the connection agreement. These mechanisms help demonstrate project seriousness, discourage speculative requests, and improve the credibility of connection queues.

Proposal

Minimum maturity requirements, including proof of project progress, financial credibility, site availability, and technical readiness, should be considered in the early stages of the connection process to reduce speculative requests, improve queue transparency, and strengthen planning certainty. Any such requirements should remain proportionate, transparent, and non-discriminatory, while considering national regulatory frameworks and market specificities.

Examples



- **Belgium:** Maturity criteria related to land access were included in the last version of the federal regulation. This consists of a declaration on honour confirming that the landowner is aware of the project and supports its further implementation. The aim is to prevent purely speculative projects from requesting a connection study and reserving capacity on the electrical network. The impact on the backlog has been limited, with approximately 15% of reserved injection capacity and 5% of reserved offtake capacity released.
- **Estonia:** A financial guarantee is included in the connection cost, which must be paid in full within 60 days of signing the connection agreement and is non-refundable. This is applied with a fixed connection price.
- **France:** When submitting a request application, developers must demonstrate their project's maturity and their commitment to its development by paying a fee of €48,000, providing all technical information about their installation, and submitting proof of control over the land. As their project progresses, they must provide further evidence of development, including permits and operation authorisations, and payment for the required works, before the project can be connected to the grid.
- **Germany:** Maturity screening is conducted for new applications to verify the submission of mandatory proof of financial credibility, site security, a basic technical concept, and a permit strategy.
  - 50Hertz conducts maturity screening for new applications to verify the submission of mandatory legal project entity information, site control or contractual lease documentation, technology concept and design criteria, and preliminary environmental constraints assessment. Projects that cannot provide these documents are not admitted to the formal study process. For storage or load, the first share of the connection cost must be paid when signing the connection agreement.
  - German TSOs apply a "first-ready, first-served" principle to transmission grid connections through a process known as *Reifegradverfahren*. New applications are evaluated and ranked based on transparent and measurable

criteria along the dimensions: land acquisition and permit status, technical concept and connection plan, financial capacity, and grid and system benefits. Applications demonstrating high maturity and quality are considered first for limited connection capacities.

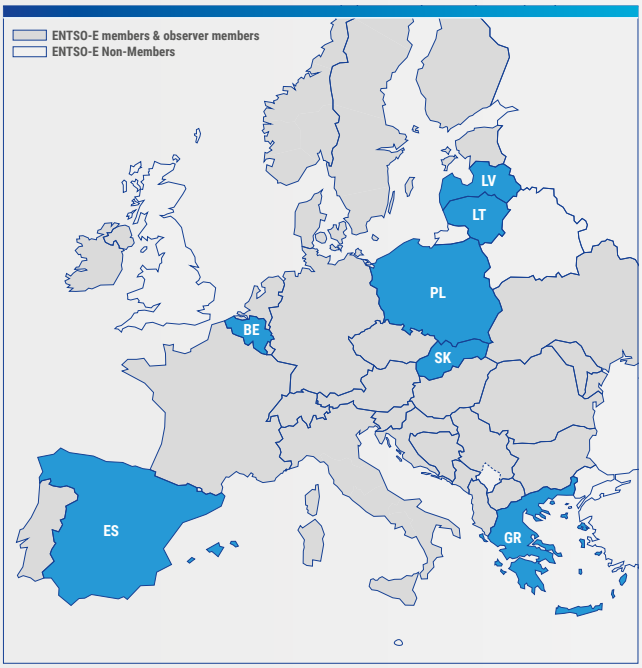
- **Greece:** A comprehensive framework that applies to all technologies regulates the financial guarantees that connection offer applicants should submit to the TSO or DSO, as applicable, together with their applications. Specifically, applicants must provide a financial guarantee equal to €7 per kW for the portion of the power exceeding 100 MW. The guarantee is reduced to ¼ of the amount upon signing the connection agreement. Upon signing the connection agreement, the total contract price for the works to be carried out by a competent operator, whether in part or in full, is paid, up to a maximum of €250,000.
- **Latvia:** System users (consumers) and electricity generators receiving a fixed transmission system service must pay a capacity reservation security deposit of €20,852.40 per MW of reserved capacity, capped at the amount corresponding to 100 MW of reserved capacity. The deposit must be paid within 60 days of the issuance of the technical requirements.
- **Lithuania:** All project types require a bank guarantee: €25/kW for generation and storage and €15/kW for consumers. Requiring a bank guarantee that remains valid throughout the project development involves a third party (the creditor), which provides an additional external incentive. This helps address the system operator's limited ability to penalise ghost projects independently. In our experience, bank guarantees must be verified by a competent institution, as there is a growing number of fraudulent financial institutions issuing fake guarantees.
- **Norway:** A maturity assessment is conducted for all applications, as required by national regulations. Capacity is allocated based on a first-mature, first-served principle. Maturity criteria include a detailed project description, capacity demand, a plan for obtaining the necessary permits, zoning permits in place, exclusive land rights, secured financing for the planning stage, a financing plan for the building stage, and a detailed milestone plan for the customer's project.
- **Poland:**
  - **Financial requirements:**
    - Non-refundable application fee of €20,000
    - Advance payment at the application stage and warranty at the connection agreement stage – both retained by the operator in whole or in part, depending on the stage of progress at the time of the investor's withdrawal; warranty is accepted in cash, guarantee, or surety agreement
  - **Non-financial requirements – required when submitting the application:**
    - Land possession
    - Legal rights enabling implementation – approvals from land authorities
  - Failure to meet milestones (failure in work progress specified in the connection agreement) results in the termination of the agreement.
- **Portugal:** A transparent, time-bound procedure – triggered by government recognition for attribution of capacity – was established for allocating electricity demand connection in areas of the network with a high volume of demand connection requests ("high-demand zones"). Applicants must provide a financial guarantee related to the requested demand capacity, ranging from €13.5/kVA to €40.5/kVA. For generation connection requests, the law requires project developers to provide a financial guarantee of €10/kVA when applying for connection capacity. Financial guarantees may be enforced in cases of non-compliance with the project schedule or project withdrawal.
- **Serbia:** The developer must provide a financial guarantee of €25,000/MW, ensuring compliance with the deadlines defined by the regulation that lasts for the duration of the project development.
- **Spain:** Generation and storage projects must provide a financial guarantee of €40/kW, which remains in place throughout the project development period and may be enforced if the project schedule is not met or the project is withdrawn. Demand projects are not required to provide financial guarantees; however, they must pay a fee to reserve capacity, which remains payable until the demand facility begins operation. Additional maturity criteria, such as land acquisition, are also considered during the project assessment process, and developers must provide further evidence of progress, including permits, operating authorisations, and payment for the required works, before the project can be connected to the grid.
- **Sweden:** Connection request applications must meet certain maturity criteria by providing detailed project information, a planned project timeline, and an energy analysis. Maturity is then assessed throughout the connection process to ensure that the stated milestones and timelines are being met.

4.3 Prioritisation of Requests

In addition to project maturity, it may be valuable to consider additional factors when evaluating connection requests, such as the overall system benefits (e.g. contribution to congestion reduction, efficient network utilisation, security of supply). Such benefits can range from contributing to national efforts to decarbonise the energy sector to improving grid utilisation (e.g. by reducing load flows), thereby enabling more efficient use of infrastructure.

When considering such criteria, requests that provide desirable system benefits could be prioritised over similar requests that lack these effects. The criteria should be defined in the national legal framework, as they depend on national policy objectives and local network circumstances, including load-flow patterns on system operators' grids. The proposed Article 18d of the Electricity Regulation would give regulatory authorities an explicit basis to approve such prioritisation where grid capacity is scarce, while leaving the criteria to national decision. For example, where provided for under national legislation, projects located in Renewable Acceleration Areas established under the Renewable Energy Directive (RED) may benefit from streamlined procedures and could be considered within broader prioritisation frameworks.

Examples



- **Belgium:** A key aspect of the grid connection study methodology is the link between individual grid connection requests and the assumptions used to identify the need for network development. The difference between these assumptions, formally approved through the NDPs, and existing and reserved capacity determines the so-called "growth potentials" for each of the main categories of grid users. Each grid connection request then draws on the growth potential corresponding to its category, without affecting that of other categories, thereby securing the achievement of commonly agreed societal ambitions.
- **Greece:** Prioritisation criteria are provided by Greek legislation (for example, for installation in lignite areas). By law, priority is given to grid connection offers for the repowering of renewable energy stations, the hybridisation of renewable power plants, and the co-location of renewable generation with storage facilities.
- **Latvia:** For electricity generators receiving a flexible transmission system service, the TSO may define the required generation profile. This allows generation profiles to be coordinated and optimised within specific network segments.
- **Lithuania:** Consumers connecting to the grid can have 90 % of their grid connection costs subsidised if their project is declared a large-scale investment project by the government. These consumers must ensure they consume enough energy from the grid for the amount paid through the energy tariff to cover the grid connection costs within 10 years.
- **Poland:** The connection must not prevent the connection of generating capacity within the limits specified in the National Act on the Promotion of Electricity Generation in Offshore Wind Farms. Currently, 12 GW of offshore capacity is reserved, with some already under construction, some at an earlier stage, and some having received only preliminary connection conditions.
- **Slovakia:** Slovak legislation, in line with relevant EU legislation, prescribes certain prioritisation (as well as some simplification) in grid connection procedures for solar, wind, and high-efficient combined heat and power generation. Note: This legislation is currently being amended.
- **Spain:** The TSO does not prioritise projects. However, when the capacity allocation mechanism differs from the general procedure and the Ministry decides to hold a capacity auction, prioritisation criteria are introduced. These may include existing industry, strategic consumers, environmental considerations, and grid-related or socioeconomic benefits.

4.4 Flexible and Non-Firm Connection Agreements

TSOs support the wider use of flexible connection agreements (FCAs) as a potential means of accelerating grid connections. The Commission's proposal to future-proof electricity bills also promotes FCAs as a tool to reduce connection queues.

FCAs, with predefined curtailment or availability conditions, can enable earlier grid access while preserving system security. They primarily address operational network constraints rather than all types of connection constraints and cannot replace physical connection infrastructure. FCAs are particularly relevant where grid reinforcement requires a longer timeline or where the competent national authority does not consider network development the most efficient solution.

Where implemented in national regulatory frameworks, such arrangements can be offered and agreed between the TSO and the connecting customer in accordance with the criteria and prerequisites stipulated in the European legal framework. In particular, FCAs must also comply with the principles of third-party access. The regulatory framework requires Member States to ensure the implementation of a system of third-party access to transmission and distribution systems based on published tariffs, applicable to all customers and applied objectively and without discrimination between system users. Member States must ensure that these tariffs, or the methodologies underlying their calculation, are approved in accordance with Article 59 of the Electricity Directive before entering into force. They must also ensure that the tariffs and, where only the methodologies are approved, those methodologies are published before entering into force. Under this framework, the TSO may refuse access where it lacks the necessary capacity. Any such refusal must be duly substantiated and based on objective, technically and economically justified criteria.

In parallel, TSOs across Europe publish clear information on the capacity available for new connections in their areas of operation. Therefore, alongside offering Member States the option to establish FCAs, national legal frameworks shall ensure, among other things, that FCAs do not delay network reinforcements and specify the connection fee design, financial compensation for the lack of firm access, geographical scope, type of grid users, and contract length. They should also ensure compliance with Article 13.7 of the Electricity Regulation.

Flexible connection and network agreements should not be mandatory for TSOs but should instead be subject to technical feasibility. TSOs must consider the grid's current connection or transmission capacity and, in some cases, the lack of available capacity. Providing flexible capacity in these cases may lead to operational incidents, such as rapid overheating of power lines caused by sudden increases in injection or consumption. For example, all inverter-based facilities and data centre capacity may change in milliseconds. In such cases, TSOs should retain the right to refuse access based on objective, technically and economically justified criteria or analysis that applies to the specific project.

Additionally, connection processes vary across European countries. In countries with a fixed price system, which guarantees a connection fee for investors, this system may become invalid if a permanent flexible connection exempts clients from paying for grid reinforcements.

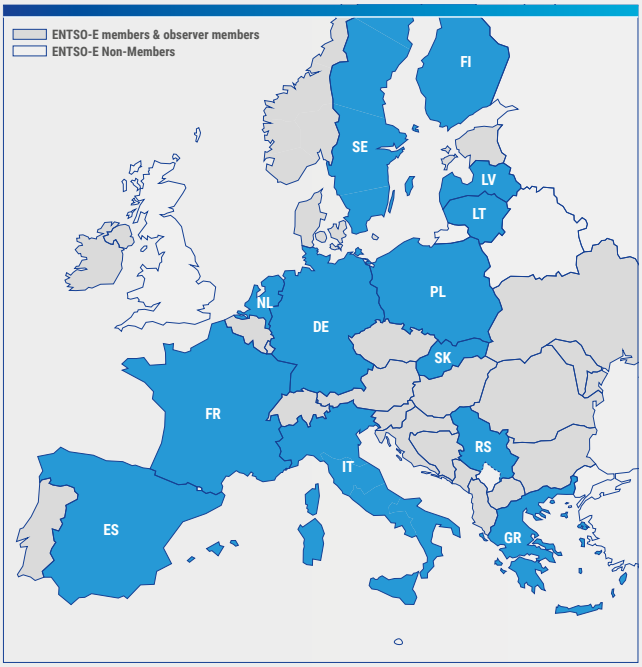
Furthermore, for some European TSOs, a key question is how to apply curtailments for flexible connection if a grid component is linked to several connection agreements and the TSO must curtail the capacity of one or more clients. The TSO therefore determines the conditions under which curtailment applies, taking into account the requirements of Article 13(7) of the Electricity Regulation, and whether issuing an FCA is possible. Additionally, when designing FCAs, increases in grid imbalances should be prevented by ensuring that appropriate countermeasures are in place.

Therefore, FCAs should be temporary until grid investments are complete. An additional concern arises when a client with a permanent FCA is later joined by a client with a firm contract and a competing usage profile that connects to the system at the same location. In this case, the potential usage hours of the FCA holder decrease, thereby infringing on the FCA contract holder's grid access. This happens because the amount of energy that needs to be curtailed increases, while the amount of curtailable energy stays the same. In a system where FCAs and firm contracts coexist, the impact of new firm contracts on existing FCA contracts should therefore be considered.

Proposal

Flexible and non-firm connection agreements should be considered voluntary tools to accelerate grid access where network constraints exist, while preserving system security. TSOs should retain the right to determine the feasibility and conditions of such agreements, in line with national regulatory frameworks.

Examples



- **Finland:** FCA is already provided for in the Finnish Electricity Market Act. Under the law:

  a) TSOs/DSOs are required to offer customers a temporary flexible CA until firm capacity becomes available (typically a few years);

  b) offering a permanent CA is voluntary, although the NRA retains the option to terminate the agreement (this is not used in practice, as it is considered too risky).

- **Slovakia:** FCAs are included in the Energy Law as an option that grid operators must offer to applicants when there is insufficient grid capacity at the connection point, the applicant's connection does not jeopardise grid operation and safety, and the applicant installs power control equipment. In such cases, the applicant must accept contractual restrictions allowing the connection capacity to be reduced under specified conditions without compensation. The grid operator must inform the applicant of the measures to be taken and the deadlines for implementing the necessary grid infrastructure to enable connection without capacity limitations. This requirement does not apply if the connection point is located in a part of the grid where reinforcement is not cost-effective under the respective NRA's guidelines.

FCA is a useful tool, but it should be implemented on a voluntary basis only.

- **France:** The French TSO has established different FCAs based on user type to speed up connections. The agreement follows an FCA template available in the technical documentation, but the parameters are dependent on the grid context and user type:
  - For user types other than demand, the installation is subject to non-compensated curtailment during the grid infrastructure works required and described in the connection agreement.
  - For demand, the user must manage its peak demand according to the available capacity.

The agreement specifies a timeline for completing the works. After this date, any limitations on injection or consumption resulting from TSO developments or maintenance are compensated. These agreements are firm.

- **Germany:** By law, FCAs are a voluntary option to address limited connection capacity and thus accelerate new connections. However, their applicability depends on the underlying connection challenge. In the transmission network, the availability of connection capacity, especially switch bays, is currently the most limiting factor for new connections. In this context, the value of an FCA is limited, as the availability is binary and independent of the operation of the asset. Instead, FCAs foster flexible operation, which helps address limited transmission or transport capacity. As Germany continues to experience limited transmission capacity at the system level, in addition to connection-related challenges resulting in high redispatch volumes, a broader application of FCAs could deliver value beyond connection issues alone.
- **Italy:** Considerations and discussions regarding the introduction of FCAs are currently underway with the NRA.
- **Lithuania:** For generation and storage capacity, all new contracts are permanent FCAs. This allows the system operator to overbook the grid threefold and use the grid optimally. Wind and solar generation are weakly correlated, so the curtailment is negligible. In addition, during sunny and windy periods when generation coincides, energy prices drop and energy producers self-curtail to avoid unprofitable prices. In modelling the grid for power-flow calculations, different scenarios are considered separately, such as maximum wind generation with no solar generation and winter consumption or maximum solar generation with no wind generation and summer consumption. Energy consumers can choose between permanent FCAs and firm contracts. Clients with FCA contracts receive reduced energy tariffs, incentivising them to choose an option that benefits the operator.

- **Latvia:** As stipulated by law:
  - Fixed transmission system service: The generator is guaranteed continuous access to the transmission system.
  - Flexible transmission system service: The TSO may curtail the generator's output for up to 876 hours per year to manage network constraints. During these periods, the generator pays a compensation fee to the TSO.
  - Curtailable transmission system service (for standalone BESS): The TSO may, at any time and to any extent, restrict power injection into the system to ensure secure system operation. This service may be granted for the full capacity requested by the storage operator, regardless of the available transmission system capacity. A curtailment fee applies when restrictions are imposed by the TSO.
- **Netherlands:** The legislation and regulations set out the conditions and circumstances under which a connected party may opt for a fully or partially variable transmission right. A fully variable transmission right applies in areas with congestion. A variable transmission right entitles the connected party to transmission capacity 85% of the time over the course of a year.
- **Serbia:** For all user types except demand, the Energy Law defines FCAs as an option. Curtailments are approved by the NRA and are not compensated.
- **Spain:** Discussions with the NRA on the introduction of FCAs are currently ongoing.
- **Sweden:** A TSO-level capacity map (excluding lower voltage levels) was published in May 2026, providing an aggregated overview of the capacity situation. Non-firm connection agreements are being piloted to bridge the timeline gap before physical grid strengthening measures can be carried out but are not yet fully implemented.



4.5 Locationally Differentiated Connection Charges

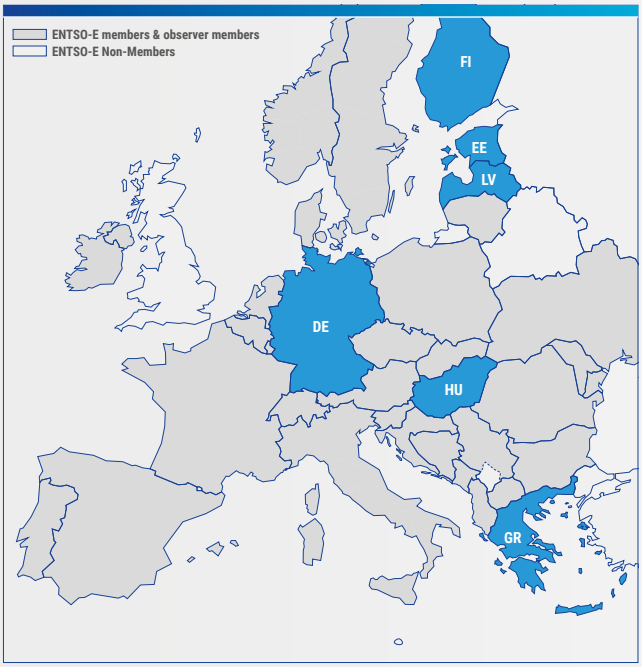
TSOs broadly support locationally differentiated connection charges. Once strongly supported by NRAs, these charges are an effective, non-discriminatory mechanism for steering projects towards areas with available grid capacity or grid-friendly locations. Many national mechanisms already follow a similar approach, such as the *Baukostenzuschuss* in Germany, and provide applicants with stable, long-term signals. This approach has the potential to reduce costs for system operators and, consequently, grid users. It may also shorten connection procedures while providing investors with clearer locational investment signals.

Connection charges reflecting grid impact, location, or voltage – and potentially differentiating between individual generating/consumption technologies or between load and generation asset – can provide neutral, non-discriminatory signals to steer projects towards grid-efficient areas, supporting both transmission system optimisation and investor decision-making. This approach can also improve system development and optimise socioeconomic costs. Furthermore, the EC and the existing legal framework emphasise the importance of local contexts, such as the level of electrification or generation and the load profile in a given area, which determine network users' ability to respond to incentives.[5] By lowering overall system costs, this approach can benefit consumers, both household and industrial, over the long term.

Proposal

Locationally differentiated connection charges should be considered a transparent and non-discriminatory tool to provide long-term investment signals and incentivise projects in grid-efficient locations, while supporting the optimisation of network development and overall system costs. Therefore, TSOs embrace the amendments in the regulatory framework regarding tariff methodologies. In addition, given that non-firm FCAs do not offer unrestricted access to the network, network charges applied to users with these types of connections should reflect this. TSOs commit to supporting NRAs when developing the tariff regime.

Examples



- **Estonia:** Grid connection costs vary by voltage level, reflecting differences in transmission grid size. Reinforcement costs are lower for connections at 330 kV than at 110 kV because the 330 kV grid has greater capacity.
- **Finland:** Locational signals are not currently used in Finland, either in connection fees or in transmission tariffs, owing to resistance from the NRA (on the grounds of existing law and high political risk). The use of locational signals has been discussed and set out in writing at European Commission level, so the topic is expected to resurface in Finland in the near future.
- **Germany:** Connection charges are based on the expected grid investment required. For newly connected load and storage customers, the connection cost is multiplied by a location-specific factor (≤ 1.0) that reflects the impact of additional load on the grid.
- **Greece:** Ministerial decree designates priority areas or regions for renewable energy source installations, such as in coal phase-out areas, where development may progress more quickly. Connection costs are linked to locationally differentiated connection charges.
- **Hungary:** In the case of applicants requiring feed-in connection capacity and those requiring load capacity on the high-voltage network, the connection fee is calculated by the network operator based on the technical content of the investments required to fulfil the connection request.
- **Latvia:** The connection fee does not depend on the location and is therefore not a significant factor, as all connection costs are borne by the developer. The connection fee is determined based on the specific technical solution required for the connection.

5 Article 18 of 2019/943 and C/2026/126 Commission Notice on Guidelines on future-proof network charges.

4.6 Transparency Through Aggregated Information

TSOs support transparency but emphasise security and confidentiality concerns. They oppose real-time publication due to their responsibility for operating critical infrastructure.

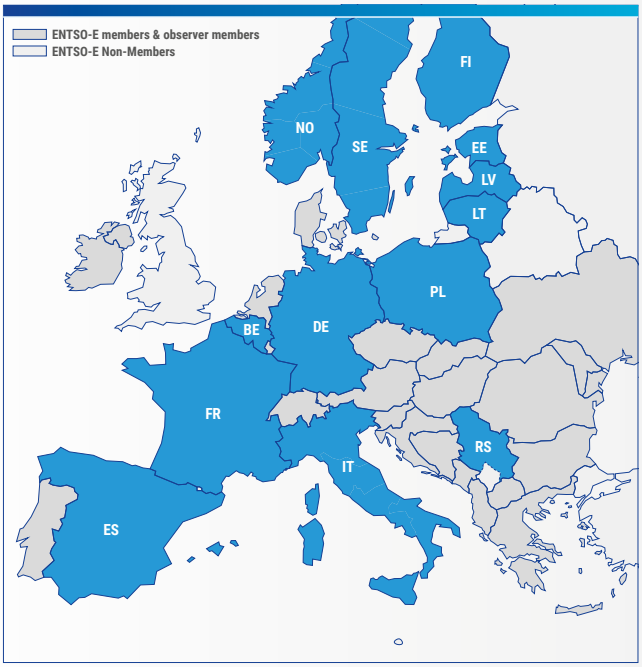
Only high-level or aggregated (non-confidential) information is considered acceptable. Publishing such information on queue volumes and available capacity can help guide applicants' investment decisions without creating misleading expectations or security risks.

At the same time, any discussion on enhanced transparency should be framed within the broader context of safeguarding critical infrastructure. In this respect, the availability of network-related information may need to be balanced against potential security considerations. A cautious approach could therefore be envisaged, whereby transparency focuses on sufficiently aggregated or non-sensitive elements, in line with the overall EU approach to critical infrastructure protection. The scope and implementation of such transparency measures would ultimately be determined by the applicable legislative and regulatory frameworks and would require coordinated action at the appropriate institutional level.

Proposal

TSOs support the publication of aggregated and non-confidential information on queue status and available capacity to improve investment visibility and guide connection requests, provided that transparency measures remain consistent with critical infrastructure protection requirements and applicable national regulatory frameworks.

Examples



- **Belgium:** The TSO publishes congestion information on its website to improve transparency for interested parties, including prospective grid users, federal and regional agencies, and the press, and to guide applicants towards less-congested areas. A hosting capacity map provides an initial, indicative overview of areas with and without available capacity in Belgium. However, some information is not made public due to system security and commercial privacy concerns.
- **Estonia:** The TSO has an interactive map for the connection process. Available capacity is not shown under the newly implemented fixed-price system, but the map indicates whether a connection can be requested at a given location and shows the associated cost. In addition, all in-process connection requests and active connection agreements for injection capacity are available on the TSO's website, including the requested capacity, technology, and deadline for the TSO to complete the connection works.
- **Finland:** The capacity map (Gridscope) is available on Fingrid's website. It provides an illustrative, interactive map view of the available capacity for consumption, generation and storage, both today and for the coming years, based on grid investment decisions already taken. Fingrid is also planning to publish some details of concluded connection agreements on its website.

- **France:** Information on queues, aggregated connected power, and available capacity per substation across France is published by both the TSO and DSOs on a dedicated website for renewable energies. Information on available capacity for storage systems is also accessible on a dedicated platform.
- **Germany:** General information is provided on available capacity for load and generation, as well as on switch bays in existing substations, including aggregated information on the current queue status. This allows customers to focus on locations with available grid connection capacity.
- **Italy:** A publicly accessible digital platform allows users to view all active connection requests, aggregated by municipality, typology, and stage in the connection process.
- **Latvia:** Available transmission system capacity is published on the AST website through the available capacity map. For the flexible transmission system service, available capacity is published in a PDF table. The AST website also provides information on the status of each developer's connection project (e.g. technical requirements issued, agreement signed, under construction, etc.), its location in the system, the reserved capacity, and the type of transmission service. Publication of this information is required by law and by the Public Utilities Commission's regulations governing the connection process.
- **Lithuania:** Current regulation requires the TSO to share highly detailed and up-to-date information. Detailed information is provided on all generation hosting capacity, queue status, and connection condition recipients.
- **Norway:** All capacity reservations and projects in the queue are published on the TSO website. This includes capacity demand, company name, area where the connection is planned, planned connection date, application date, etc.
- **Poland:** The TSO publishes general information online on submitted applications, issued terms, connection agreements, and refusals per substation. The TSO is implementing a remote system for submitting connection applications.
- **Serbia:** The TSO is obliged to publish a list of all projects in the queue on the website. This includes capacity demand, company name, area where the connection is planned, planned connection date, and completion phase.
- **Spain:** General information is available on available capacity for load and generation, as well as switch bay availability for existing and planned substations, including aggregated data on the current queue status.
- **Sweden:** The TSO provides aggregated information on application volumes in the queue at the national and regional levels, as well as on reserved and allocated capacity at the national level. The statistics provided pertain to applications received by Svenska kraftnät, and the information is updated regularly.



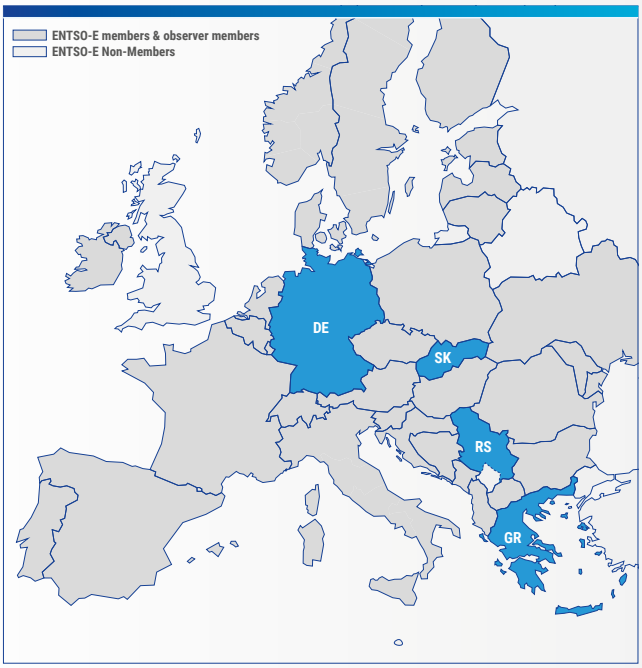
4.7 Timely Aggregated Assessment of Connection Requests

TSOs shall have the ability to assess connection requests collectively within one study/assessment procedure. This could simplify and accelerate the connection process, save human and financial resources, and provide system operators with an advance view of the necessary development of their grid infrastructure.

Proposal

National legislation and regulatory frameworks should allow TSOs, where needed, to perform aggregated (cluster) assessments of multiple connection requests submitted within the same area or time window. There should be transparent rules for clustering applications, allocating available capacity, and communicating outcomes to applicants, ensuring greater efficiency in grid connection processes.

Example



- **Germany:** The new connection procedure is designed as a cluster study, where the applications are mapped against available connection capacity on a regular basis (every 10 months).
- **Greece:** Small producers can combine their installations to reach a total capacity of 8 MW. They can then apply as a cluster for a connection offer from the TSO rather than submitting individual requests to the DSO. This measure has been applied in legislation since 2021.
- **Serbia:** The TSO assesses connection requests by preparing connection studies every six months. The TSO may define a common connection for two or more connection requests.
- **Slovakia:** This approach is not based on current national legislation. At the TSO level, it is applied by agreement with applicants. For example, where multiple connection requests are to be assessed at the same time, applicants are offered the option of conducting a single joint impact study. The TSO has had positive internal experience with this approach and may consider incorporating this type of connection request impact assessment into legislation. This would require discussions with the NRA and the responsible ministry.



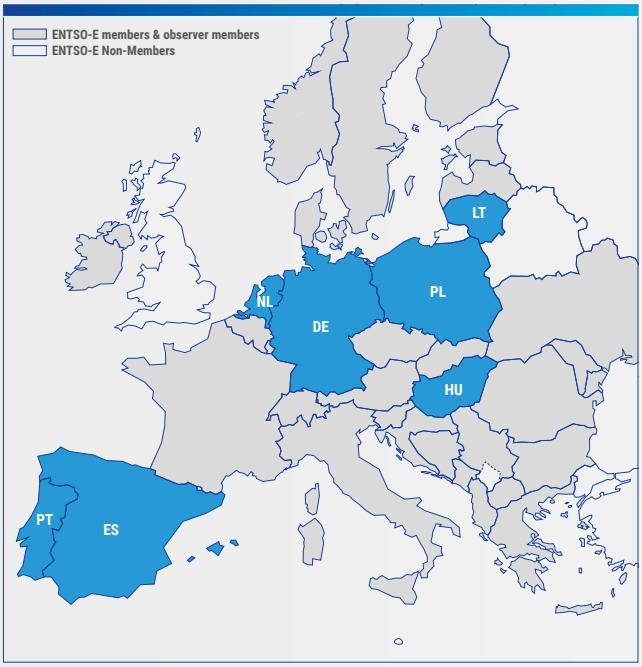
4.8 Encourage Hybridisation/Co-location

The hybridisation of power plants and the co-location of generation with storage facilities can help optimise the use of existing network capacities. Furthermore, complementary generation and load patterns can reduce the load at a given connection point, thereby alleviating pressure on the network. Similar benefits may also arise from hybrid configurations that combine demand and generation assets, where flexible consumption can support more efficient network utilisation and reduce peak grid impacts.

Proposal

Regulatory frameworks should enable hybrid and co-located renewable energy projects by allowing multiple assets (generation, storage, and flexible demand) to share a single grid connection under transparent technical conditions. Connection arrangements should maximise the utilisation of existing network capacity while ensuring that the agreed connection capacity and system security limits are respected and the utilisation of the grid connection is optimised.

Examples



- **Germany:** Bonus points are awarded to combined projects to encourage more efficient use of switches.
- **Hungary:** The NRA issued a decree on the publication of technical and economic data on available feed-in capacity for medium- and high-voltage connections, with a nominal capacity of at least 0.5 MW, as well as weather-dependent production equipment and electricity storage. Publishing data on feed-in connection capacity helps inform investors planning to install feed-in production or storage equipment at an existing connection point implemented by another investor, thereby enabling better utilisation of the existing capacity available in the feed-in direction.
- **Lithuania:** Hybridisation is essential to using the grid efficiently. Due to Lithuania's geography, the annual generation profiles of wind and solar power plants have negligible overlap. Furthermore, on sunny and windy days when generation overlaps, overall energy generation is high and wholesale energy prices drop significantly, prompting energy producers to curtail themselves to avoid unprofitable prices. Based on Litgrid's experience, co-located hybridisation operates according to the same principles as hybridising the entire transmission grid. By applying hybridisation principles across the entire grid, Litgrid created large amounts of available capacity. However, achieving grid-scale hybridisation requires enforcing FCAs on all renewable generation. Where a project is co-located via a direct line (i. e. a consumer is connected directly to a generator), the generator's reserved capacity is reduced by the power of the consumer connected via the direct line. This mechanism frees up capacity for new generation connecting to the transmission grid.
- **Netherlands:** The law stipulates that cable pooling is permitted for various installations (storage, consumption, and generation). To avoid creating a closed distribution system, no more than five installations may be connected to a single connection point.
- **Portugal:** Portuguese law provides for the hybridisation of power generation plants to optimise the use of existing network capacities. Some hybrid systems are already connected in Portugal, including wind farms with photovoltaic plants or hydroelectric plants with photovoltaic plants. However, the combined plants in a hybrid system may inject into the grid only the original established connection power. The developer must manage the power of the hybrid plants to ensure that this limit is never exceeded.
- **Poland:** Cable pooling (involving multiple companies) and hybridisation (involving a single company) are permitted to increase connection utilisation. Assessment criteria are less stringent if the required connection capacity remains unchanged. Technically, this can be implemented using busbar trunking systems, with up to six entities connected to one bay.
- **Spain:** Hybridisation with both renewable technologies and storage is permitted and encouraged. Hybrid projects get a 50 % reduction in the financial guarantee needed to obtain permits, as well as reduced timelines for permitting and administrative authorisation procedures.

4.9 Repowering Existing/Already Connected Assets

Repowering existing or already connected assets can help optimise the use of existing grid infrastructure and accelerate the integration of new capacity without requiring entirely new connection procedures. By reusing existing connection points and network assets, repowering may reduce permitting complexity, limit additional grid investments, and support the more efficient use of available system capacity, while maintaining system security and compliance with technical requirements.

However, clear regulatory and legislative rules are needed to establish criteria for potential capacity increases and for technical and technological upgrades to refurbished/existing grid-connected assets, while allowing grid operators to guarantee system security and safety.

Proposal

Regulatory frameworks should promote the repowering of existing grid-connected assets through streamlined permitting and connection procedures, while allowing the reuse of existing grid connections wherever technically feasible. Clear criteria should be established for capacity increases and technology upgrades, ensuring that repowered installations continue to meet applicable grid connection requirements and do not compromise system security or operational reliability.

Examples



- **Greece:** Directive 2023/2413, which has been incorporated into Greek law, stipulates an overall permitting deadline of 12+6 months for repowering renewable energy source installations in renewable energy source acceleration areas, including grid connection procedures. It is worth noting that the law provides an exemption for the time required to construct or repower renewable energy power plants, their grid connections, and the related grid infrastructure necessary to ensure grid stability, reliability, and security. The same exemption applies to renewable energy source installations outside acceleration areas and to offshore installations.
- **Portugal:** Under Portuguese law, repowering power plants refers to modernising or replacing existing generation equipment while generally maintaining the same site and purpose. The framework also allows an increase of up to 20 % in grid connection capacity without triggering a completely new allocation process, with that additional capacity being fully dispatchable by the grid operator. Overall, the regime tends to encourage repowering, especially for renewable energy plants, because it improves efficiency and output without requiring new land use, although compliance with grid connection rules and other regulatory constraints remains necessary.
- **Serbia:** Any request for capacity increase at an existing connection point is assessed as a new connection.
- **Slovakia:** No concrete rules (regulatory or legislative) are in place for connection procedures of repowered/already connected assets. SEPS, as a TSO, follows the RfG/DCC directives to set rules for connecting repowered assets. When assessing requests to increase capacity at existing connection points, the same system security and safety criteria apply as for new connections, although the procedure may be less challenging for both the grid operator and the applicant, depending on the requested capacity increase.
- **Spain:** Repowering power plants involves upgrading or replacing existing generation equipment while generally preserving the same site and operational purpose. The framework also permits an increase of up to 5 % in grid connection capacity without requiring a new allocation process.

4.10 Better Consultation With Stakeholders Before Publishing an NDP

As described in the EC's Guidance document, Member States, NRAs, and grid operators shall involve various stakeholders more actively in grid planning processes, such as in NDP preparation. This measure should ensure that grid operators are aware of the type, amount, installed power, and location of different technologies that may connect to their grid at a given time. It should also enable grid operators to respond in a timely manner to proposed investment by preparing grid reinforcements or other non-wire solutions to facilitate future grid connections.

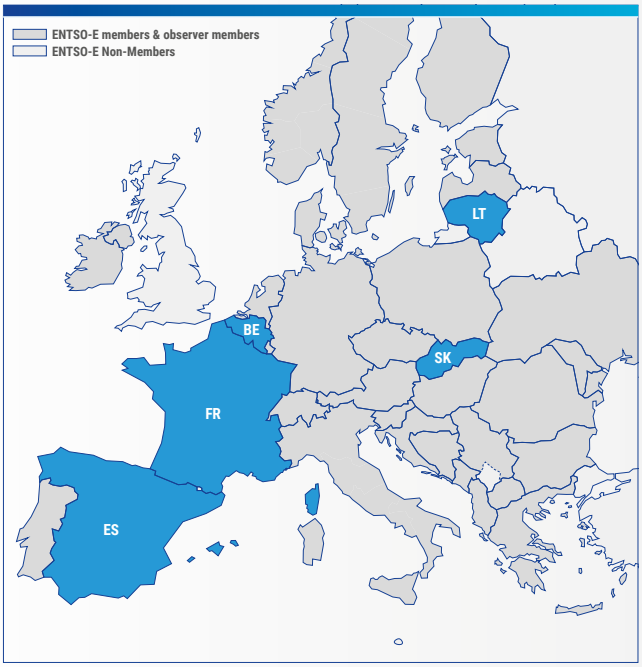
The obligation to consult on NDPs throughout their preparation already exists under EU and/or national legislation. NRAs and Member States already have sufficient powers to support cooperation between grid operators and stakeholders in grid planning processes. Any additional measures in this area should be adopted carefully to avoid imposing further bureaucratic obligations on grid operators and their grid planning procedures.

Proposal

Existing stakeholder consultation processes at the scenario stage of NDPs should be used to strengthen the exchange of information between grid operators, project developers, network users, public authorities, and other relevant stakeholders. Early sharing of information on expected investments and connection needs, while avoiding duplication, should support more accurate network development planning, facilitate the timely identification of reinforcement and non-wire solutions, and improve the efficient integration of new users into the electricity system, without introducing disproportionate additional administrative requirements.



Examples



- **Belgium:** The scenario-building phase of Elia's NDP involves extensive collaboration and consultation to ensure that it reflects the latest views and assessments of capacity needs in the coming years. The scenario is now developed jointly by the electricity TSO and the gas TSO to ensure consistency in the planning assumptions used across the two sectors. Collaboration with DSOs is also crucial to avoid double counting and, more generally, to prevent uneven development of the electrical infrastructure. This scenario framework is crucial for anticipating future needs, given the long lead times for infrastructure projects compared with those of typical grid user projects. It also directly affects how connection requests are handled, through the grid connection study methodology explained in a previous section.
- **France:** RTE's 10-year network development plan (SDDR) involves extensive consultation with various stakeholders, including developers, DSOs, and the French administration, to develop scenarios with relevant and challenged parameters. An environmental evaluation will be conducted by the French environmental authority. The preliminary results and analyses covering all aspects of the plan – including scenario definition, expected works related to grid development, asset management, offshore tenders, industrial capacity, and plan financing – will be discussed publicly before the final report is published online.
- **Lithuania:** Litgrid's 10-year NDP is being coordinated with the DSO and the gas system transmission operator. Coordination with the gas system transmission operator takes place because Litgrid and that company share the same corporate owners.
- **Slovakia:** National legislation already requires public consultation on NDP scenarios and the final NDP. Furthermore, the largest and most important grid users are required to provide input data to the TSO for NDP preparation. Grid operators (TSOs and DSOs) consider not only submitted grid connection requests but also requests for an official position paper from the grid operator, which is required to obtain a certificate from the Ministry of Economy under national legislation.
- **Spain:** The scenario to be used in the NDP is the NECP as recently fixed by law, as both are important energy planning tools led by the Ministry. Stakeholders are already deeply involved in the preparation of the NECP. Stakeholder participation in the NDP is also provided for by law. In the first step, market actors and regional administrations are invited to submit proposals on grid developments and new connection needs. This step is also open to any interested association or individual. A draft NDP is then subject to public consultation, during which comments, modification requests, or new proposals are received, including key considerations from the NRA and feedback from the regional administrations. Finally, the NDP is presented to Parliament and approved by the government.

4.11 Digitalisation of Connection Procedure

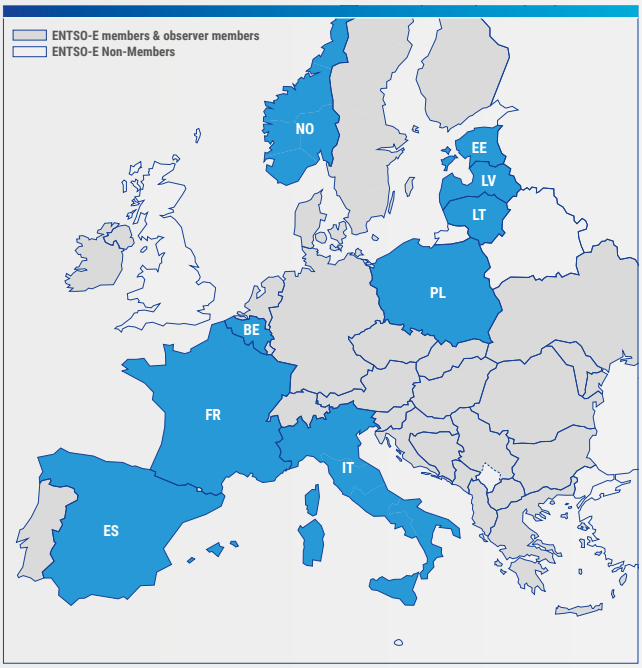
TSOs support this measure, as it could improve the traceability of connection requests. Furthermore, it could promote the harmonisation of data provision, reducing the need for requests for additional data. It also supports a fair and non-discriminatory approach to handling connection requests, while ensuring that applicants have consistent access to information about their connection requests and the subsequent steps in the process.

Digitalisation of the connection procedure aligns with the need for transparency, as discussed in Section 4.6.

Proposal

TSOs and DSOs within the same country should be encouraged to implement digital connection management platforms with harmonised data requirements and standardised interfaces to streamline the submission and assessment of connection requests. Digitalisation should improve transparency, facilitate communication between applicants and grid operators, enhance the traceability of connection procedures, and contribute to more efficient and non-discriminatory connection processes.

Examples



- **Belgium:** Elia has undertaken to address the connection process transversally, from raising awareness on grid opportunities to the execution and commission of works. Through its one-stop customer portal, EPIC, it supports energy-intensive companies throughout the process, allowing them to onboard, request and monitor feasibility studies, and manage their contracts (sign, annexes, etc.). The portal will soon also coordinate exchanges during the execution of works (e.g. execution, compliance, and invoicing). For customers connected to distribution grids, Elia is closely coordinating with its DSO partners to provide consistent and usable information. To this end, the parties are developing common customer-facing platforms or exchanging information with the DSO through its dedicated EPIC portal environment.
- **Estonia:** The TSO connection customer portal allows users to submit applications for transmission grid pre-studies, grid connections, and connection modifications. The portal also serves as a platform for managing the entire application process and exchanging information with the TSO.
- **France:** Clients can submit requests for preliminary connection studies through the online client platform. The possibility of extending this to all connection requests is under consideration.
- **Italy:** The grid connection process is fully digitalised, enabling applicants to track the progress and status of their application in real time via a dedicated online platform.
- **Latvia:** AST plans to introduce a new IT system in 2027 to monitor and manage the entire connection process, from the submission of an application to the issuance of the Final Operational Notification (FON). Through this system, developers will be able to track the individual steps and statuses of the connection process, as well as request and obtain all necessary information and documentation related to their connection project.
- **Lithuania:** A client portal is under development, with an expected launch in 2027.
- **Norway:** A national digital portal for grid connections has been developed. Customers can always see the status of their requests, and local and regional DSOs can communicate more easily with the TSO.
- **Poland:** The TSO is implementing a remote system for submitting connection applications.
- **Spain:** Each TSO and DSO has its own portal for submitting applications and publishing relevant information. In addition, the NRA recently published maps that provide an aggregated view of this information.



5 Measures Requiring Caution or Redesign

Other proposals raise significant feasibility or risk concerns from the TSO perspective.

5.1 Strict Connection Deadlines and Penalties

Transmission system assets at the 110 kV voltage level and above consist of complex, expensive, and robust equipment that must be carefully considered before investment or connection decisions are made. It is in the best interest of the TSOs to connect new customers in a timely manner. However transmission-level connection timelines are heavily influenced by permitting, land acquisition, the technical connection solution and grid network configuration, the requested capacity, the connection location, long equipment supply chains with rapidly and suddenly changing delivery times, and construction constraints that are beyond the TSO's control.

Furthermore, when a high number of connection capacity requests are received, network reinforcement investments by more than one network operator may be necessary to fulfil those requests. In such cases, the connection deadline may depend on the coordination of investment activities among the network operators concerned, making it questionable whether a fixed deadline set in advance in legislation would be appropriate.

Building transmission assets, primarily at the 110 kV voltage level and higher, takes time, and in almost every case does not meet applicants' expectations or requirements for connection time. Fixed deadlines and penalties risk increasing the administrative burden on TSOs without accelerating the physical delivery of connections. Fixed deadlines also lead to rushed technical solutions rather than cost-effective grid investments. In addition, the technical solution may need to be modified to address increasing demands for greater grid resilience against third-party interference, such as physical attacks and sabotage, as well as grid security requirements.

When such a requirement is introduced, both system operators and administrative bodies may need to implement extensive procedures to monitor timelines and manage deadline extensions. Since delays are largely outside the TSO's control, extensions would consequently always be granted. As a result, the procedure would not be faster, but costs would still arise from the associated administrative burden.

5.2 Direct Lines[6] as a Systematic Solution

Direct lines are viewed positively as a tool for co-location (see Section 4.8). By linking generation, storage and demand on or near the same site, they can speed up project delivery in congested areas and reduce the capacity that needs to be contracted from the public network.

However direct lines do not constitute a "grid connection", as they connect a power generation site directly to a consumption site, enabling energy to be supplied directly from the producer to the customer without the intermediation of the network. These lines may be appropriate in specific cases; however, we do not recommend that grid operators offer them as a preferred option for every connection request, as this risks complicating system operation, reducing transparency, and undermining coordinated grid development, not to mention the loss of information on the grid operators' side regarding electricity consumption and generation trends.

Reference from the guidance

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.

Using direct lines as a systematic solution leads to the development of parallel grids on private property, typically supplying only one consumer. In contrast, grid infrastructure development focuses on supplying the maximum number of consumers with the least number of lines. A systematic approach based on direct lines may therefore result in several lines where the TSO could achieve the same outcome with a single line.

Additionally, there are construction and maintenance considerations, including the standards that the lines must comply with and the need for an independent association to perform regular inspections to ensure the lines are up to date.

The biggest issue with direct lines is that there is no longer a formal system operator responsible for their operation. This aspect is amplified when the line is used by multiple system users.

6 According to the Electricity Directive, "direct line" means an electricity line either linking an isolated generation site with an isolated customer or linking a producer and an electricity supply undertaking to directly supply their own premises, subsidiaries, and customers.

5.3 Hosting Capacity Forecasting at the Transmission Level

Improving transparency, supporting stakeholders' investment planning decisions, mitigating the need for new network development, maintaining Member States' attractiveness as business locations, enhancing their competitiveness, and encouraging grid users to make informed location decisions that shorten connection times and reduce costs are legitimate goals from a European perspective. However, in meshed networks, interpreting data published by the TSO correctly requires considerable caution and a certain level of network knowledge on the part of potential applicants, the lack of which may lead to false expectations. Since published data must be interpreted in its technical context, it must be emphasised that the additional information and disclaimers published by TSOs are just as important as the hosting capacity value itself. **Such tools should remain indicative rather than binding.**

TSOs aim to publish indicative information on the available capacity within the timeline envisaged in Article 50(4a) of Regulation (EU) 2019/943.

Grid Action Plan 6 on Hosting Capacities tasked ENTSO-E and DSO Entity to "*work towards harmonised definitions for available grid hosting capacity … lead to a pan-EU overview of available grid hosting capacities for new network users to connect, together with information on the volumes of connection requests being processed*". The value of increasing the accessibility of national hosting capacity information at the EU level is recognised by the two associations. In this regard, a pan-EU platform linking all national hosting capacity pages, called Capacitypedia, was launched in May 2026.

However, since the initial discussions between system operators and institutional and industrial stakeholders on the objectives of Capacitypedia, it was determined that national practices differ widely based on regulatory, operational, and institutional constraints, limiting the possibility of harmonising the definitions at the EU level. As a result, Capacitypedia provides, in a comparable manner, clear information on the national definitions and methodologies used by system operators in Europe, enabling readers to understand and better assess published grid hosting capacity values.

While the published information on national hosting capacity calculation methodologies[7] shows that certain TSOs use methodologies, including multi-year forecasts, the above-mentioned constraints may prevent other system operators from doing so. Furthermore, the grid hosting capacity values published by system operators are consistently indicative and non-binding.

5.4 Additional Mandatory Governance Structures

Mandatory new working groups risk duplicating existing planning processes (NECPs, TYNDPs) and introducing immature requests into long-term planning frameworks. In addition, coexisting TSO–DSO cooperation in network planning and knowledge sharing in each country should not be underestimated, including existing national processes to discuss the plans and expectations of existing and potential grid users.

TSOs stress that such coordination already exists in the grid development process (NDP/TYNDP). Additional mandatory working groups would slow planning, divert human resources from other development tasks, duplicate existing structures, and introduce uncertainty in planning products by forcing the consideration of immature requests. Strong concerns exist over linking fast-moving project lead times with slow-moving and mid- and long-term network planning cycles.

It would be beneficial for TSOs if connection plans submitted by different developers for consideration in existing grid development cooperation were clearly defined and sufficiently mature. Otherwise, they provide a false impression of future system needs.

7 Examples of national methodologies: Joint Progress Report on Capacitypedia.

6 Reconnecting Planning and Connection Processes

A recurring challenge identified by several TSOs is the limited alignment between long-term grid planning processes and the dynamics of connection requests. While NDPs are based on validated policy targets and long-term system needs, connection queues often reflect short-term individual project pipelines that can evolve rapidly.

Transmission grid planning typically operates on long time horizons (10–20 years) and focuses on reinforcing the core transmission network to accommodate expected system transformation. These investments are designed to support future system needs rather than specific individual projects. In contrast, connection requests are often driven by individual developers' timelines, which may change or not materialise.

Without improved coordination between these processes, there is a risk that:

- Connection queues may not accurately reflect projects that will ultimately materialise.
- Grid reinforcement priorities may become influenced by short-term connection dynamics rather than long-term system optimisation.
- Infrastructure development may become less efficient or misaligned with broader policy objectives.

Addressing this gap therefore requires better coordination between planning assumptions, regulatory frameworks, and project pipelines, while recognising the different time horizons involved. Furthermore, it may be worth considering clear national strategic guidelines for the evolution of the grid, allowing system operators to prioritise specific grid users to a certain extent in the interest of an efficient and coordinated energy transition. This might mean that there are limitations for one technology within a certain time frame to allow for other necessary technologies to emerge as well. However, system operators are currently only able to delay grid connection when there are physical limitations. The proposed Article 18 d of the Electricity Regulation would provide a legal basis for such prioritisation where capacity is scarce, with the criteria to be set nationally.

TSOs therefore see value in:

- Improving the linkage between planning assumptions and connection prioritisation, while maintaining transparent and predictable connection procedures.
- Developing frameworks that allow anticipatory investments when credible demand signals exist and where this improves long-term system efficiency.
- Strengthening cooperation between TSOs, DSOs, regulators, and project developers to improve the visibility of future demand and project maturity.
- Encouraging greater transparency from project developers and industrial actors regarding realistic project timelines and capacity needs.

Such measures could help ensure that connection decisions and grid planning remain mutually supportive, while preserving the efficiency and reliability of long-term system development.

7 Roles and Responsibilities for Effective Grid Connection Reform

Effective reform of grid connection rules requires clear allocation of roles and responsibilities, as well as a stable and predictable legislative and regulatory environment. Addressing connection backlogs and ensuring efficient grid development depends on coordinated action from policymakers, regulators, system operators, and project developers:

- Policymakers and NRAs should establish clear prioritisation frameworks aligned with societal objectives (e.g. decarbonisation, security of supply, electrification). This includes ensuring that energy policy targets and transition pathways are clearly defined and updated in a timely manner to reflect evolving developments (such as new large demand sources like data centres). Stable and consistent policy signals are essential to provide a predictable investment environment and to equip TSOs with the regulatory framework needed to carry out cost-efficient and forward-looking grid planning.
- TSOs should implement these frameworks through transparent, technical, and non-discriminatory connection procedures. This includes applying objective criteria for connection allocation, ensuring efficient use of available network capacity, and providing clear information to market participants regarding grid availability and timelines.
- Investors and project developers should be subject to clearer obligations regarding the quality and maturity of their projects. This may include providing reliable data, demonstrating project readiness, meeting defined milestones, and committing financially where appropriate to reduce speculative reservation of grid capacity.

A recurring concern is the asymmetry of obligations across stakeholders. In many jurisdictions, TSOs face strict delivery deadlines and potential penalties, while accountability mechanisms for applicants whose projects do not materialise remain limited. Addressing this imbalance could help improve the credibility of connection queues and ensure that available network capacity is allocated to projects that are most likely to be realised.

Ultimately, successful reform requires a balanced framework of incentives and responsibilities across all actors, ensuring that planning, connection processes, and investment decisions contribute coherently to the long-term efficiency of the power system.

8 Conclusion: Looking Ahead

ENTSO-E stand ready to contribute constructively to the evolution of Europe's grid connection framework. Accelerating connections is both necessary and achievable, but only if reforms remain technically realistic, legally robust, and aligned with long-term system needs while reflecting regional circumstances and TSO-specific operational realities.

The national examples presented in this paper show that much of this work is already underway. Many of the measures included in the European Commission's Guidance are already applied in Member States and have demonstrated effectiveness.

These include:

- milestone-based queue management and use-it-or-lose-it mechanisms;
- maturity requirements and financial guarantees;
- flexible connection agreements;
- the publication of aggregated information on queues and available capacity;
- the digitalisation of connection procedures.

These experiences also show that there is no single model. Connection processes, regulatory frameworks, and grid characteristics differ across Europe, and effective solutions must be designed to reflect these national specificities.

At the same time, faster connections cannot be delivered by connection procedures alone. A significant share of bottlenecks lies beyond the control of system operators, in permitting, spatial planning, supply chains, and the capacity of public administrations. Progress will therefore depend on coordinated action from policymakers, regulators, permitting authorities, system operators, and project developers, supported by a stable and predictable legislative and regulatory environment.

Several developments will shape the next steps:

- **Technical requirements:** the ongoing revision of the Connection Network Codes (CNC 2.0) is expected to update the technical requirements for new technologies and system needs.
- **Hosting capacity information:** Capacitypedia, launched in May 2026, has improved the accessibility of national hosting capacity information at the EU level.
- **Tariff regimes:** TSOs commit to supporting NRAs as they develop tariff regimes that provide long-term locational investment signals.
- **Legal framework:** the co-legislators' work on the proposed Article 18d of the Electricity Regulation will set the EU basis for maturity requirements, prioritisation and flexible connection agreements where capacity is scarce. This includes the approaches discussed in this paper, such as clear national strategic guidelines that allow system operators to prioritise specific grid users.

Throughout this process, system security, reliability, and operational feasibility must remain non-negotiable. Reconnecting long-term grid planning with connection processes and ensuring a balanced allocation of obligations across all actors, will be essential. Together, these will ensure that available network capacity is allocated to projects most likely to be realised and that the grid develops in line with Europe's societal priorities.

This paper is intended as a foundation for continued expert discussion, refinement, and convergence towards solutions that deliver faster connections without compromising security, affordability, or societal priorities.

Reference Materials

Note on Geographic Scope: In this paper, "Europe" refers to EU Member States and related countries. For the avoidance of doubt, this includes the following countries:

- **EU Member States (27):** Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden
- **Other Contributing ENTSO-E members:** Norway, Serbia

Unless explicitly stated otherwise, all references to "European" or "Europe" in this paper should be understood to cover this group of countries.

List of Abbreviations

Abbreviation	Meaning
AST	AS Augstsprieguma tīkls (Latvian TSO)
BESS	Battery energy storage system(s)
CA	Connection agreement
CEER	Council of European Energy Regulators
CNC 2.0	Connection Network Codes (revision)
DCC	Demand Connection Code
DSO	Distribution system operator
EC	European Commission
EEA	European Economic Area
ENTSO-E	European Network of Transmission System Operators for Electricity
EU	European Union
FCA	Flexible connection agreement
FON	Final Operational Notification
GW/MW/kW	Gigawatt/megawatt/kilowatt
kV/kVA	Kilovolt/kilovolt-ampere
NDP	Network Development Plan
NECP	National energy and climate plan
NRA	National Regulatory Authority
PPM	Power park module
RED	Renewable Energy Directive
RfG	Requirements for Generators Regulation
RTE	RTE Réseau de transport d'électricité (French TSO)
SDDR	Schéma décennal de développement du réseau (RTE's 10-year network development plan)
SEPS	Slovenská elektrizačná prenosová sústava, a. s. (Slovak TSO)
TSO	Transmission system operator
TYNDP	Ten-Year Network Development Plan

Annex

Definitions Used in the Text (Glossary)

Anticipatory Investment	Investment in grid infrastructure made ahead of confirmed connection requests, based on expected future system needs and credible demand signals, rather than only once a connection request has been received.
Cable Pooling	The sharing of a single grid connection point by multiple installations (e.g. storage, consumption, and generation) belonging to multiple companies, in order to increase connection utilisation. See also Hybridisation/Co-location.
Capacitypedia	A pan-EU platform, launched in May 2026, linking all national hosting capacity pages. It provides, in a comparable manner, information on the national definitions and methodologies used by system operators in Europe, enabling readers to understand and better assess published grid hosting capacity values.
Cluster (Aggregated) Assessment	The assessment of multiple connection requests submitted within the same area or time window within one study/assessment procedure, based on transparent rules for clustering applications, allocating available capacity, and communicating outcomes to applicants.
Curtailment	A reduction in the power that a grid user injects into or withdraws from the grid, either instructed by the system operator to manage network constraints and ensure secure system operation, or decided by the grid user itself (self-curtailment), for example in response to low market prices. Depending on the national framework and the connection agreement, curtailment may or may not be compensated.
Direct Line	An electricity line either linking an isolated generation site with an isolated customer or linking a producer and an electricity supply undertaking to directly supply their own premises, subsidiaries, and customers (Directive (EU) 2019/944).
Firm and Non-Firm Connection	A firm connection guarantees the grid user continuous access to the grid up to the contracted connection capacity. A non-firm connection provides access subject to curtailment or availability conditions defined in the connection agreement. See also Flexible Connection Agreement.
First-Come, First-Served	Under a first-come, first-served approach, connection requests are assessed by the relevant TSO or DSO individually and in the order in which they are submitted. The requested connection capacity (for generation or consumption) and associated installed capacity (e.g. generators, PPMs, storage facilities) declared in the connection application are considered in the network assessment following the chronological order of submission. All other active connection requests are also taken into account in network calculations, meaning that later requests will generally receive progressively later estimated connection timelines. Binding offers for connection agreements are issued on a case-by-case basis and in order of submission. The offer typically includes, among other elements, the earliest possible connection timeline for the requested capacity. However, the order of submission does not necessarily determine the order in which projects are ultimately commissioned, as timelines may vary depending on: › The type and scope of required network reinforcements › The construction timelines of the project developer's assets › Permitting procedures

First-Mature (First-Ready), First-Served	An approach under which connection requests are evaluated and ranked based on transparent and measurable maturity criteria (e.g. land acquisition and permit status, technical concept and connection plan, financial capacity, and grid and system benefits). Applications demonstrating high maturity and quality are considered first for limited connection capacities.
Flexible Connection Agreement (FCA)	A connection agreement with predefined curtailment or availability conditions, which can enable earlier grid access while preserving system security. FCAs primarily address operational network constraints and cannot replace physical connection infrastructure.
Grid Connection Queue	The grid connection queue refers to the list of all connection requests that have been submitted to the relevant network operator but whose network connection has not yet been commissioned.
Hosting Capacity	The amount of additional generation, demand, or storage capacity that can be connected at a given location in the grid without compromising system security, as indicated by the system operator. Definitions and calculation methodologies differ across countries (see Capacitypedia), and published hosting capacity values are indicative and non-binding.
Hybridisation/ Co-location	The combination of multiple assets – such as generation, storage, and flexible demand – behind a single grid connection, allowing complementary generation and load patterns to optimise the use of existing network capacity, within the agreed connection capacity. See also Cable Pooling.
Non-Wire Solution	A measure that increases available connection capacity or facilitates grid connections without requiring new grid assets (e.g. clearing inactive connection requests to free up capacity).
Repowering	Modernising or replacing existing generation equipment while generally maintaining the same site and purpose, allowing the reuse of existing connection points and network assets.
Speculative Request (Ghost Project)	A connection request submitted early to secure a queue position rather than to reflect near-term project readiness, and which is therefore unlikely to materialise.
Use-It-or-Lose-It Approach	Under this approach, the system operator has the right to reduce the originally allocated capacity in the event that a grid user does not use its contracted capacity for a certain period of time (e.g., twelve months) after approval of the grid connection, the conclusion of the contract, or some other pre-specified period of time. After this the capacity becomes available again for other users. The use-it-or-lose-it system could therefore mitigate against capacity hoarding. (CEER, *Paper on Grid Connection Challenges* (24 June 2026))

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