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From Backlog to Breakthrough: Managing Connection Queues in Distribution Networks

Eurelectric position paper

June 2025

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We cover the entire industry from electricity generation and markets to distribution networks and customer issues. We also have affiliates active on several other continents and business associates from a wide variety of sectors with a direct interest in the electricity industry.

We stand for

The vision of the European power sector is to enable and sustain:
- A vibrant competitive European economy, reliably powered by clean, carbon-neutral energy
- A smart, energy efficient and truly sustainable society for all citizens of Europe

We are committed to lead a cost-effective energy transition by:

investing in clean power generation and transition-enabling solutions, to reduce emissions and actively pursue efforts to become carbon-neutral well before mid-century, taking into account different starting points and commercial availability of key transition technologies;

transforming the energy system to make it more responsive, resilient and efficient. This includes increased use of renewable energy, digitalisation, demand side response and reinforcement of grids so they can function as platforms and enablers for customers, cities and communities;

accelerating the energy transition in other economic sectors by offering competitive electricity as a transformation tool for transport, heating and industry;

embedding sustainability in all parts of our value chain and take measures to support the transformation of existing assets towards a zero carbon society;

innovating to discover the cutting-edge business models and develop the breakthrough technologies that are indispensable to allow our industry to lead this transition.

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Distribution & Market Facilitation Committee

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A Eurelectric position paper June 2025

Executive summary and key messages

Summary

The rapid electrification of industries, transport and heating, alongside the integration of renewable energy sources, has led to significant **connection queue backlogs** in electricity distribution networks across Europe. These delays hinder the energy transition, slow down economic growth and create inefficiencies in grid utilisation. The **"first come, first served"** approach can be better suited in some Member States than others. This calls for the national regulatory authorities (NRAs) or national governments to provide a clear framework and set of prioritisation criteria to allow system operators to **move away from the 'first-come, first-serve' approach as the default way of managing the connection queue,** where system operators have indicated that the 'first come, first served' principle is inefficient for their operation.

Key factors driving connection queues include:

- **Grid capacity constraints**, particularly in areas with aging infrastructure or high renewable penetration.
- **Over-reservation of capacity**, where speculative projects hold unused grid capacity, blocking other applicants.
- **Lengthy permit-granting processes**, both internal (DSO approvals) and external (regulatory and environmental permits).
- **Regulatory limitations on DSOs' ability to refuse connections**, impacting grid efficiency.

To address these challenges, **several European countries are implementing reforms** such as **maturity assessments, priority-based allocations and digitalisation of connection processes**. However, further regulatory guidance may be required at the EU level to streamline and accelerate connections while maintaining **fair access** and ensuring **grid stability**.

Key Messages

1. **DSOs Are Committed to Fair and Timely Grid Connections**
   - DSOs take seriously their obligation to connect all customers in a non-discriminatory manner within a reasonable timeframe.
   - They activate all available levers, including digitalisation and automation, to improve efficiency.
   - Their efforts must be supported by appropriate national legal and regulatory frameworks, as connection requests will continue to increase substantially due to a significant increase in renewable integration and electrification of consumption to meet EU targets.

2. **Grid Capacity Constraints Are a Growing Challenge**
    - Rising connection demands and grid capacity scarcity create difficult trade-offs in allocating limited resources.
    - Flexibility in network design can be used to temporarily increase the connection capacity, but as a complement to traditional investment which represents the ultimate solution to the network capacity constraints.
    - Anticipatory investments in network buildout can help prevent some capacity constraints, by building the network based on reasonably certain projections of generation and load projects which can be validated against DSO's distribution network development plans (DNDPs)
    - Moving away from the "first come, first served" principle could be necessary in some Member States, but implementation may differ across Member States based on national priorities.
    - If system operators have indicated that the first come, first served principle is inefficient for their operation, then national authorities or governments should provide a clear framework of criteria for prioritisation.

3. **Speculative Requests Must Be Disincentivised Without Hindering Electrification & Renewables**
    - Free or low-barrier connection studies contribute to queue congestion; introducing fees for speculative connection requests could reduce unnecessary paperwork and capacity reservations.
    - Proportionate penalties for overusing contracted capacity could prevent grid congestion while ensuring fair access to available capacity.
    - Planning permission should be in place before connection approvals, or at minimum, permitted together to ensure feasibility.

4. **Pricing Signals Should Reflect Economic Scarcity Without Discouraging Decarbonisation**
    - Grid capacity is a scarce economic good and should be priced accordingly to ensure efficient use.
    - Symmetric fees for feed-in and demand connections make sense in a decentralised system.
    - When TSOs provide Bulk Supply Points, a significant percentage should be reserved for DSO growth rather than being allocated entirely to large industrial customers. The exact allocation should be determined based on local DSO needs rather than set in a top-down manner.

5. **Regulatory Reforms Should Streamline and Accelerate Permitting**
    - Permitting delays affect all voltage levels and contribute to connection queue congestion.
    - A more coordinated permitting framework is needed, rather than fragmented regional or municipal processes.
    - Faster permitting for network system owners will be critical for ensuring timely grid expansion and reinforcement.

6. **Flexible Connection Agreements (FCAs) Can Help Optimise Grid Use**
    - Interruptible connection agreements should be available not just in constrained areas but widely for large consumers and producers to avoid discrimination.
    - National regulators (NRAs) should develop FCA frameworks while ensuring they do not hinder long-term network investments.

7. **There Is No One-Size-Fits-All Solution**
    - Variations of the first-come, first-served approach works for some markets but needs adaptations for others.
    - Countries must tailor their connection frameworks to balance fairness, efficiency and energy transition goals.
    - A balance must be struck for large-scale load contracts between replicability and customisation, considering the heterogeneity of DSO responsibilities and conditions.

Background

Current Legal Framework

The **Electricity Directive (Directive (EU) 2019/944)** is the foundational European legislation governing distribution system connection policies. It sets uniform guidelines for the internal electricity market, ensuring non-discriminatory access to the distribution network. The directive also mandates DSOs to operate separately from non-distribution-related businesses and highlights their role in integrating renewable energy and ensuring tariff transparency.

Key articles of the directive relevant to distribution network access include:
Article 6a: Establishes principles for flexible connection agreements.
Article 15: Mandates reasonable grid connection timelines for active customers with energy storage.
Article 30: Defines the designation and certification of DSOs.
Article 31: Requires DSOs to provide clear information on connection requests and to enable digital submissions.
Article 32: Ensures DSOs provide non-discriminatory access to new market entrants.
Article 33: Focuses on integrating electro-mobility and electric vehicle charging infrastructure.
Article 34: Outlines DSOs' responsibilities for data transparency and non-discriminatory information sharing.

Additionally, network codes establish indirect guidelines for DSOs. Future regulations may introduce more specific provisions for distribution networks.

State of play: Connection Queues Across Europe

Connection queues form when electricity producers, consumers, or prosumers submit requests to join the distribution network, requiring studies, contracts, and approvals before a connection can be made. These queues exist even in areas with available grid capacity and can be a barrier to the energy transition.

Different Member States experience varying constraints. In countries like **Italy, Slovakia, Ireland, France and Spain**, demand connections typically follow a "first come, first served" approach, with DSOs assigning capacity upon request. In **Hungary**, demand connections are generally processed within **0–2 years**, based on the size of the required grid investment.

Production connections face greater challenges due to grid limitations and additional procedural requirements. **Hungary's production queues** are particularly congested, with the newly arising connection targets facing a 2028 deadline, and even extending **as far as 2030**. **Norway applies a maturity assessment process**, ensuring only feasible projects secure connection slots. **Italy's production connection process** varies by voltage level, and discussions are ongoing to align reservation periods with lengthy authorisation procedures for renewable projects.

Overall, **demand connections proceed with fewer delays**, while **production connections require additional evaluations** and face significant grid constraints. A notable exception to this is in Spain, where these kinds of connections have experienced a significant surge in recent years. Further details on country-specific connection procedures are provided in the annex.

Common challenges causing or exacerbating connection queues

Several factors contribute to the emergence and persistence of connection queues. **Scarcity of capacity** in the grid can create bottlenecks, particularly in areas with high penetration of renewable energy or urban centres where demand growth outpaces infrastructure upgrades. **Access constraints**, such as the inability to adequately allocate grid capacity based on the location of the connection request and the available infrastructure, exacerbate the problem. **Over-reservation of capacity or connection needs**, where applicants hold onto unused capacity, can worsen these queues by artificially inflating demand. Additionally, **internal and external permitting processes**, such as environmental assessments or municipal approvals, often prolong the time required to connect. Other issues include the **right to refuse** (where DSOs may decline connections based on technical constraints) and the variability of **existing national measures**, which may be fragmented, inconsistent, or insufficient to address growing demand. Together, these factors highlight the need for robust policies and coordinated approaches to streamline connection processes and optimise grid utilisation.

Scarcity of capacity

Electricity distribution networks across Europe are increasingly facing **capacity constraints**, due largely in part to the exponential growth in connections over the past few years, leading to delays in connection queues for new projects. Rising demand for grid connections—driven by the **expansion of renewable energy, electrification of transport and heating, and industrial decarbonisation**—is putting pressure on networks, especially in regions where infrastructure is aging or operating near its limit. In some cases, connection requests must wait for grid reinforcements before they can proceed, **slowing the integration of renewables and complicating Europe's energy transition**.

Approaches to managing these constraints vary across countries. In **France**, long-term investment planning aims to anticipate future grid capacity needs, with **regional network plans for renewables (SRRRER)** minimising risks of shortages. In addition, permanently embedding flexibility in network design, like Enedis's ReFlex project, can enable significant increases to the network capacity. As a first phase roll-out of the ReFlex project, by 2027, Enedis will create over several hundreds of MW of additional connection capacity on the first hundred HV/MV transformers where ReFlex creates most value. However, in areas where reinforcements are delayed, **flexible connection agreements** are being considered to maintain grid access. Similarly, **Italy has not yet faced widespread scarcity**, but with **high volumes of small-scale renewable projects** expected to connect in the coming years, capacity issues may emerge, particularly in non-interconnected areas such as small islands. Upcoming regulations will introduce **flexible connection agreements** to help manage demand in **renewable energy zones, industrial parks, and ports**.

Other countries are already experiencing increased grid congestion. **Slovakia** is seeing a **surge in renewable energy connection requests**, while **Ireland and Spain face transmission-level capacity limitations** that affect DSOs' ability to secure space for distribution loads. In Ireland, **data centers in constrained areas** have specific connection criteria, and concerns exist over customers exceeding their Maximum Import Capacity (MIC) contracts, worsening grid constraints. The lack of a **"use it or lose it" policy** also increases the risk of unutilised capacity being suddenly claimed, leading to further strain on the system.

For further details on country-specific capacity challenges and management approaches, please refer to Annex 1.

Access constraints

Access constraints in electricity distribution networks are becoming increasingly pronounced, driven by the difficulty of allocating grid capacity based on the geographical location of connection requests and the existing infrastructure. As demand grows, particularly in areas undergoing rapid electrification due to the shift towards electric vehicles, renewable energy adoption, and increased electrification of heating, grid capacity is often insufficient to meet new connection requests. In regions where infrastructure is already stretched or outdated, this mismatch between demand and capacity results in longer connection queues, as operators struggle to balance new requests with necessary grid upgrades. The mounting pressure from a rapidly electrifying society further exacerbates these delays, creating a bottleneck that hampers the efficient and timely integration of new energy sources and infrastructure upgrades.

Over-reservation of capacity or connection needs

Ghost projects in the context of electricity distribution networks refer to demand or supply connections where developers reserve grid capacity far in excess of what they ultimately need or hold onto reserved capacity for projects that fail to materialise. These projects effectively block other potential users from accessing the grid, exacerbating connection queues and creating inefficiencies in capacity allocation. Ghost projects are particularly problematic in regions experiencing high demand for new grid connections, as they lead to artificial scarcity, inflate grid congestion and oftentimes inflate the cost for producers by re-selling their place in the connection queue, and hinder the timely integration of renewable energy or electrification initiatives.

European countries are implementing various measures to **prevent speculative capacity reservations** and improve the efficiency of grid connection processes. In **Italy**, the national regulator (NRA) has established **strict timeframes** for project milestones, requiring producers to provide updates on **authorisation procedures and construction progress**. In Spain, such timeframes are established for generation projects, but not for demand projects. Additionally, improvements are needed in the **coordination of shared connection infrastructure**, as the current system lacks **clear procedures, structured timelines, and defined responsibilities** for operators involved in joint projects.

Similarly, **France has introduced rigorous entry criteria** to prevent speculative projects from occupying space in the queue. Connection requests must include **formal project approval, construction permits, and compliance commitments** with grid codes. Additionally, **duplicate applications** across the **DSO and TSO queues are prohibited**, ensuring fair allocation of capacity. A **three-month validity period for quotations** and an **advance payment requirement** further discourages non-committal applications. **Slovakia also enforces strict deadlines** for producers to sign contracts and fulfil technical requirements, releasing capacity if they fail to meet obligations. From 2025, a new rule will **increase the minimum contracted reserved capacity to 50% of the MRC** to encourage **more realistic capacity reservations**.

In contrast, **Ireland has fewer restrictions on speculative demand applications**, allowing customers to submit requests **without planning permission or upfront fees**. This has resulted in **a high number of unused connection rights**, consuming significant resources. Additionally, MIC (Maximum Import Capacity) requests are often **higher than the actual site needs**, creating inefficiencies. In Spain there would be upfront fees (like a guarantee), but no planning requirements other than a deep connection fee payment are required. Introducing **application fees and feasibility-level studies** could help reduce speculative applications and improve grid capacity planning.

For further details on national policies and their implementation, please refer Annex 1.

Permitting processes

Delays in **permit-granting processes**, both internal (managed by DSOs) and external (overseen by regulatory authorities), significantly contribute to **longer connection queues** in electricity distribution networks. **Internal DSO processes** can create bottlenecks when approval frameworks are **complex, resource-constrained, or inconsistently applied**, particularly for projects requiring grid reinforcements. At the **external level**, environmental, land-use, and construction permits involve multiple regulatory bodies and often require **lengthy consultation periods**. Misalignment between **DSO procedures and national permitting frameworks** further exacerbates delays, slowing the integration of new projects and the transition to a **more electrified and decarbonized energy system**.

Several European countries have begun **reforming their permitting processes** to address these challenges. In **Italy**, the traditional system proved **too complex and slow** to manage the recent surge in renewable energy connection requests. As a result, **major simplifications** were introduced in 2023 to streamline approvals. Similarly, **France** has recognised the urgent need for **permitting reform at the national level**. In **Norway**, permitting processes face the same backlog issues as grid connection queues, with some applicants waiting **up to eight months just to receive a case manager**. Additionally, **local resistance and legal complaints** are key obstacles, particularly for renewable infrastructure projects.

Other countries have **implemented legally defined timelines** to improve efficiency. In **Slovakia**, a **30-day approval period** is mandated for connection requests, with some renewable energy sources eligible for an **accelerated and simplified process** (as short as 10-15 days). These structured timelines ensure faster connections while reducing administrative delays. However, across Europe, the need for **better alignment between grid expansion needs and permitting regulations** remains a pressing issue.

For further details on country-specific permitting frameworks and recent reforms, please refer to Annex 1.

Right to refuse

In the European Union, the right of distribution system operators (DSOs) to refuse connection requests is primarily governed by technical requirements. These requirements are crucial to maintain system security and to ensure the safety of system operation. For DSOs, the two EU technical regulations in that matter are **Commission Regulation (EU) 2016/631**, also known as the **Requirements for Generators (RfG) Regulation and Commission Regulation (EU) 20216/1388, also known as Network Code on Demand Connection.**

RfG mandates that DSOs refuse connection to power-generating modules that do not comply with established technical requirements, unless a derogation has been granted by the relevant authority. The refusal must be communicated in writing, providing a reasoned statement to the power-generating facility owner and, where applicable, to the regulatory authority. Likewise, the Network Code on demand connection sets up harmonised requirements that demand facilities must respect to connect to the grid.

Implementation of this regulation varies across EU Member States, leading to differing policies regarding connection refusals. For instance, in **Germany**, DSOs are required to provide detailed technical justifications when refusing a connection request, ensuring transparency and allowing applicants to address specific issues. In general, in **France,** DSOs cannot refuse a connection request

as long as the latter is compliant. But the law allows French DSOs to exceptionally refuse a request based on grid stability and security concerns: Only installations designed to operate under the normal and exceptional frequency and voltage conditions of a public electricity network may be connected to it, without resulting in: 1° A danger to people and property; 2° A disturbance to the systems implemented by the network operator to ensure its operation and protection; 3° An abnormal degradation in the quality of electricity distributed or transmitted over this network; 4° A constraint for other users of the network. In **Spain**, a justification must be provided and particularly, the request may be denied if it represents a problem for the security of supply for other network users.

In **Ireland** the DSO does not have the right to refuse a connection offer to demand customers; the DSO cannot prioritise between certain customer types or location of their load. The reinforcements needed may be substantial with long delivery timelines, but the DSO are obliged to issue a connection offer. The only exception to this is datacentre customer applications (of any size) under specific regulatory criteria. These variations reflect the diverse approaches within the EU to balancing grid reliability with the facilitation of new connections.

Existing Prioritisation Practices

Within the European Union

France

As described before, in France, the allocation of the capacity is made by the first come, first served principle (with the conditions specified in the section “Over-reservation of capacity”, to get in the queue). But the building of the physical connection (whether for producers or consumers) is obviously planned with the customer, according to his planning.

Since 2023, the law has given power to the prefect of the administrative region to modify the order in the queue to accelerate the decarbonisation and electrification of large industrial areas. The TSO is currently studying the possibility of prioritising the connection of future clients near its substations (faster and cheaper).

Germany

The DSO is not allowed to discriminate between any customer groups, therefore the DSO cannot turn down a datacentre in favour of a hospital or the other way around. Acknowledging the shortage of capacities, the German Regulator BNetzA started a consultation process BK6-24-245 at the end of 2024 for different methods of dealing with the very high demand applications.[1]

Due to the large number of high voltage demand requests and their implications on available capacities, the DSO of Berlin stopped accepting requests exceeding 3.5 MVA from the first of January, 2024. At the same time, it introduced a new mechanism to distribute capacities to these customers which account for less than 1% of the overall number of applications but for more than 97% the total requested demand of a year.

The introduced scheme starts every year with the calculation of the available capacities, considering the progress of new build grid connections to the TSO, own grid infrastructure upgrades, and the prognosis for the development of households, SME, heat pumps and charging points for the next ten years. After publishing the capacities on the homepage, the application period is open for approximately 10 weeks. In addition to the intended demand, we ask for a minimum demand with which the applicant could start the project. In case not enough capacity is available to fulfil all requests, in the following 4 weeks the requests will be matched with the existing capacities. The key to that process is the distribution of available capacities in ratio per applicant.[2]

Hungary

As the PV-penetration steadily increased in the last 10 years, the current PV-capacity reached 7,5 GW which equals to the Hungarian peak consumption. The PV-penetration already exceeds the 2030 target. While huge CAPEX investment was made in recent years to integrate the new renewable capacities, there is still large interest for new connections and a long queue has been formed. As currently no new connection options are available, an industry working group has been launched in mid-2024 on ‘Network Connections’.

[1] https://www.bundesnetzagentur.de/DE/Beschlusskammern/BK06/BK6_82_NetzAs/827_BK6-24-245/BK6-24-245_node.html

[2] For a full description of the procedure please refer to our homepage https://www.stromnetz.berlin/anschliessen/anschluss-mittel-hochspannung/repartierung/

The members of the working group were experts from the ministry, the regulatory authority, the DSOs and the TSO. According to the proposal, the new procedure will be based on the National Energy and Climate Plan targets: gap-analysis is performed to identify those network areas and technologies where new connections are justified. During the iteration, the gaps will be defined based on the energy transition and the national targets. The connection points defined will be available for applicant projects.

The successful applicants will have the possibility to connect to the network. During the realisation of the projects, well-defined milestones will be in force (for instance paying the connection charge or acquiring the power plant permit in due time) for which use-it-or-lose-it principle will be applied in case of non-fulfilment.

Ireland

In Ireland a “first come, first served” queue approach is used. A customer joins the queue based on the date they submit a demand application. Capacity on the network is only reserved when the connection fee is paid.

Italy

In Italy there are no principles of prioritisation of connections, they are all managed with the "first come, first served" principle.

However, for connection of production plants the NRA provided specific access conditions for selected kinds:

- generators with power less than 800 W can submit a request with a single form and no fee is required for the connection.
- photovoltaic production plants with power less than 200 kW and high-efficiency cogeneration plants with power less than 50 kW can request connection with a simplified procedure and pay a fixed lump sum.
- production plants from renewable sources and high-efficiency cogeneration plants (different from the previous ones) follow an ordinary procedure and pay a lump sum fee based on the power requested for injection to obtain the quote (connection fee). The complementary quote is determined by the power requested for injection and the distance from the transformer substations. Other production plants follow an ordinary procedure and pay a flat rate fee based on the power requested for injection to obtain the quote. The complementary quote is determined based on the effective cost of connections. This distinction has the purpose of discouraging the request for connection of plants from non-renewable sources and of encouraging the connection of small plants and therefore distributed generation.

In the perspective of accelerating the development of RES, it would be possible to facilitate the connection of projects that have greater opportunities to follow faster authorisation processes, such as the complete reconstruction of existing plants, while maintaining the existing connection. In particular, in cases where network reinforcements are not strictly necessary, the DSO/TSO could grant a temporary connection solution (possibly with power limitation or as a temporarily/permanent interruptible agreement), allowing the use of existing user and network infrastructures, while giving the applicant the option to accept or decline the temporary solutions.

Additionally, the connection of hybrid plants under the same connection point “POD” (Point of Delivery) should be facilitated, allowing the possibility of connecting generation units from different sources with a connection capacity that is not the sum of the two maximum capacities but rather the maximum of the two production units. This virtuous measure would help address network saturation

issues and enable operators to avoid requiring additional network capacity to install new renewable energy generation plants on existing PODs (e.g., new photovoltaic installations on the POD of an existing or developing wind farm), while allowing the TSO to optimise the use of the national transmission grid (RTN).

Netherlands

The Dutch grids are currently highly congested, both for demand as for production. Some connection requests require prioritisation as their societal impact is too significant. Therefore, the Dutch NRA has, together with stakeholders, designed a legislative framework to prioritise certain groups. Adhering to the non-discrimination principle remains of paramount importance.

There are three groups with priority:

1. Congestion-relievers: This group specifically targets customers which can increase the grid capacity. Such as batteries, providing flexibility services. It is important to note that this prioritisation is reserved for connections which create capacity, not for connections which only take up a little capacity. This prioritisation holds both for consumption as production.
2. Safety: This group consists of groups such as the police, ambulance, military and hospitals. This category only holds for consumption.
3. Basic needs: Also, a prioritisation on basic needs such as education, heating and housing. This only holds for consumption.
4.

Group 1 has the highest priority, followed by group 2 etc. Within a group, first come, first served is used. Also, the allocated capacity must be used for the core activity of the group. No capacity will be allocated for extra solar panels of the police station e.g. It is important to note that his scheme is only concerning capacity allocation, not the building of the physical connection.
Note: Within a table, first come, first served is used between functions and subfunctions.

Reasoning of the prioritisation:
Congestion-relievers are given the highest priority, as other parties in the queue benefit from the congestion-relieving behaviour creating space for other parties through better utilisation of the power grid.
Group 2 security are prioritised next, because the functions contained therein obviously aim to contribute to (national) security.

Functions in group 3 are given a lower priority than functions in category 2, as these functions address more individual rather than collective needs.

A more detailed overview of these categories is available in Annex 2.

Romania

In Romania the public grid connection of new grid users is governed by ANRE Order 59/2013 (with many subsequent amendments).
It establishes the steps and procedures necessary for connecting users (producers, consumers, prosumers above 400 kW, storage, HVDC) to the public transmission and distribution grids.

The applied principle is “first come, first served”. Generators with intended installed capacities over 50 MW submit their grid connection applications with the TSO, while the ones with lower capacities apply to the DSO. Still there is an important number of projects submitted to the DSO but subjected to the scrutiny of the TSO. Different procedures are applied for joint endorsement TSO-DSO of such projects in order to save time and simplify processes.

Having in view the huge queue of new generation facilities applying for grid connection (probably over 50,000 MW in the waiting list in different stages of approval), the Regulator ANRE decided to instate a procedure of the type “put your money where your mouth is”.
By Order 53/2024, ANRE approved the Methodology on allotment of electric network capacity for connection of generators .

Auctions take place in view of allotting the available capacity in the Transmission and the Distribution networks, for grid connection of power generators with installed capacities above 5 MW for which grid capacity allocation requests have been submitted.

The auctions are organised in network zones established by the TSO as per ANRE regulations. The TSO develops and administers the platform for capacity allocation. It organises the activity for capacity allocation. Auctions are organised on an annual basis for a period starting two years later. For each transmission network zone the available capacity that does not include reinforcement works is determined. Same for the distribution network areas at HV (110 kV) and MV.
The following are taken into account when determining the above-mentioned capacities:

- Grid connection endorsements and grid connection contracts signed, without grid reinforcement works;
- Grid connection contracts for generation/consumption points with realised grid reinforcement works;
- Consumption/generation points commissioned.
-

By 15 January of year N, the TSO publishes the available capacities for year N+2 for each year of the proposed allocation period and each network area as described above. Between 16 January and 28 February, prospective grid users submit grid capacity allocation requests for given years and given network areas.

Between 16 March and 15 June of year N, the TSO realises a global solution study, aimed at determining the supplementary grid reinforcement works needed for covering the network capacity for the submitted requests.

By 16 June, the TSO publishes for each network zone and each year from the allotment period:

- results of the solution study
- available network capacity resulting from additional reinforcement works, for N and N-1 network elements
- the capacity requested by the applicants
- total estimated value of network reinforcement works
- starting price for auctions aiming at allocating grid capacity
- dates for organising auctions, correlated with capacity allotment years

Starting 1 JJuly, grid capacity auctions are organised, a day for each grid area and allotment year. Offers are aligned in decreasing order.

If the sum of capacities pertaining to the allotment applications exceeds the capacity available for grid connection including the additional grid reinforcement works, all offers are accepted up to the level of such available capacity. For each winning offer the winner pays the auctioned price.
Within 5 days from award the allocation contracts are signed.

New grid users are obliged to constitute a guarantee amounting to 1% of the contract value (capacity allocated x bid price). Payment of the contract value is done in tranches, the first one being more than 20% of the total contract value.

The concrete procedure for implementing the present methodology is to be published by the TSO by 1 July 2025.

Slovakia

In Slovakia, the principle of "first come, first served" is generally applied, although there is a legal right to priority connection for renewable energy sources, but this is not specified in any way (it is not defined in the law).

Small sources - accelerated and automatised connection process, do not pay a connection fee up to their maximum reserved capacity. The time periods for comment/acceptance of a connection request are set by law.

Local sources - fast-track and automated connection process, under certain conditions do not pay a connection fee (most do not). The time periods for comment/acceptance of a connection request are set by law.

Commercial sources - follow the standard connection process, if they connect at the point of their own point of consumption, they do not pay a connection fee up to the capacity of that point of consumption. The time periods for comment/acceptance of a connection request are set by law.

Denmark

In Denmark a “most ready – first served/connected” approach is used. When a customer wants to be connected to the network, a documentation process starts. No space in the network is reserved at this point. The customers who can submit documentation first are then offered a connection. Space in the network is only reserved when the connection fee is paid. This ensures that the most mature/most willing to pay are connected first.

Grid congestion is experienced in many places in Denmark. This is mostly because the TSO network is not being expanded fast enough. This is primarily a challenge when connecting new production.

Spain

In Spain, a "first come, first served" approach is used and there is not allowed to discriminate between any customer groups. There are certain transmission nodes reserved for public tenders in both generation and demand.

Beyond the European Union

Great Britain

The Gate 2 entry to queue formation process is driven by two main factors: readiness and strategic alignment. Readiness is determined by either land or planning requirements. For land readiness, projects must meet minimum acreage requirements (or the offshore equivalent), provide an original red line boundary for the site and secure land rights. For planning readiness, projects must submit an application for planning consent following the Development Consent Order (DCO). If the project follows the planning route, it must also meet the minimum acreage and red line boundary requirements in addition to the planning submission.

Strategic alignment, on the other hand, ensures that the project is in line with key long-term energy plans and regulations. Projects must either align with the pathways outlined in the CP30 Plan, be designated under the Project Designation Methodology, or qualify as a transmission-connected demand project that is outside the scope of the CP30 Plan's pathways. This strategic alignment ensures that projects are positioned to meet broader energy system goals and can be integrated effectively within the existing infrastructure framework.

When projects pass these Gate 2 criteria, they're put in a new nationwide queue based on their historical queue spot. This queue is 'filled up' till it meets the GW needed by 2030. If a project fails to meet the milestones it falls out of the queue and is filled up by the next project in the queue. Once the projects aligned with the 2030 pathway(s) have been identified, the remaining projects will be considered against the 2035 pathway. All projects which indicate that they can connect in 2035 or earlier will be considered against the 2035 pathway for their technology type, in their zone of the network. Eligible projects include those which have met the **Gate 2 readiness Criteria.**

Internal DSO practices to increase the speed and efficiency of connection decisions

Distribution system operators (DSOs) can take action to address the rising connection challenges by optimising their internal processes, and many innovative IT solutions, including artificial intelligence (AI), are available to help achieve this. Advanced digital tools can streamline grid connection procedures by automating application reviews, optimising grid capacity allocation, and providing real-time updates to customers. Data-driven forecasting and analytics can enhance the ability of DSOs to predict network congestion, identify areas for expansion, and efficiently integrate distributed energy resources (DERs) such as solar panels or electric vehicle chargers. These tools also improve transparency, enabling customers to track their connection requests, receive prompt responses, and benefit from a more seamless connection process.

While the implementation of such solutions requires significant upfront investment, the long-term benefits often outweigh the costs. Improved efficiency in connection processes not only leads to higher rates of customer satisfaction but also accelerates the deployment of renewable energy and electrification projects, directly contributing to the EU's competitiveness and decarbonisation goals.

By reducing delays and optimising capacity usage, DSOs can increase the pace at which DERs are integrated into the grid, facilitating the transition to a more sustainable and resilient energy system. These innovations demonstrate how digital transformation can help DSOs meet customer needs while supporting Europe’s broader energy and climate objectives.

Digitising the connection approval process

As DSOs enhance grid observability, leverage digital forecasting and develop customer-facing interfaces, the potential to shorten connection processes grows significantly. However, since the connection process often involves external factors, the feasibility of implementing certain digital solutions may depend on these external variables. This section highlights several examples of how digitalisation can streamline and support the connection process.

The main new digital features introduced to facilitate the management of connection requests are:

Digitalised front-end solutions for customers

The section provides examples of how DSO digitalisation can support customers to plan, apply and follow a connection procedure.

Online portal for connection application and tracking: Being able to submit and track the connection request online enables customers to be able to plan ahead, and minimising follow-up communication to DSOs. In Slovakia, where the DSO ZSD and VSD operates, the connection process is almost exclusively made electronically – online (large resources are an exception - requests for large RES are also submitted online through the online portal, however the next steps are not supported online). In France, the main DSO also has an online portal where clients can create their account and make their connection requests. In addition, Enedis are currently developing a **customer relationship management tool** to have a 360° view of the client and his/her ongoing requests. E-Distribuzione is another grid operator providing request tracking for real-time and fully transparent progress consultation of requests. In Spain, such online portals for connection application and tracking is mandatory for all system operators.

Online portal with automatic processing: In Germany, E.ON has developed its in-house solutions which is applied by its DSOs in Germany but also by external DSOs beyond Europe. The solution is the Online Connection Check (OCC). The customer submits a connection request through the web portal, providing details about the planned connection. The Online Connection Check (OCC) automatically performs a technical grid analysis to evaluate the feasibility of the connection request.

Based on the OCC results, the system generates an automated assessment indicating whether the connection is possible without grid reinforcement. If the connection is technically feasible, the customer receives immediate feedback and can proceed with the connection process. If not, alternative solutions or grid reinforcement options are evaluated. Only when the manual review is needed, the request is marked for manual processing and the system notifies the user that expert evaluation is required. The system generates detailed technical reports documenting the assessment results and connection requirements. The customers' status updates and results are communicated back to the requestor.

Document validation: E-Distribuzione, an Italian DSO, uses AI to facilitate the application. When applying for a connection, different documents should be submitted to the grid operators. To facilitate the process, QR codes have been set up on the website to automate the document validation with AI algorithms, reducing processing and waiting times for customers.

Quotation simulator: In Italy, E-Distribuzione provides a product for low-voltage prosumers, aiming to verify the presence/absence of work on the network and to assess the related connection costs. The simulator allows customers to autonomously obtain useful information on the complexity of their connection request, thus providing greater awareness of the time required for connection.

A similar example is a **Capacity map with connection indication:** E.ON Energidistribution has a service named "Can I Connect?" which allows users to quickly assess the feasibility of connecting solar panels or EV chargers (up to 25 kW) to the grid. By entering location and capacity, users receive an instant connection indication. The service helps consumers plan renewable energy investments and provides E.ON with insights to identify areas in need of grid reinforcement.[3]

In Spain, the publication of these capacity maps is mandated by law. Generation capacity maps are already available at both the distribution and transmission levels, whereas demand capacity maps are foreseen by the end of 2025.

Enedis, the main French DSO, provides a tool to **simulate connection and obtain quotes**. This tool is developed and available for mass market clients.

Digital twin for real-time info on grid capacity: At Netz Niederösterreich, the Austrian DSO, is currently implementing a digital twin for the grid. The goal is to ensure automated grid power flow calculation and provide the customers with real-time information on the available grid capacity.

Digitalised back-end solutions

This section seeks to provide examples of how grid operators can utilise digitalisation to improve the process of network analysis assessing capacity and needed measures, as well as the quotation procedure of providing technical and commercial offer for the connecting actor.

Smart Quotation: E-Distribuzione, in Italy, has automatised the two processes of the quotation procedure. Firstly, the calculation of technical details and costs for connecting to the grid can be done automatically. Secondly, once the calculation is performed, an automatic response is sent to the customer. All these functionalities aim to digitalise, simplify and improve the connection experience of both prosumers and producers.

Automatic request processing for simpler requests: In Sweden, E.ON Energidistribution has streamlined the solar connection process by introducing automation, cutting down wait times from six weeks to minutes. The system evaluates the impact of PV installations on the grid, with 70-80% of requests processed automatically. This applies to connections below 63 Ampere, and where the connections do not require physical expansion. Developed in partnership with Digpro Solutions, it simplifies the approval process and is envisioned for other grid operators in the future.[4]

Digital twin for large grid calculations: the Austrian DSO, Netz Niederösterreich uses its digital twin for planning, where a power flow calculation program is used for larger grid calculations. In future they will use the digital twin for power flow calculations in the low voltage grid.

Proactive and forward-looking additional feed-in capacity for large renewables

German grid operators currently consider each request for connection independently, selecting the most technologically and economically feasible connection point. But this approach has its downsides. Bayernwerk and Lechwerke have proposed the network-oriented feed-in socket idea—a scalable concept, e.g., an HS/MS transformer station, that combines several renewable energy connections. This approach enhances grid capacity transparency, makes cost-effective network planning easier, and fosters closer collaboration between TSOs and DSOs. Legal and regulatory reforms would have to be implemented for this to be done at scale.

A more detailed explanation and diagram may be found in Annex 1.

Co-location

The better usage of already existing connection points without immediately needed network upgrade is a brilliant solution. This can be ensured by common usage of the connection point, called co-location, hybridisation or cable-pooling. The sharing of already built injection capacity might enable the connection of new producer capacities to the network. In Hungary, that solution is preferred until the new connection procedure will be implemented.

The regulatory framework for co-location has been developed and is under announcement. The following main points are planned to be introduced:

i. Database of connection points available for co-location (published on the NRA website and updated every 3 months)
ii. Education of market participants (meeting for informing market participants organised by the TSO)
iii. Legal framework established (for example the list of mandatory elements of the contract between the co-locating parties has been included in the implementing regulation of the electricity law)

[4] https://www.eon.se/nyheter/digitalisering-kortar-vaentetider-foer-solceller-fran-veckor-til

iv. Frequently Asked Questions available on the NRA website to enhance understanding of co-location

Speeding up connections by offering flexible connection options

Without further network investment, new producers or consumers can be added to the network if they are ready to accept flexible connection options. In these cases, the new user accepts that the connection is available only part-time, i.e. during a certain part of the day or week.

In Denmark consumers and producers can choose a permanent interruptible connection agreement. The consumer or producer will not pay the deep and standard connection fee. In exchange they risk being interrupted when the grid is congested. If they choose an interruptible connection, there will be no grid expansion. The interruptible connection agreement can be chosen on parts of or the whole connection effect.

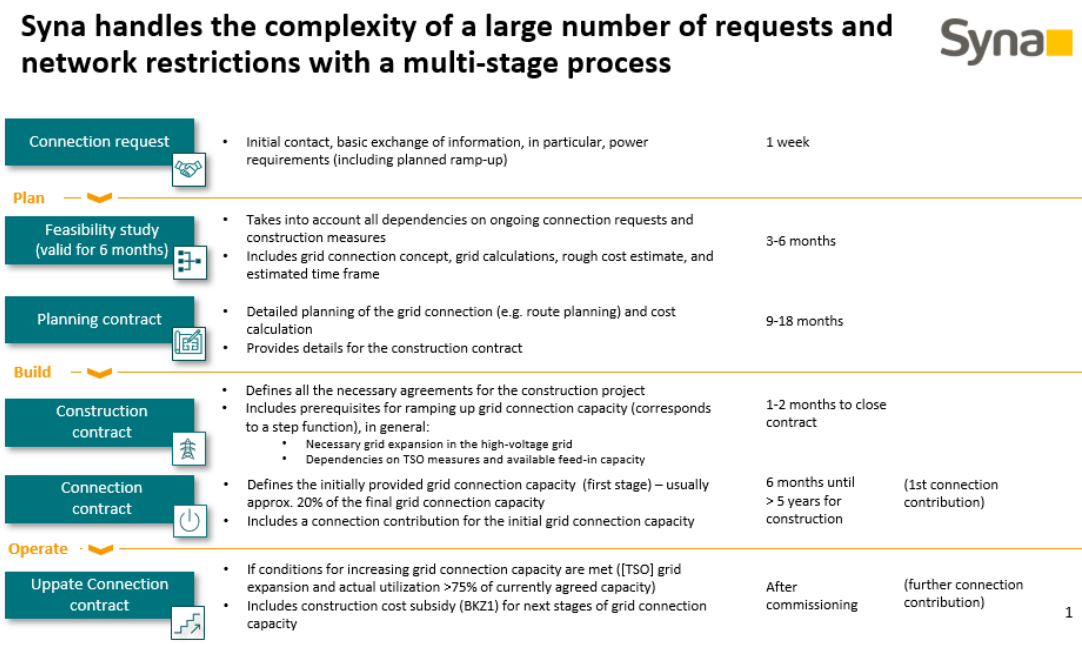
In Norway it is called “connection with conditions”. If a grid connection is not feasible under normal conditions, the grid company can offer connection with conditions that make it feasible. This agreement can be permanent to avoid grid investment contributions (a form of connection fee), or temporary until the necessary grid investments are finished. The reward for the latter is faster grid connection. If there is an outage affecting the conditioned connection, they get no refund. If the conditions say so, they can be disconnected when grid is congested. This arrangement is popular, and the rules for the queue are the same as for non-conditional connection. When the grid is reinforced, number one in the queue gets prioritised, not the ones already connected with conditions. So, it’s not a way to skip ahead of the queue. One can be connected conditionally and have a spot in the queue unconditionally at the same time.

Interruptible connection agreements are a cost reflective and transparent tool, which supports efficient use of the grid. They are best suited to large consumers or producers. Permanent interruptible connection agreements should be available to large consumers/producers generally, and not only in currently high-demand grid areas, to ensure non-discrimination. Flexible connection agreements are implemented in some Member States for example in Denmark. In many other member states, flexible connection agreements are being discussed but are not yet implemented. For example, flexible connection options are being considered in Spain under Circular 1/2024. However, the development of specific regulation is still pending.

FCAs combined with process innovation to better reflect users’ needs

In Germany, to fairly accommodate load growth due to the boom of data centers construction in the vicinity of Frankfort, Syna designed a process based on conditional gradual release of additional capacity to the data center in pre-communicated blocks also taking into consideration evolving business needs while respecting the pace of network expansion at TSO level. The next block will only be opened if the customer (based on metered data) is using a larger part of the capacity that was allocated earlier. This “staircase” approach avoids allocating all remaining DSO capacities to just a few customers (thereby possibly blocking all electrification exercises by other industries). Please note that the connection contract is closed, including the full capacity requested (but will only release that capacity if predefined requirements are met). Syna also uses full value in longer term planning exercises. Process wise, a greater transparent and informed consent from both sides is ensured

thanks to a structured process with 3 contractual gates. Each gate also comes at an additional cost for the party requesting the connection (but all costs paid in advance are later being deducted from the connection fee). The main advantage here is that Syna is enabled to allocate (scare) planning capacities to more serious connection requests.



Existing connection fee regimes

Connection fees can play a significant role in shaping how quickly and efficiently new users can connect to the electricity distribution network, and they can directly affect the size and persistence of connection queues. These fees are designed to cover the costs of grid infrastructure upgrades or extensions required to facilitate new connections. However, the structure of these fees (whether **shallow** or **deep**) can influence project viability and the behaviour of those seeking connections, thereby impacting the formation and resolution of queues.

Shallow connection fees require users to pay only for the infrastructure directly needed to connect their project to the nearest point in the distribution network. The broader costs of reinforcing the grid to accommodate the connection are typically borne by the DSO and recovered through general network tariffs paid by all users. This approach can encourage more projects to apply for connections, as it lowers the upfront costs for developers. However, it can also lead to congestion and overbooking of capacity if insufficient grid reinforcement is planned.

Deep connection fees, on the other hand, allocate the full costs of both direct connection infrastructure and any necessary grid reinforcements to the connecting user. This approach can incentivise more careful project planning and reduce speculative connection requests. In both models, the design of connection fees significantly affects how capacity is allocated and the pace at which new connections are realised, with clear trade-offs between equity, efficiency and system expansion. Balancing these considerations is key to managing connection queues and ensuring fair access to the grid.

Deep connection fees

In Denmark, the DSOs use deep and standardised connection fees. These are well suited to the Danish situation, where we are experiencing ever increasing demand for new grid capacity, from both consumers and producers.

Deep and standard connection fees provide cost reflectiveness, transparency and fairness when recovering the cost of grid expansion due to new connections. The new customers pay for the upgrades of the network, that they on average cause. Standard connection fees derived from average connection cost at a relevant voltage level enable a fixed connection charge pr. MW, regardless of cost of specific connection. This eliminates the cost sharing problem there can occur when having deep, actual-cost connection fees.

Deep and standard connection charges also offer additional benefits such as being suited to give locational signals and inducing efficient grid capacity demand by incentivising customers to choose a suitable connection capacity.

Shallow connection fees

In general terms, in Italy a shallow methodology is applied, in which the distributor has a series of obligations within its scope, to maintain, expand and reinforce the network in accordance with a natural year-on-year growth in demand, or due to individual requests. For this activity it receives a regulated remuneration (paid in the electricity tariff, either through the RAB methodology or other).

In the other hand, for some connections, depending on the nature and characteristics, customers are responsible for bearing part (or all) of the cost of the new connection (always from their private installation to a defined point owned by the distributor). The spirit of the rule is *non bis in idem*, i.e. that customers are not charged twice for the same concept, with this revenue being directly received by the customers and subsequently deducted from the regulated remuneration. It is also common in those cases where the work can be carried out either exclusively by the distributor or optionally by third parties (certified), the quote presented to customers always respond to criteria of minimum cost and quality of service.

Mixed connection fees

In France, there is a different fee regime for renewable energy producers. DSOs and the TSO work together to plan the necessary investments/reinforcements of the grid to create enough capacity for the next 10 to 15 years, based on the national political ambitions for renewables development and on an estimation of future renewables connection. In each (HV/MV) substation, an amount of capacity is reserved for renewables. The cost of the needed shared infrastructures (TSO infrastructures and HV/MV substations between TSO and DSO) is redistributed to every producer that we connect to grid via the quotation, according to their power demand (on a *pro-rata* basis). Additionally, the producer will have to pay for the infrastructure directly needed to connect their project to the nearest point in the distribution network.

In Germany there is a mixture of connection fees, depending on the size and voltage of the connection. In general, there is no *Baukostenzuschuß* below 30 kVA in low voltage. The DSO in Berlin only charges it for mid and high voltage connections and publishes the price per kW on the homepage.

In every voltage level the user must pay for the infrastructure directly required to connect their project to the nearest point in the distribution network. To speed up the process there are fixed prices for small and medium connections if the connection is located at a reasonable distance to the connection point of the distribution network.

In Spain, users pay deep connection charges based on the cost of reinforcement; however, smaller users just pay a fixed standard amount in place of the deep connection fee.

In Hungary, both demand and generation pay a connection fee based on the capacity for injection and withdrawal. In case of generation deep connection charges are applied, while in case of demand a somewhat shallow connection charge system is applied. The level of the connection fee is differentiated also based on the voltage level which the user is connected to for injection and high-voltage withdrawal, the connection fee is based on the performance-proportional part of the investment. For medium-voltage and low-voltage withdrawal, there is a flat rate regarding connection fee (based on values after the capacity and the necessary wire/cable installations).
In Slovakia, the connection fees are deep and are paid for the size of the capacity reserved. Also, in the case of a request to increase the maximum reserved capacity, the difference between the requested and the already existing maximum reserved capacity is subject to a fee.
The applicant for connection pays part of the eligible costs related to the connection and the securing of the required power. The amount of the share is determined according to the value of the input power required.

At the LV level, everyone (within the territory of the DSO) pays the same connection fees. The amount of the fee depends only on the size of the circuit breaker installed. For applicants for

connection at the HV and MV level, the connection fee is calculated on the basis of the formula in the price decree. For applicants for connection at LV level, the connection fee is set in NRA pricing decision at the fixed amount (of course taking into account the size of the installed circuit breaker). This value was initially set on the basis of real costs and is now only updated for core inflation. There are no differences in connection fees with regard to a specific location or placement, everything is calculated on the basis of the average cost for each voltage level separately.

Conclusions

As the **demand for grid connections continues to surge**, DSOs are facing **unprecedented capacity constraints**, requiring **smarter and more flexible approaches** to connection management. NRAs or national governments should provide a clear framework set of prioritisation criteria to allow system operators to move away from the 'first-come, first-serve' approach as the default way of managing the connection queue, where system operators have indicated that the first come, first served principle is inefficient for their operation. Such a move would therefore allow for **policy-driven prioritisation** while maintaining **non-discriminatory access**.

To ensure **faster, more efficient and fairer grid connections**, key recommendations include:

- ✓ **Introducing price signals and economic incentives** to discourage speculative applications, while ensuring they do not discourage electrification and renewables.
- ✓ **Implementing stricter requirements for connection requests**, including **fees, other penalties or even revocation of access rights for speculative applications, penalties for exceeding contracted capacity, and ensuring planning permissions before connection approvals**.
- ✓ **Improving coordination between DSOs and TSOs**, ensuring DSO expansion.
- ✓ **Streamlining permitting procedures at the national level**, reducing delays caused by **fragmented municipal or regional approval processes**.
- ✓ **Expanding the use of Flexible Connection Agreements (FCAs)** to optimise grid utilisation **without causing discrimination** between market players.
- ✓ Allowing for **the adoption of technical solutions supporting gradual, more cost-efficient and quicker scaling-up of the network,** keeping up pace with the development of renewables
- ✓ Ensuring **proper regulatory frameworks to speed up the adoption of digital solutions**

Given that no **single regulatory model fits all markets**, **Member States must tailor their approach** to balance **economic efficiency, grid expansion needs and fair access to connections**. Policymakers and regulators must work closely with DSOs to ensure that Europe's energy transition proceeds without unnecessary delays, while maintaining **a fair and transparent grid access system for all consumers and producers**.

Annex 1

Connection Queues for Demand

France

In France, the queue system applies the first come, first served principle and involves allocating the required network capacity for each project in the order of receipt of the complete and compliant connection requests.

Germany

According to the German *Energiewirtschaftsgesetz* (EnWG), the grid operator is obliged to connect everyone to its grid if reasonable on a first come, first served basis. The requests for a connection to the DSO have increased considerably in recent years. This higher process load was met by the larger DSOs by introducing a customer portal to digitalise the incoming requests and establish online communication with customers and installers. The first-come first served principle stayed in place, as the process times in the DSO were not critically high. However, the time to receive approvals to lay new cables in public streets went up and with it the waiting time for the customers. Looking at low and mid voltage connections, there were capacities in the existing grid which allowed, in general, a short connection time without the need to build extensions.

In Berlin there were about 12 high voltage customer connection points for several years. In the last 2 years we have had to deal with dozens of additional requests which accounted for more than the actual peak load of the whole city. The DSO was overrun by very large high voltage connection applications of 50 to 150 MVA. Even higher connection demands were referred to the TSO for technical reasons. The connection of this kind of loads to the DSO grid has implications to the connection of both the distribution and the transmission grid. As typical project times for reinforcing the connection to the TSO exceeds 5 to 10 years, it became obvious that the first come first served principle had to be changed. Otherwise, all existing and planned future capacities would have been blocked and purchased by the first few customers, as the DSO is not able to differentiate between customer groups or type of connections. Also, some capacities must be withheld for small individual low voltage customers (households, SME), which are protected by law, and their future new electricity demand for household heat pumps or charging points.

The new system was introduced in January 2024 and only applies for large requests exceeding 3.5 MVA in mid and high voltage and therefore there is no change for 99% of all customer requests.

Hungary

In Hungary, queues for both demand and production do exist. However, the demand queues could be handled more smoothly: the required network investment are usually realised in short term (0-2 years), or the demand connection request is fulfilled quickly if no significant network investment is needed.

Ireland

Connection offers are issued to customers on a ‘first come, first serve’ queue basis. MIC is only allocated to a customer once their connection offer is signed and fee paid. The delivery time for connections is dependent upon the level of reinforcement required to provide the customer with the requested MIC. DSO provides a connection offer based on the MIC the customer requests; anecdotal evidence shows this is often more than the customer will realistically need.

Italy

In Italy, the application queue is regulated by the "first come, first served" principle and the available power on the network is assigned accordingly to the requestor.
If network reinforcements are necessary by DSOs (shallow connection), these are estimated and communicated to the customer at the time of the quote (connection fee) and they are considered necessary to complete the connection.

Norway

In Norway there are queues for both demand and production. The demand queues are the most prevalent, and cause congestions mostly higher up in the grid. In some areas the queues are in the entire bidding zone.

The principle of the queues is "first come, first served", but with a higher bar for what it means to "come first" (>1MW). To be allowed to formally request grid connection, the consumer has to provide information for a *maturity assessment*. The date (and time) which they deliver information good enough to be approved will be their *maturity date*, which services at their "ticket" in the queue, and allows the grid company to sort the queue on equal terms across different grid companies. This allows for one big national queue.

The maturity assessment requires the consumer/producer to supply information about their project plans, realistic capacity need, status on required public permits and private agreements, financial plans and a milestone plan. This information is used to follow up on both the capacity queues, and the reserved capacity for projects which are not yet connected. The grid companies are required to follow up on the mature projects regularly and remove projects which are no longer mature. This means that projects which have reserved capacity still could lose this capacity if they do not keep up with their promised progress, making room for more mature projects in the que.

Connection request with a total power need below 1 MW does not have to be queued in the regional distribution grid and transmission grid. It is proposed to raise the limit to 5 MW in the transmission grid, but this is not yet implemented. Small connection requests are therefore not maturity-assessed but could be in cases of local grid congestions. However, as the grid investment times are shorter, this rarely occurs.

Projects which are not yet mature can still inquire about grid capacity and are entitled to a rough cost and time estimate, but this is all non-binding on both sides.

The maturity assessments have several benefits: (1) Ghost projects are not allowed to reserve capacity or be queued. (2) The applied capacity need must be proven realistic, therefore reducing over-reservations. (3) Increased transparency and equal treatment. (4) Grid analysists have an easier time deciding which requests to include in their analysis and not. (5) Reservation/que-number is project-personal. Re-selling of a reservation or a place in the que is strictly prohibited. Any changes must be approved by the grid companies, as grid capacity should not be a commodity to be sold at a marketplace.

Slovakia

In Slovakia, the queue of applications is based on the first-come, first-served principle and the applicant is allocated the available capacity in the network accordingly.
If there is no distribution system in place at the point where the customer wants to connect, or if there is insufficient capacity on the distribution system at that point, the DSO will provide the customer with a proposed solution together with a time estimate for the solution.

Connection Queues for Production

France

In France (DSO), the queue system involves allocating the required network capacity for each project in the order of receipt of the complete and compliant connection requests. The criteria for completeness and compliance are specified below in § “Over reservation of capacity”.

Germany

As the demand in Berlin is much higher than the production of renewable electricity and the DSO grid in a city is very dense, there is in general no grid reinforcement necessary for small scale PV plants and therefore no connection queue for it. Nevertheless, the process times to approve the connection and to install the appropriate electricity meter were challenges which have now been met by the introduction of the customer portal. If a production asks for a new connection to the grid, then there is no difference between that and a connection of a consumer.

Example box: Feed-In Socket

As per the current legal German framework, grid operators must assess each grid connection request individually and choose the technically and economically most favorable grid connection point. This isolated processing has several disadvantages for the parties involved.

Therefore, Bayernwerk and Lechwerke in Germany have developed the network-oriented **feed-in socket concept**, a simple, quick to implement and technically efficient solution. It could be for instance a HS/MS transformer station or an HS/MS transformer which can be scaled in the future, bundling the connection of several renewable assets.

Implementing this concept would provide clarity on grid hosting capacity to project owners and enable DSOs to implement a more cost efficient and forward-looking network development. It will also create potential and necessity for closer coordination between Transmission System Operators (TSOs) and Distribution System Operators (DSOs) to find the right location taking into considerations the capacity of the two networks.

Legal and regulatory adaptations would be necessary for its implementation.

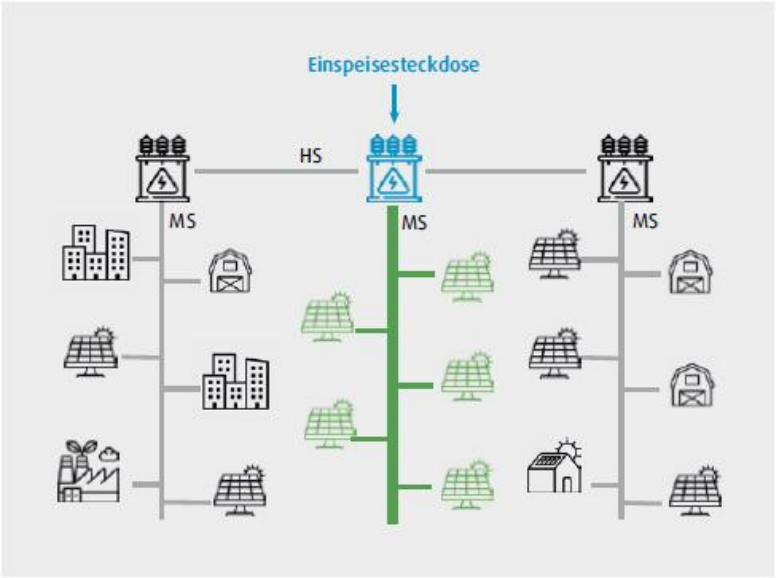


Bild 2. Beispielhafte Darstellung einer Einspeisesteckdose als HS/MS-Umspannwerk

Hungary

The queue for production connection is very long in Hungary currently (with new connection target dates even for 2030) and has been practically frozen at the medium and high voltage level networks. To handle this issue, an industry working group has been established in mid-2024 with the aim of elaborating a new connection allocation algorithm (for details see existing prioritisation practices).

Italy

In Italy, the application queue is generally regulated with the “first come, first served” principle.
For plants with nominal power up to 1 MW, the available capacity on the network is assigned to the requestor following the acceptance of the quote until the connection is completed or the customer renounces it.

In the case of connection plants > 1MW, the technical solution proposed by the System Operator is valid for 210 working days for plants connected in MV and for 270 days for plants in HV or VHV.
in this timeframe the network capacity is temporarily reserved; after the deadline and in absence of necessary permits, the technical solution becomes indicative.

In Italy, there is currently a discussion about the reservation of the indicative solution after the conclusion of its expiration date; it would be appropriate to link the expiration of the indicative solution’s duration period to its actual termination, with the consequent reallocation of capacity by the grid operator.

Once the permits for the connection of the plant connection have been obtained, the indicative solution must be verified again.
It is necessary to acknowledge that the timelines indicated by the national grid connection network code (“TICA”) are certainly insufficient to complete the authorisation processes, which, in many regions, typically take more than 3 years for photovoltaic plants and 4 years for wind farms. It is not uncommon for an operator to obtain authorisation only when the accepted “STMG” (i.e. the acronym for the indicative solution) has already become unfeasible.

Therefore, it would be appropriate to update the validity terms of the indicative solution and make them more consistent with the actual duration of the authorisation procedures, for example, by adjusting them depending on whether the project is subject to simple environmental impact assessments (“VIA”) and/or whether it requires regional or national authorisation, and calculating them net of delays attributable to the TSOs/DSOs.

Within the connection request for production, it is also possible to request a connection for consumption (connection of prosumer); in this case the request is managed as one and in the moment of activation both the consumption supply and the production plant are activated.

Norway

The production queues in Norway are longer in the south, mostly due to solar projects. Production projects follow the same maturity assessment-regime as the demand requests, but they are mostly considered as their own queue.

Slovakia

In Slovakia, the queue of applications is based on the first-come, first-served principle and the applicant is allocated the available capacity in the network accordingly.

If there is no distribution system in place at the point where the customer wants to connect, or if there is insufficient capacity on the distribution system at that point, the DSO will provide the customer with a proposed solution together with a time estimate for the solution.

Managing Capacity Constraints

France

In France, DSOs and the TSO work together to plan the necessary investments/reinforcements of the grid to create enough capacity for the next 10 to 15 years, based on the National political ambitions for renewables development and on an estimation of future renewables connection. This planning (called SRRRER: *Schéma Régional de Réseau de Raccordement des Energies Renouvelables* – Network Regional Plan for Renewables) enables us to minimise the risk of capacity shortage for renewables. But in some parts, where the reinforcements need a lot of time, DSOs are now considering flexible offers to avoid a blockage in the queue.

Ireland

In Ireland there is an issue in certain parts of the network with capacity limitations at transmission level. The DSO requests additional capacity at a transmission level and work with the TSO in optimising network solutions. However, the DSO is dealt with as if any other transmission customer. Reservation of capacity at new transmission bulk supply points for DSO load is critical e.g. 70%, along with the number of bays available for use by the DSO in these new stations where there is mixed TSO DSO operation. The only customer which has particular connection criteria at the moment in Ireland are datacentres in constrained areas. Once an area is reinforced and capacity is created it could quickly be utilised again by a small number of large datacentres.
There are customers using power above their contracted MIC which increases the issue of capacity scarcity in certain areas. In Ireland the monetary fine is the same for a customer who exceeds their MIC once or multiple times in a calendar month. Customers repeatedly exceeding contracted MICs should be dealt under a new mechanism.

In Ireland there is no mechanism to take back MIC that has been paid for by a demand customer; no 'use it or lose it' policy. A policy to address this would be helpful in reducing the risk around unutilised MIC suddenly being used. Once an MIC connection is paid for the customer is entitled to utilise any portion of that MIC, ramping up and down as per their own requirements.

Italy

In general terms, the Italian distribution network has not yet encountered problems of scarcity, in the medium term it is expected that this could happen because there is a large amount of connection required, in line with the huge amount of small-scale renewable plants that need to be installed to achieve the climate targets set for 2030, and some problems could emerge. The flexible connection agreements, which in Italy are not yet regulated (but will be following the provisions of Directive 1711/24), could certainly bring benefits. For example, in RES acceleration areas, in ports, in industrial parks & potential datacentre locations, TEN-T network, etc.

Slovakia

In Slovakia, the DSO sees an increased number of requests for connection of new and new sources (especially subsidised renewable energy sources), which obviously puts pressure on building capacity to connect resources. Moreover, in line with AFIR Regulation we are expecting an increase of high-scale (over 5 MW per connection point) connection requests for ultrafast chargers.

Over-Reservation of Capacity

France

In France, most “ghost projects” are avoided by the numerous criteria that the request must meet to get in the queue. And they are as following:

- A formal approval of the project or a construction permit issued by the local authority must be attached to the request. (consumer & producer)
- Conformity with the RFG code (or at least the producer's commitment to provide evidence of the conformity before his commissioning request. (producer)
    - The requested capacity must not exceed the installed capacity (sum of the nominal power of each generator (or inverter)) (producer)
    - A same project cannot be in both DSOs’ and TSO’s queue, at the same time. TSO and DSO’s work together to detect those projects. (producer)

The quotation communicated to the customer is valid for 3 months and if the customer accepts the quotation, an advance must be paid to keep his place in the queue and the allocated capacity. (consumer & producer)

Germany

Following the national German technical rules VDE AR N 4110 and 4120, the applicant for a grid connection has to deliver a list of power demanding installations on his premisses and more technical details for appliances like inverters or large engines. With this information, and a plausible factor to decrease the demand as not all machines will draw their power at the same time, it is possible for the DSO to verify the requested demand. Large connections will have to pay for their connection and a fee on top of that to improve the general grid capacities. This *Baukostenzuschuss* is approved by the regulator to cover costs for extensions to facilitate the connection. It is priced per demanded kW and the price is published on the homepage every year. This incentive to keep the requested load at a reasonable level is unfortunately comparatively small and has no impact on strategic investors seeking very powerful high voltage connection points.

Considering that most new build connections will take a few years until they reach their maximum usage it should be noted that in general, a considerable amount of requested and contracted capacities will never be needed. Nevertheless, the customers refuse to hand back capacities, and the DSO has no means of reclaiming them without their consent.

Ireland

In Ireland there is no need for a customer to have planning permission for development on the site to get a demand application processed. Customers do not pay any fee to submit a demand application to the DSO, a customer only pays if they wish to accept a connection offer. DSO spends significant time on connection studies that are not taken up by customers. Customers do not need to tie in MIC requested with specific development on site; often MIC requested is in reality more than what will be required by the site. Introduction of application fees may reduce the number of speculative applications that are submitted. Higher level of study may be adequate for speculative projects that need more of a feasibility study than full connection study to determine project viability.

Italy

The Italian NRA has established criteria to counter the reservation of network capacity by producers.

Some of the measures adopted are:
- timeframes for the presentation of the start of the authorisation procedure and the start of works for the production plant, if these are not presented the estimate lapses and the power is released.
- timeframes for the update of the authorisation process by the producer, if the producer does not respond the DSO can request the status of the authorisations from the public administration responsible for the authorisations. If the public administration declares that the authorisations have not been granted the estimate lapses and the power is released. - timeframes for the update of the status of the works, if the timing for the works indicated in the authorisations is not respected the estimate lapses and the power is released.

An additional, yet fundamental, area of improvement concerns the management of Technical Tables ("Tavoli Tecnici TERNA") for identifying shared connection solutions among requesting operators. Regarding the cases where the network infrastructure for connection is shared among multiple applicants, the coordination process of the technical tables is not adequately structured or characterised by clear timelines, as it is entrusted to the involved operators without Terna (the Italian TSO) taking an active mediating role.

It is essential to define and make clear procedures regarding the conduct of the shared electrical works, the engagement and interaction methods among participants, the criteria for identifying the responsibilities of the lead entity, as well as the sharing of project documents.

Slovakia

In Slovakia, there are deadlines for producers to sign a connection contract and meet the technical conditions, and later to sign a contract with the supplier and physically connect the installation. If the producer fails to meet these deadlines, the connection contract is terminated and the capacity is released to other applicants.

From 2025, regarding access to the distribution system, the new rule is that the customer must contract reserved capacity of at least 50% of the value of the MRC (previously it was only 20%). This measure of the NRA (defined in Decree) aims to motivate customers to optimise the size of the reserved capacity.

Permit-Granting

Italy

In Italy, the traditional permitting granting processes have proven to be too complex and lengthy, making it unmanageable to handle the huge number of requests for connection of renewable plants that have emerged in recent years, so starting from 2023, numerous simplifications have been introduced.

Norway

In Norway the permitting process struggles with the same ques as the grid companies. There have been some simplifications, but the process is still lengthy. For some it can take up to 8 months just to get a case manager. The number of complaint-openings and local resistance for renewable related infrastructure is the number one-time thief. Now the production projects have to be maturity assessed by the grid company to be allowed to start the permitting process. However, it is hard to

distinguish between the maturity of production projects which have not yet been though the permitting process, as much is still yet to be explored.

Slovakia

In Slovakia, a connection request has a 30-day approval period. If approved, the DSO will connect the applicant as soon as possible. Some types of renewable energy sources are connected in an accelerated/simplified process, some do not have to pay connection fees. Time periods are set by law.

Annex 2

Dutch Prioritisation Category Tables

Table 1
Congestion-reliever: A congestion-reliever is a party whose network operator determines, based on the most up-to-date data possible, that the allocation of transport capacity to this party results in an increase in the available transport capacity, for other parties and does not result in an increase in congestion in another network operator's network.

Table 2 – Security

Function	Subfunction
Emergency aid	Fire brigade
	Ambulance stations
	Control rooms
Police and defence	Police
	Armed Forces
Security services	General Intelligence and Security Service
	Military Intelligence and Security Service
	National Coordinator for Security and Counterterrorism
Justice and prison system	Judiciary
	Penitentiaries
	Juvenile correctional institutions
	Institutions for forensic care
	Transport and Support Service
Water management	Water boards
	Third parties responsible for water management
Acute health care	Trauma centres
	Acute specialist medical care
	Regional Ambulance Services
	General practitioner care in GP surgeries
	Municipal health services
	Outsourced tasks of Municipal Health Services
	Acute mental health care
	Pharmacies offering evening night and Sunday pharmaceutical care

Table 3 - basic needs

Function	Subfunction
Public drinking water supply	N/A
Education	Primary education
	Secondary education
	Special education
	Secondary vocational education
Residential demand	N/A
Heat supply	Heat supply with permit obligation

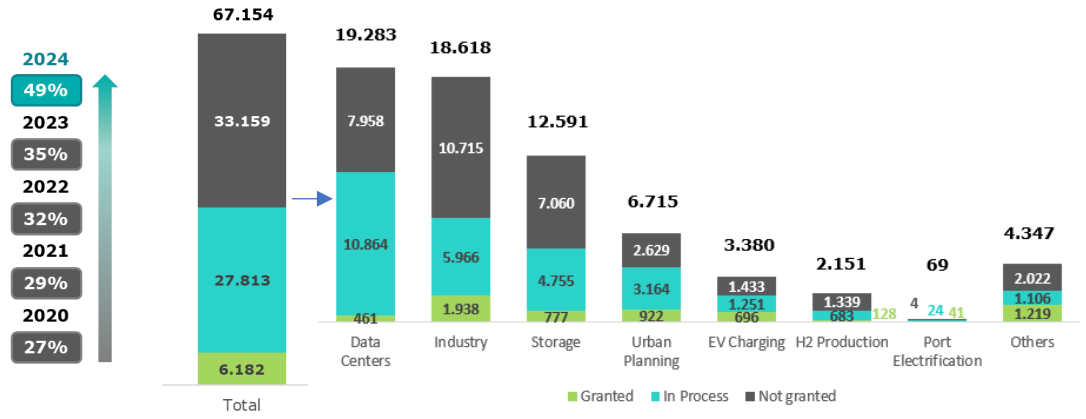
	Supply of heat without a licence obligation
	Heat grid management
Gas networks	N/A

Annex 3 - Spain: An Example For Growing Demand Connection Requests, & Proposals on How to Tackle them

The Spanish Case: Unprecedented Surge in Demand Connection Requests

Existing demand is requesting electrification, and new industries are applying for access and connection to the grid to settle in the country. Meeting this demand, in addition to being the DSOs' duty, represents a unique opportunity for Spain to achieve a level of electrification compatible with its energy transition targets while boosting economic growth through green reindustrialization.

Figure 1: Share of capacity not granted per year (%) and total capacity requested in 2024 to Spanish DSOs, broken down by processing status and demand type (MW)



This reality is reflected in the large volume of requests received for access and connection of demand to the distribution grid (67 GW). In 2024, these have amounted to 40% of the overall country's current contracted capacity (174.5 GW). However, there is concern that the integration of the demand into the grid is not swift enough, as the share of requests that cannot be granted (mainly due to lack of capacity) is growing at a double-digit rate and by 2024, already accounts for 50% of the requested capacity. As per the "first come first served" principle, DSOs must ensure a level playing field when processing applications and all requests must be treated the same. However, failure to address the 19 GW of requests associated with industrial projects, which would boost the Spanish economy, is

particularly concerning. If this demand cannot be met in a timely manner, this country-wide opportunity will not materialize. Furthermore, we cannot forget that storage facilities are paramount to guarantee security of supply by promoting and reinforcing the flexibility of the system and, ultimately, contributing to better use of renewable energy production.

In this regard, DSOs and regulators are collaborating to make a proper use the regulatory lever to streamline the connection process and be able to meet demand in a timely manner without compromising security of supply. To this end, three priority regulatory levers have been identified: 1) Organizing demand access and connection requests on demand; 2) optimizing the use of the existing network; 3) guaranteeing a remuneration model and a Rate of Return (RoR) that allows attracting sufficient capital to undertake the necessary investments to adapt the electricity networks to meet the electricity demand levels that the decarbonization of the economy implies.

Regulatory proposals to organize demand access and connection requests on demand

In Spain, due to the increase in demand access and connection requests, DSOs have proposed a set of measures to the NRAs to optimize the use of the existing network, recommending simple actions to free up demand connection capacity in the short term. These include the following:

- A fast-track mechanism to enable new positions on the transmission network to support the distribution network and allow for additional demand connection. Currently, the transmission grid planning process is not adapted to the dynamic needs of the distribution grid, so a more agile and flexible planning process would ensure a rapid response to such demand.
- Regulatory modification to allow the transmission grid operator to grant connection permits to support the distribution grid when the need is justified. The modification consists of simplifying the procedure that would allow DSOs to use free generation and reserve positions in transmission substations to support the distribution grid.
- Additionally, an agile and flexible review of transmission grid planning is proposed, with two alternatives: a) simplify the procedure for approving modifications to transmission grid planning (including those mentioned above) or b) increase the frequency with which transmission grid planning can be reviewed. Currently, transport network planning can be updated every two years, and the proposal would be to update this planning at least every six months.

Regulatory proposals to optimize the use of the existing network

To identify the most mature projects, Spain, through Circular 1/2024, has made it mandatory for DSOs and the TSO to publish demand capacity maps displaying available capacity at transmission and distribution nodes. This initiative aims to provide greater transparency for potential consumers, allowing them to better assess which areas offer the most available capacity. As a result, access and connection requests can be submitted in a more informed and orderly manner, with *ex-ante* knowledge of the grid's status.

This provision is expected to come into force in 2025, and surely will alleviate over-reservation of capacity on its own. But even then, in Spain, given the large volume of demand capacity requested in the past few years, there are further measures that could be implemented in relation with guarantee requirements and a milestone scheme for the expiration of demand access and connection permissions. These include:

- Extending the requirements for certification of use/ownership of the plot in which the projects will be located[5] retroactively to every request that received connection permission prior to January 12th, 2025, but has not yet formalized a third-party access contract. To this end, it is proposed to establish a transitory period to provide such information; after this period, the connection permit would expire. In addition, network users would be allowed to renounce the connection permit without penalty (i.e., granting recovery of the guarantee, if applicable).
- Extending guarantee requirements[6] to all voltage levels above 1 kV for demand connection requests. To streamline the guarantee and reinforcement project commission process, it is proposed allowing, in certain cases, the substitution of guarantees with "payments on account" to cover for network adequacy, reinforcement, and, when applicable, extension costs. These payments would be reconciled with the DSO prior to third-party access contracting specifically, by deducting the corresponding amount from the total sum owed by the developer to the distributor.
- Requesting guarantees for urban development plan connection requests, conditioned to the procurement of the network operation authorization.
- In Spain, prior to the enactment of RDL 8/2023, connection permits for urban planning applications and connections at voltages below 36 kV did not have an expiration date. However, RDL 8/2023 introduced a requirement that these connections must formalize a third-party access contract within five years from the date the Decree came into effect. This fixed deadline is viewed as insufficient, which is why it is proposed implementing a sliding expiration scale where the older the permit, the sooner it would expire.
- Introducing a milestone scheme for the expiration of demand connection permissions. Currently, the only deadline for the expiration of demand connection permissions is that they must formalize a third-party access contract within five years from the date they receive said connection permit. For this reason, it is proposed introducing several intermediate milestones that must be achieved in time to keep the connection permission.

Regulatory proposal to guarantee a remuneration model and a Rate of Return (RoR) that allows attracting sufficient capital to undertake the necessary investments.

A stable and predictable remuneration framework that recognizes investments adequately and incorporates incentives for digitalization, will allow Spain to generate benefits for consumers and in terms of the economy, employment and the environment.

[5] Regulated in Circular 1/2024 (Annex I.1.j),
[6] Regulated in "Real Decreto ley 8/2023"

For this reason, and for the third regulatory period starting in 2026, a competitive remuneration model is being proposed to guarantee the connection of the industry and among the measures that are highlighted are the following:

- Speeding up the recognition and remuneration of investments.
- Ex-ante remuneration model that provides legal certainty and simplification of reporting.
- A stable and competitive remuneration model that recognizes anticipatory investments and encourages digitalization.
- Stable RoR within the regulatory period to project certainty.
- Setting a competitive RoR to incentivize electrification and providing protection against inflation. DSOs have submitted a proposal that sets a competitive RoR for the 2026-2031 regulatory period in line with those set by other European countries and in accordance with the Ministry's Energy Policy Guidelines[7].
- Adequacy of the investment limit, which is nearly exhausted with the maintenance of existing assets.

[7] OPE: Orientaciones de Política Energética, Orden TED/1193/2024

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Environmental Leadership

- Commitment, innovation, pro-activeness

Social Responsibility

- Transparency, ethics, accountability

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