ACER
European Union Agency for the Cooperation of Energy Regulators

ACER

Report on Electricity Transmission and Distribution Tariff Methodologies in Europe

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Executive summary

(1) The electricity transmission and distribution networks represent the backbone of the national and European energy systems and play a key role in the energy transition. Network tariffs have the core objective to recover the costs incurred by transmission and distribution system operators. In the Member States the National Regulatory Authorities (NRAs) have to fix or to approve transmission or distribution tariffs or their methodologies.

(2) Tariff methodologies shall neutrally support overall system efficiency over the long run through price signals to network users. Since charges related to transmission and distribution networks can constitute a considerable cost to the network users, the way how tariffs are set can provide additional incentives (additional to those given by energy pricing) to the network users to adapt their behaviour. The effectiveness of such signals depends on factors such as the type of network user and the share of the network costs in the final bill.

(3) Network tariffs, among other requirements set by EU law, shall be cost-reflective, transparent and non-discriminatory. Tariffs can be designed in multiple ways. Finding the right balance between various tariff-setting principles (e.g. cost recovery, cost reflectivity, efficiency, non-discrimination, transparency, non-distortion, simplicity, stability, predictability and sustainability) is a complex task and it involves different trade-offs, where different NRAs may identify different approaches according to the pursued principles in each national context. The complexities increase even more under a rapidly evolving energy system featured by increased integration of renewable energy sources, increased demand by electrification as well as by a more active role of network users, and require a regular reassessment of whether the tariff methodologies continue to be appropriate. Finally, the recent energy crisis and an increasing consideration for the affordability of the final energy bill pose extra challenges, and may also have an impact on the network tariffs setting.

(4) In order to increase transparency and comparability in tariff-setting where binding harmonisation is not seen as adequate[1], ACER shall provide and update, at least every two years, a best practice report on transmission and distribution tariff methodologies. NRAs shall duly take the best practice report into consideration when fixing or approving transmission or distribution tariffs, or their methodologies[2].

(5) This Report provides a review of transmission and distribution tariff methodologies across EU Member States and Norway. This third edition focuses on selected tariff-related topics, for which a more extensive data collection and analysis was carried out. For other tariff-related topics not covered in detail in this third edition, an update of the information at country level was carried out. On the latter topics, this Report provides the updated main findings as well as the still valid ACER recommendations from previous editions of the Report.

(6) A summary of the novel and previous ACER recommendations is provided in the below Summary Table. For more details on the recommendations, please refer to the corresponding chapter of this Report.

[1] Cf. Recital (40) of Regulation (EU) No 2019/943.
[2] Cf. Article 18(10) of Regulation (EU) No 2019/943.

(7) Finally, looking towards the fourth edition of the Report, planned towards the end of 2024/early 2025, ACER intends to follow-up on how NRAs are taking into consideration the ACER recommendations.

Summary Table of the ACER recommendations

Cost model:[3] (more information in Chapter 3)
➢ Within the next 4 years, subject to available resources of the NRAs, NRAs should evaluate the advantages and disadvantages of applying incremental or forward-looking cost models.
Cost cascading:[4] (more information in Chapter 3)
➢ Network users should contribute to the costs of each network level used by them. ➢ NRAs should collect network costs, where feasible and cost-effective, classified by different voltage levels, as this is a pre-requisite to apply the cost-cascading method. ➢ NRAs should collect data on power flows, including the occurrence of inverted power flows, and the volume of injection and withdrawal per voltage level, to determine whether cost-cascading is still an adequate approach. ➢ NRAs should ensure transparency on the cost categories not subject to cost-cascading, providing the economic rationale for this decision. ➢ Exemptions on the application of the cost-cascading principle (e.g. to certain network user groups) should be justified and regularly re-evaluated.
Injection charges: (more information in Chapter 4)
➢ The costs caused by a network user should be properly reflected in its tariffs. If a network user only withdraws from or only injects into the transmission or distribution grid, in principle, only the costs relevant for withdrawal or the costs relevant for injection should be attributed to this network user. ➢ If a network user both withdraws from and injects into the grid, both network uses should be considered when setting the tariffs, by properly taking into account the potential cost-offsetting effect and the overall cost-impact to the network. ➢ Where volumetric charges apply, net-metering should be avoided. ➢ Injection charges should be consistently defined across transmission and distribution to avoid undue incentives for connection towards one of the network levels. ➢ NRAs should consult at least the NRAs of neighbouring countries of any substantial change regarding injection charges in advance. ➢ When setting injection charges, all network-related cost-burdens on the concerned network users should be considered, including those recovered via withdrawal charges, connection charges, or other means, to avoid any double-charging. ➢ Energy-based injection charges should not be used to recover infrastructure costs. Costs, which do not show correlation with neither capacity nor energy, but rather with the number of network users or the number of meters, in principle, should be recovered via lump sum charges.
Connection charges: (more information in Chapter 5)
➢ Where deep connection charges apply and the connection of a network user serves future network users, cost-sharing between current and future network users should be considered. ➢ Within the next 4 years, NRAs should evaluate the advantages and disadvantages of enabling interruptible or flexible connection agreements.
Reactive energy charges: (more information in Chapter 6)
➢ NRAs should monitor the evolution of costs due to voltage control and reactive energy management. ➢ Where such costs are deemed significant, the NRA should consider a review of reactive energy charging.

[3] In this Report, 'cost model' means the approach followed in the tariff methodology to set the charges of the network tariffs, such as the average cost, incremental cost or forward-looking cost models.
[4] In this Report, 'cost cascading' means the tariff-setting method implying an allocation of some costs of a certain voltage level towards network users connected at a lower voltage level, but not the other way around.

➢ NRA should take into account the frequently used thresholds for reactive charging and the frequently used values across Europe.
Time-of-use network charges: (more information in Chapter 7)
➢ Where time-of-use signals are introduced to reflect system costs, the network tariff structures and the signals should be mandatory for all network users, without a possibility to opt-out (optionality may be temporarily reasonable during transition). ➢ Where no time-of-use signals are applied, the NRA should investigate the need from cost-efficiency and/or network congestion point of view to introduce such signals. Such studies should aim to identify which elements affect their effectiveness and efficiency. ➢ Where time-of-use is already applied, the NRA should regularly evaluate their impacts and their appropriateness. NRAs should improve data collection and analysis regarding individual network users. ➢ Where fit-for-time-of-use meters are largely missing, as a temporary solution, NRAs may design network tariffs by determining for different user profiles their contribution to the system peak.
NRAs role in tariff setting: (more information in Chapter 8)
➢ The NRA should directly set the transmission and distribution tariff methodologies or, as a strict minimum, approve them.
Tariff structure and cost recovery: (more information in Chapter 8)
➢ NRAs should differentiate the network costs at least according to the following categories: transmission infrastructure; transmission losses; distribution infrastructure; distribution losses; metering services; system operator purchases of system services; costs due to reactive power; ➢ NRAs should obtain sufficiently granular data on network development and system operation and identify for each of these cost categories the most appropriate cost drivers; ➢ NRAs should be able to differentiate at the level of individual network charges the share of each cost category listed above.
Frequency of tariff setting methodologies: (more information in Chapter 8)
➢ The length of the tariff methodology period should be at least 4 years (the set methodology may be subject to revision before, due to rapid changes in the sector, if duly justified). ➢ Network tariff values should be updated at least yearly based on variations of the drivers defined by the tariff methodology and on inflation. ➢ A multi-year transition process should be preferred when changes in the tariff methodology significantly impact the tariff values for individual grid users.
Stakeholder involvement: (more information in Chapter 8)
➢ Public consultations should be used systematically to interact transparently and inclusively with stakeholders.
Transparency in tariff-setting: (more information in Chapter 8)
➢ At least the following information should be published in each Member State: o the detailed methodology to set transmission and distribution tariffs, including in particular the cost categories covered by them; o at least when the tariff methodology is set, the amounts recovered by each tariff element; and o each year, the transmission and distribution tariff values for each network user group.

1. Introduction

(8) The electricity transmission and distribution networks represent the backbone of the national and European energy systems and play a key role in the energy transition. Network tariffs have the core objective to recover the costs incurred by transmission and distribution system operators.

(9) Pursuant to Article 59(1)(a) of Directive (EU) 2019/944[5], each national regulatory authority (NRA) has the duty of fixing or approving, in accordance with transparent criteria, network tariffs or their methodologies, or both.

(10) In line with Regulation (EU) 2019/943[6], tariff methodologies shall reflect the fixed costs of transmission system operators (TSOs) and distribution system operators (DSOs) and shall provide appropriate incentives to the transmission and distribution system operators to increase efficiencies, to foster market integration and security of supply, to support efficient investments, to support related research activities, and to facilitate innovation in the interest of consumers in areas such as digitalisation, flexibility services and interconnection.

(11) Article 18(1) of the same Regulation establishes that charges applied by network operators for access to networks, including charges for connection to the networks, charges for use of networks, and, where applicable, charges for related network reinforcements, shall be cost-reflective, transparent, take into account the need for network security and flexibility and reflect actual costs incurred insofar as they correspond to those of an efficient and structurally comparable network operator and are applied in a non-discriminatory manner.

(12) Tariff methodologies shall also neutrally support overall system efficiency over the long run through price signals to network users, and shall not discriminate, positively or negatively, production, energy storage and aggregation. It also shall not create disincentives for self-generation, self-consumption and for participation in demand response. Since charges related to transmission and distribution networks can constitute a considerable cost for network users, the way how tariffs are set can provide additional incentives (additional to those given by energy pricing) to the network users to adapt their behaviour. The effectiveness of such signals depends on factors such as the type of network user and the share of the network costs in the final bill.

(13) Tariffs can be designed in multiple ways. Finding the right balance between various tariff-setting principles (e.g. cost recovery, cost reflectivity, efficiency, non-discrimination, transparency, non-distortion, simplicity, stability, predictability and sustainability) is a complex task and it involves different trade-offs, where NRAs may identify different approaches as most suitable according to the pursued principles in each national context. The complexities increase even more under a rapidly evolving energy system featured by increased integration of renewable energy sources, increased demand by electrification as well as by a more active role of network users, and require a regular reassessment of whether the tariff methodologies continue to be appropriate. Finally, the recent energy crisis and an increasing consideration for the affordability of the final energy bill pose extra challenges, and may also have an impact on the network tariffs setting.

[5] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU. OJ L 158, 14.6.2019, p. 125. Cf. Article 37(1)(a) of Directive 2009/72/EC
[6] Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity. OJ L 158, 14.6.2019, p. 82. Cf. Article 14 of Regulation (EC) No 714/2009

(14) In order to increase transparency and comparability in tariff-setting where binding harmonisation is not seen as adequate[7], ACER shall provide and update, at least every two years, a best practice report on transmission and distribution tariff methodologies in accordance with Article 18(9) of Regulation (EU) 2019/943, while taking account of national specificities. Pursuant to Article 18(10) of that Regulation, NRAs shall duly take the best practice report into consideration when fixing or approving transmission or distribution tariffs, or their methodologies.

(15) This Report constitutes the third edition of the best practice report foreseen in Regulation (EU) 2019/943, following the ACER 2019 report on practices regarding transmission tariff methodologies[8], as well as the ACER 2021 report on practices regarding distribution tariff methodologies[9]. It is the first edition covering information both on transmission and distribution tariffs.

(16) This Report provides a review of transmission and distribution tariff methodologies across EU Member States and Norway. It focuses on a limited number of tariff-related topics, - which were deemed as of particular interest to NRAs in view of recent or ongoing tariff works and/or based on targeted consultations by ACER[10]-, for which a more extensive data collection and analysis was carried out. For other tariff-related topics not covered in detail in this third edition, an update of the information at country level was carried out.

(17) This edition of the Report features five topics in focus. First, it investigates the cost models used across countries to set the economic signals of the network tariffs and the application of the cost-cascading method. Second, it investigates the application of injection charges, including ACER's regular monitoring of the appropriateness of the ranges of allowable transmission charges paid by producers (G-charge), pursuant to annex Part B of Commission Regulation (EU) No 838/2010.[11] Third, it reviews the connection charges applied when producers, consumers and other network users connect to the grid. Fourth, it investigates the application of reactive energy charges. Fifth, it discusses the time-of-use signals embedded into network tariffs. For other tariff-related topics, not in focus in this edition, the updated main findings as well as the still valid ACER recommendations from previous editions of the Report can be found in Chapter 8.

(18) This Report is based on the input provided by NRAs between February 2022 and December 2022[12] on their respective transmission and distribution tariff methodologies. For transmission tariffs in Ireland and distribution tariffs in Bulgaria, in lack of inputs, with some exceptions[13], the Report builds on the information provided by the respective NRAs to ACER in 2019 and 2020

[7] Cf. Recital (40) of Regulation (EU) No 2019/943.
[8] ACER report on transmission tariff methodologies in Europe, December 2019 https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Practice%20report%20on%20transmission%20tariff%20methodologies%20in%20Europe.pdf
[9] ACER report on distribution tariff methodologies in Europe, February 2021 https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Report%20on%20D-Tariff%20Methodologies.pdf
[10] Cf. ACER webinars on electricity network tariffs for injection (10 Nov 2021) and on time-of-use electricity network tariffs (16 Nov. 2021): https://www.acer.europa.eu/public-events/acer-webinar-electricity-network-tariffs-injection-targeted-consultation; https://www.acer.europa.eu/public-events/acer-webinar-time-use-electricity-network-tariffs-targeted-consultation
[11] The term 'G-charge' refers to the transmission charges paid by producers, excluding connection charges, charges related to ancillary services and specific system loss charges, and whose annual average value is capped by Commission Regulation (EU) No 838/2010. In contrast, the term 'injection charge' means all transmission and distribution charges paid by producers for the use of the network (i.e. it also excludes connection charges, but it includes other non-connection charges, such as charges related to ancillary services and system losses)
[12] Most information was collected in the first semester, complemented with additional clarifications in the second semester.
[13] Some information required for the G-charge monitoring has been provided for Ireland.

(for the previous ACER tariff reports), to the extent possible. The detailed input provided by NRAs, which is analysed across the different chapters of the Report, is provided in Annex 1.

(19) In light of the unprecedented surge in electricity prices since mid-2021, ACER also carried out a general review of the tariff designs supporting vulnerable customers and any temporary tariff measures to ease or redistribute tariff burdens. The findings of this assessment, with information collected mainly in the first semester of 2022, are provided in Annex 3 of this report.

(20) It is worth reminding that network tariff-setting is the result of a three-step process. First, the allowed or target revenues of the network operators (including the remuneration method for TSO or DSO costs) and other relevant costs are determined. Second, the tariff structure is defined. Third, the costs are allocated to each of the tariff structure's items (i.e. charges paid by network users). This Report focuses on the last two steps.

(21) The rest of this Report is structured as follows:

- Chapter 2 provides the definitions used in the Report;
- Chapter 3 investigates the cost models applied and cost cascading;
- Chapter 4 investigates the transmission and distribution tariffs for injection;
- Chapter 5 analyses the structure of connection charges;
- Chapter 6 investigates the reactive energy charges;
- Chapter 7 discusses the time variation of tariffs;
- Chapter 8 provides the main findings and recommendations on those tariff-related topics that are not in-focus in this edition;
- Annex 1 provides the input from NRAs, which is analysed across the different chapters of the Report;
- Annex 2 provides the relevant links to the tariff methodologies and some other tariff-related information in each country;
- Annex 3 deals with tariff-related measures to protect vulnerable customers and/or cope with high energy prices.

2. Definitions

(22) According to the definitions set by Directive (EU) 2019/944 and Regulation (EU) 2019/943:

a) 'Distribution' means the transport of electricity on high-voltage, medium-voltage and low-voltage distribution systems with a view to its delivery to customers, but does not include supply;

b) 'Distribution system operator' means a natural or legal person who is responsible for operating, ensuring the maintenance of and, if necessary, developing the distribution system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the distribution of electricity;

c) 'Producer' means a natural or legal person who generates electricity;

d) 'Smart metering system' means an electronic system that is capable of measuring electricity fed into the grid or electricity consumed from the grid, providing more information than a conventional meter, and that is capable of transmitting and receiving data for information, monitoring and control purposes, using a form of electronic communication;

e) 'Transmission' means the transport of electricity on the extra high-voltage and high-voltage interconnected system with a view to its delivery to final customers or to distributors, but does not include supply;

f) 'Transmission system operator' means a natural or legal person who is responsible for operating, ensuring the maintenance of and, if necessary, developing the transmission system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the transmission of electricity.

(23) In addition, for the purpose of this Report, the following additional definitions apply:

a) 'Connection charge' means charge, typically one-off charge, covering the costs (or part of the costs) of connecting new users to the transmission or distribution system or upgrading the connection. Connection charges may be shallow or deep. In case of shallow connection charges the network users pay for the infrastructure connecting its installation to the transmission or distribution grid (line/cable and other necessary equipment), while in case of deep connection charges, the network users pay (additionally) for the costs of other reinforcements/extensions in the existing network, required in the transmission or distribution grid to enable the grid user to be connected;

b) 'Distribution tariff methodology' defines the rules for allocating distribution costs to (groups of) network users. The tariff methodology as defined in this Report does not include the determination of allowed or target revenues of the network operators;

c) 'G-charge' means the transmission charges paid by producers in each Member State, as referred to in annex Part B of Commission Regulation (EU) No 838/2010, excluding connection charges, charges related to ancillary services and specific system loss charges;

d) 'Household consumer' means a network user who withdraws electricity from the grid for the consumer's own household consumption, excluding commercial or professional activities;

e) 'Injection charge' means all transmission and distribution charges paid by producers, except for charges for physical assets required for connection to the system or the upgrade of the connection (i.e. connection charges), but including other non-connection charges (such as charges related to ancillary services and system losses);

f) 'Network user' means a natural or legal person connected to the transmission or distribution network (excluding the DSO and TSO), who injects electricity in and/or withdraws electricity from the network;

g) 'Payment for reactive energy/power' means the charge for withdrawing and/or for injecting reactive power outside the allowed limits;

h) 'Public consultation' means a publicly announced consultation, in which any individual, group or organisation is allowed to participate;

i) 'Tariff methodology period' means the period for which the general rules for the tariffs are set. During this period the tariff values may be updated several times;

j) 'Time-of-use network tariffs' (or tariff time elements) means charges for network service(s) that vary according to when the service is used e.g. by peak/off-peak, season, month, weekdays/weekends, hour;

k) 'Transmission tariff methodology' defines the rules for allocating transmission costs to (groups of) network users. The tariff methodology as defined in this Report does not include the determination of allowed or target revenues of the network operators;

(24) In this Report, the term "network charges" includes all charges paid to the TSO and DSO. As illustrated in Figure 1, among these charges ACER differentiates between:

a) the charges for use of the network (i.e. charges due to the costs developing and operating the transmission and the distribution grid and system which are recurring every year);

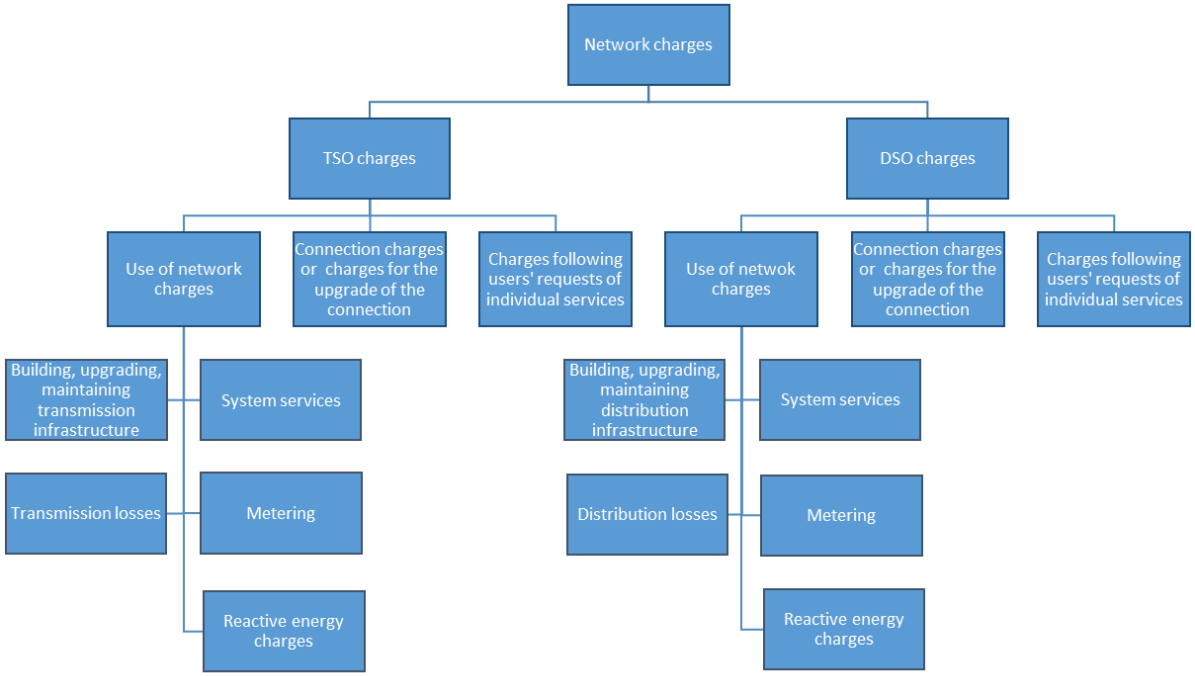
b) the charges for connection to the system or the upgrade of the connection, which are typically one-off charges;

c) the charges for individual (specific) services provided by the TSO or DSO at the request of the network user (e.g. installation of a new meter upon user's request or reconnecting a network user in case of disconnection due to late payments, etc.);

(25) Inside the charges for use of the network, ACER differentiates further between the transmission and distribution tariffs for building, upgrading and maintaining infrastructure and the transmission and distribution tariffs for losses, from other charges, such as the charges for system services, charges for metering and charges which are paid for withdrawing and/or for injecting reactive power outside the allowed limits (i.e. reactive energy charges).

(26) Network charges shall not include unrelated costs supporting unrelated policy objectives.

Figure 1: Segmentation of network charges



3. Cost model and cost cascading

3.1. Cost model

(27) In this Report, the expression “cost model” refers to the conceptual approach for determining the network tariff values. National approaches are categorised according to three cost models, whether they are based on an average cost, an incremental cost or a forward-looking cost. Figure 2 below provides a general description of the three approaches, as well as a reference on how cost recovery is ensured in each case.

(28) Cost models are not to be confused with the methodology for setting the allowed or target revenues of the network operator. Cost models are used to determine the unit prices of the network tariffs, given the level of allowed or target revenues to recover and the level of forecasted quantities.

Figure 2: Cost models for setting network tariffs

Cost model	Description	Cost recovery
Average cost	The allowed or target revenues of network operators are allocated to the cost drivers as an average cost, meaning the ratio between revenues and quantities.	Full cost recovery is ensured by design, if the quantities are correctly forecasted
Incremental cost	Increments in network costs are associated to increments in cost drivers, where data used refers mainly to historic data. The incremental cost per cost driver represents an average long-run marginal cost.	May result in residual costs that need to be accounted for to ensure full cost recovery.
Forward-looking cost	Increments in network costs are associated to increments in cost drivers, where data used refers mainly to forecasted data and/or simulation models. The incremental cost per cost driver represents a long-run marginal cost.	

(29) The average cost model determines unit prices of the network tariff by dividing the allowed or target revenues by the forecasted quantities (such as demand).[14] This cost model is backward-looking as it considers costs that have already been incurred in the past. In contrast, the incremental and forward-looking cost models estimate the unit prices of the network tariff through an incremental or marginal approach, by estimating additional (incremental) costs due to an increase (increment) of a cost driver.[15] As a result, and assuming that quantities for the next tariff period are correctly forecasted, the average cost model ensures full recovery of the allowed or targeted revenues by design, while the incremental (or marginal) costs of the other two approaches may result in a lower level of revenues compared to the allowed or targeted revenues[16]. The difference of that revenue level with the level of allowed or target revenues is often labelled as “residual cost”.

(30) As cost recovery is the core objective of tariff-setting, a tariff methodology based on the incremental or forward-looking cost models needs to employ some adjustment to ensure full cost recovery, bringing the residual cost to zero. From a theoretical perspective, the tools to overcome this problem are either a fixed “lump sum” term to avoid the distortion of economic decision-making or, if that is not feasible, a rule of Ramsey-pricing[17]. From a practical perspective, the solution usually involves multiplicative or additive adjustment of all or some prices to ensure cost recovery.

(31) Figure 3 provides a schematic comparison of the three cost models in terms of inputs and outputs for tariff-setting. The main difference is that the incremental and forward-looking cost models use a set of unit prices as inputs to the tariff-setting, which in the output phase need to be adjusted to ensure cost recovery.[18]

[14] For instance, dividing revenues, in euros (EUR), by forecasted consumption, in MWh, to obtain an energy-based price, in EUR/MWh.
[15] The difference between these two approaches is that the incremental cost model resorts mainly to historic data, while the forward-looking cost model requires a simulation model to forecast the future network investments.
[16] I.e. due to economies of scale
[17] Ramsey pricing consists in adjusting the unit prices in a differentiated way in order to reach the overall revenue goal. More precisely, the prices applied to the more (less) elastic demand should be less (more) adjusted as this will minimize the overall economic distortion.
[18] The unit prices used as inputs are computed ex ante, before the tariff-setting process.

Figure 3: Schematic comparison of the cost models for tariff-setting

	Input	Output
Average cost model	$\boldsymbol{R_i} - Revenues\ of\ variable\ i$ $\boldsymbol{Q_i} - forecasted\ demand\ of\ variable\ i$	$\boldsymbol{P_i} - Unit\ price\ of\ variable\ i$ $\boldsymbol{P_i = \frac{R_i}{Q_i}}$ $\boldsymbol{0 = \sum_i R_i - \sum_i (Q_i \times P_i)}$
Incremental or Forward-looking cost model	$\boldsymbol{R_i} - Revenues\ of\ variable\ i$ $\boldsymbol{Q_i} - forecasted\ demand\ of\ variable\ i$ $\boldsymbol{P_i} - Unit\ price\ of\ variable\ i$	$\Delta \boldsymbol{R} - Residual\ cost$ $\boldsymbol{\widetilde{P}_i} - Adjusted\ unit\ price\ of\ variable\ i$ $\boldsymbol{\Delta R = \sum_i R_i - \sum_i (Q_i \times P_i)}$ $\boldsymbol{0 = \sum_i R_i - \sum_i (Q_i \times \widetilde{P}_i)}$

Note: The index i represents the range of subcategories that exist in tariff-setting, for instance different voltage levels and/or different billing variables (e.g. contracted power, energy).

(32) In theory, the incremental or forward-looking cost models are better approaches to signal the true cost of using the network, if the residual cost is recovered in a non-distortive way (i.e. via lump sum charges).

(33) To illustrate the potential of these cost models, one may consider the case of electricity networks, where the main cost is usually related to the development of the network, which is typically correlated with peak demand. In the extreme case where the network has excess capacity, to the point that it is unlikely to require further investments over the next decades, from an economic perspective the true (incremental) cost of using the network during the peak is close to zero. Hence, the unit prices to be used as inputs for tariff-setting would also be close to zero. Obviously, such unit prices would not recover the target or allowed revenues of the network operator, leading to a revenue shortfall (residual cost) and to the need to adjust the unit prices. If that adjustment is performed in a least-distortive manner, the incremental or forward-looking cost models can be preferred when compared to an average cost model.[19]

(34) Figure 4 shows the application of these cost models in Europe. Most countries follow an average cost approach, which is probably related to the advantages in terms of cost recovery, as it ensures recovery of the allowed or target revenues by design, and to the complexities in modelling incremental or forward-looking costs.

(35) Based on the answers provided by NRAs, three countries (FR, NO, PT) apply models based on incremental costs and another three countries (HR, EE, SE) follow a forward-looking cost model. For the countries applying these cost models, it becomes necessary to define how to allocate the residual cost resulting in the tariff-setting process.

[19] If the network has excess capacity, it would not be efficient to signal to end-users a high price during peak periods (which could result from an average cost approach, signalling the cost of peak-related network investments from the past). This would unnecessarily lead to load shifting, affecting consumer's welfare and economic activity.

(36) All assessed countries reported that they apply the same cost model across transmission and distribution tariffs, which might stem from the need to have a coherent tariff methodology across transmission and distribution.

Figure 4: Cost models applied to network tariffs in Europe

	Transmission tariff	Distribution tariff
AT		
BE		
BG		
HR		
CY		
CZ		
DK		
EE		
FI		
FR		
DE		
GR		
HU		
IE	No data	

	Transmission tariff	Distribution tariff
IT		
LV		
LT		
LU		
MT	N/A	
NL	.	
NO		
PL		
PT		
RO		
SK		
SI		
ES		
SE	Partially	Partially

Average cost Incremental cost Forward-looking cost

Note: The analysis is not applicable for the transmission tariff in MT, in lack of a transmission network. In some cases the inputs provided by NRAs (BG, IE, LV, PL) were interpreted by ACER as corresponding to an average cost model, in lack of required clarifications.

(37) Estonia and Croatia reported the use of a forward-looking cost model, to account for costs that are changing during the application of the network charges. Sweden only applies the forward-looking cost model to the capacity-based charges of the network tariff, while other approaches apply to other cost elements.[20] In the case of France, Norway and Portugal, these countries reported the use of incremental cost models, which determine price signals reflecting the costs of expanding the network by certain increments.[21] Across these countries, different billing variables are used for the main price signal of the cost model: Estonia uses an energy-based charge; Sweden and Norway[22] use a power-based charge; Portugal[23] uses two power-based charges and Croatia and France use a combination of energy- and power-based charges.

(38) Across these six countries (HR, EE, FR, NO, PT, SE), because they employ the incremental or forward-looking cost models, ensuring cost recovery requires dealing with residual costs.[24] In Estonia, the law does not allow to apply any additive or multiplicative adjustment to account for

[20] SE: The forward-looking costs are power-based, and will be charged with a power-based charge (preferably during the peak hours), and the variable costs for the network losses will be charged with an energy charge. Overall, there are four components that make up the tariff, one energy charge (based on the variable costs), one power-based charge (based on forward-looking costs), and two fixed charges (one for customer related costs, and lastly a semi-fixed component for the residual costs).
[21] The incremental price signal indicates what is the incremental cost for the network to accommodate an increment in the cost driver (e.g. peak power or consumption).
[22] NO: While the main billing variable to recover network costs is a power-based charge, the incremental cost model only applies to the energy-based charge, which is determined from an analysis of marginal losses in each connection point.
[23] PT: Portugal also indicates that when applying the network tariff to users connected at normal low voltage (≤ 41.4 kVA), the unit price of one of the power-based charges is converted into an energy-based charge, as the former does not exist as billing variable for these users.
[24] As explained earlier, applying directly the prices signals from the incremental or forward-looking cost models may result in a different level of revenues compared to the allowed or targeted revenues. The difference of that revenue level with the level of allowed or target revenues is labelled here as residual cost (i.e. the residual cost is positive/negative if the former is higher/lower).

any residual cost. If network costs are higher than the revenues obtained from the incremental unit price, the network operator has the right to submit a request for approval of new network charges. France and Portugal apply a multiplicative adjustment of the unit charges to account for the residual cost. Norway recovers the residual costs through fixed and power-based charges. Sweden applies a separate component to recover the residual cost.[25] Croatia did not provide this information.

(39) Additional information regarding the practices of the countries employing the incremental or forward-looking cost models is presented in Table 1 in Annex 1.[26] The description on how the residual cost is dealt with in these costs models, is presented in Table 2 in Annex 1.

(40) In terms of cost models, several countries reported recent changes on the computation of network tariffs. Details on the changes can be found in Table 7 in Annex 1.

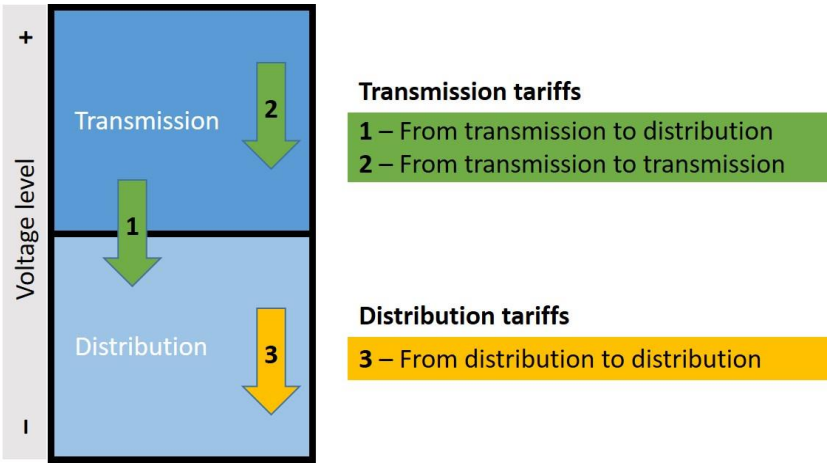
3.2. Cost cascading

(41) When setting network tariffs, cost cascading traditionally refers to the allocation of some costs of a certain voltage level towards network users connected at a lower voltage level, but not the other way around. It means that network costs are cascaded in a top-down paradigm, reflecting the traditional organisation of the power sector where generators are (almost) exclusively connected at the transmission level. Ultimately, it implies that network users connected at a lower voltage level pay (all-together) higher network tariffs, since they pay the costs of the voltage level of connection, as well as the costs related to higher voltage levels.

(42) In the case of transmission tariffs, this may exist in two forms. First, it may occur from transmission to distribution, meaning that costs related to the transmission network are cascaded towards network users connected to the distribution network. Second, it may occur from transmission to transmission, where costs of a higher voltage level of the transmission network are cascaded towards network users connected at a lower voltage level of the transmission network. In addition, a third form of cost cascading can also occur at the level of distribution tariffs, from distribution to distribution, where costs of a higher voltage level of the distribution network are cascaded towards network users connected at a lower voltage level of the distribution network. The three forms of cost cascading are illustrated in the Figure 5 below.

[25] SE: The NRA refers to it as a semi-fixed component.
[26] That information describes the objectives, the main billing variable, the major computational steps and the differences between transmission and distribution, if any.

Figure 5: Forms of cost cascading applied to transmission and distribution tariffs



(43) The second and third forms of cost cascading (i.e. from transmission to transmission and from distribution to distribution) require a network segmentation by voltage level. For instance, cost cascading from transmission to transmission can exist if transmission costs for the extra-high voltage (EHV) level are cascaded downwards to users connected at the high voltage (HV) level of transmission, while the costs of the HV level are not borne by the users connected at EHV. Moreover, cost cascading from distribution to distribution can exist if distribution costs for the medium voltage (MV) level are cascaded downwards to users connected at the low voltage (LV) level of distribution, while the costs of the LV level are not borne by users connected at MV level.

(44) In the case of cost-cascading from transmission to distribution, the transmission costs may be billed to distribution-connected users in two different forms. Distribution-connected users may pay explicitly a transmission tariff related to the transmission costs (e.g. via a transmission tariff element in their final electricity bill) or they pay the transmission costs implicitly through their distribution tariff (e.g. only the DSO is explicitly charged for costs of the transmission network, which are then reflected in its distribution tariff).

(45) Figure 6 summarises the application of cost cascading across countries. Cost-cascading from transmission to distribution exists in each of the assessed countries with a transmission network,[27] while cost-cascading inside the transmission and inside the distribution networks occurs in 9 and 26 countries, respectively[28]. Nine countries (AT, BE, EE, FR, DE, HU, LV[29], NL, SE) apply all three forms of cost cascading.

[27] In the case of MT, cost-cascading of transmission tariffs (from transmission to transmission / from transmission to distribution) cannot exist by definition, as there is no transmission network.
[28] Cases where all transmission costs are allocated in bulk to all network users is not considered as a form of cost cascading in this Report, and has therefore not been considered in the analysis. In a few instances (BG, IE) cost-cascading from transmission to transmission was not confirmed or sufficiently clarified.
[29] LV: There is only one TSO and it operates the grid in 330 kV and in 110 kV. Tariffs are calculated only for 110 kV users, so all costs from 330 kV are allocated to lower voltage transmission levels.

Figure 6: Forms of cost cascading applied to transmission and distribution tariffs, by country

	AT	BE	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GR	HU	IE	IT	LV	LT	LU	MT	NL	NO	PL	PT	RO	SK	SI	ES	SE
From transmission to distribution	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●
From transmission to transmission	●	●						●		●	●		●			●				●								●
From distribution to distribution	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●

Note: In a few instances (BG, IE) cost-cascading from transmission to transmission was not confirmed or sufficiently clarified. MT has no transmission network.

(46) The lack of cost-cascading inside transmission and/or inside distribution was often explained by the NRAs due to a lack of cost collection/ cost differentiation per voltage level or that the transmission network consists of only one network level. More details on the different forms of cost-cascading applied to transmission and distribution tariffs across the countries can be found in Table 3 and Table 4 in Annex 1.

(47) In most countries, cost cascading applies to all cost categories under the same rules. However, there are several cases of partial or differentiated cost-cascading for certain costs. Partial cost-cascading exists when some cost categories are not cascaded, while differentiated cost-cascading occurs when different cascading criteria are applied to different cost categories and/or to different network users. For example, costs more directly related to serving users connected at a certain voltage level, such as metering and billing, are not cascaded downwards in some countries (HR, DK, GR, HU), resulting in partial cost-cascading. In an additional country (BE) ancillary services and system integration costs are not cascaded, as they cannot be differentiated according to the user groups or voltage levels.[30] One country (PT) described a differentiated cost-cascading, where the unit price of the network tariff is adjusted when it is applied to lower voltage levels. More information on partial or differentiated cost cascading is provided in Table 5 in Annex 1.

(48) As shown in Table 6 in Annex 1, two countries (AT, PT) reported that they apply exemptions[31] from cost-cascading to specific groups of network users. The exemptions were justified by cost-reflectivity (e.g. the concerned network users are exempted because they are deemed not to use voltage levels above the one they are connected to or because their network use provides other benefits to the system).

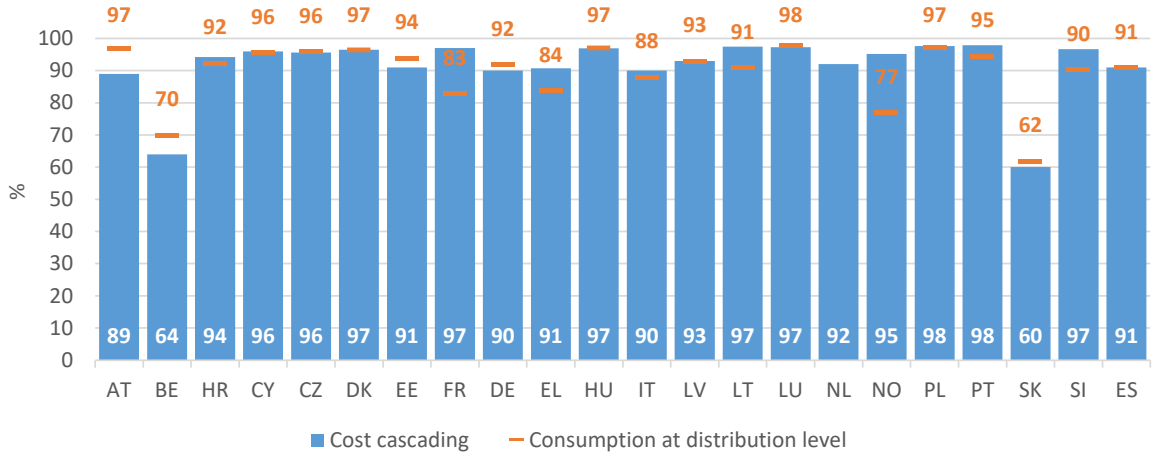
(49) Figure 7 below shows the degree of cost cascading from transmission to distribution across countries, by representing the share of the transmission revenues that is collected from network users connected at distribution level. In order to have a reference value for the relevance of the

[30] BE: Moreover, in the case of the Flanders region, all distribution costs that aren't (directly) related to a certain voltage level are not cascaded, namely: costs of system services, management costs, costs of capital, public service obligations, pension schemes and local retributions

[31] Countries that apply overall exemptions from network tariffs to specific groups of network users have not been considered for the assessment of this specific form of exemption.

transmission and distribution networks, the percentage of consumption occurring at distribution level is also indicated in Figure 7.

Figure 7: Degree of cost cascading from transmission to distribution (%)



Note: "Cost cascading" in this figure measures the share of transmission costs paid by distribution-connected users. "Consumption at distribution level" measures the share of energy withdrawal from the distribution grid, compared to overall energy withdrawal (measured at end users' meters). This analysis is not applicable to MT because it has no transmission network. Consumption data is not available for NL. Information is missing for: BG, FI, IE, RO, SE.

(50) ACER observes that in all countries - where this information was available - at least 89% of the transmission costs are cascaded downwards to the distribution level, except for two countries (BE, SK), where this share is lower than 65%. In all countries the share of cost cascading is broadly in line with the relative share of consumption occurring at distribution level in each country.

(51) Since the findings above imply that a significant share of network costs of a certain network level is paid by users not directly connected to that network level, it is worthwhile to analyse whether end users are provided with information on this fact. In about half of the countries the payment of the cost-cascading from transmission to distribution occurs explicitly, with a separate tariff or tariff element providing information on the magnitude of this cost-cascading.[32] However, in the other half of the countries it exists on an implicit basis, where no separate tariff or tariff element exists to quantify the value of the cost-cascading effect.[33] The list of countries with explicit and implicit payment of cost-cascading is presented in Figure 8 below.

[32] This information may be provided directly in the power bill or on some online platform that can be easily accessed by end users.
[33] One example of implicit payment occurs when the cascaded transmission costs are incorporated into the distribution tariff, without allowing end-users to understand what share relates to the transmission costs.

Figure 8: Type of payment of cost-cascading from transmission to distribution

Type of payment	Country
Explicit (separate tariff or tariff element)	BE, BG, HR, CY, DK, GR, IE, IT, PT, RO[34], SK, SI[35], ES
Implicit (no separate tariff or tariff element)	AT, CZ, EE, FI, FR, DE, HU, LV, LT, LU, NL, NO, PL[36], SE

(52) More recently, some academic literature[37] has begun to question the traditional cost-cascading approach, to the extent that inverted power flows, from a lower voltage level to a higher voltage level, are becoming more frequent. Inverted power flows, if more dominant, challenge the idea of a top-down cascading of costs, implying that some form of reverse cost-cascading may be necessary.[38]

(53) Based on NRAs responses only two countries (DE, SE) consider the use of (explicit) reverse cost-cascading in the future. The vast majority of the countries are not considering its application in the near future. In many cases NRAs (AT, FI, FR, GR, HU, IT[39], LT, LU, NL, NO, RO, PT[40], SK[41], SI) indicate that inverted power flows are not a frequent phenomenon or argue that there is no evidence of benefits for higher voltage users arising from low voltage investments (BE, CZ). In some instances such explicit reverse cost cascading would be hindered by the fact that the costs are not collected per voltage level (MT) or the lack of sufficient information on the flows in the network (ES).

(54) No NRA reported any recent changes regarding cost-cascading, but it is under review or consideration in a few countries (PT, SE). Details on the changes can be found in Table 7 in Annex 1.

3.3. Conclusions and recommendations

Cost model:

(55) The majority of countries follow an average cost model when setting network tariffs, both for transmission and for distribution.

[34] RO: Transmission tariffs are separate from distribution tariffs and both are indicated in the final bill.
[35] SI: There is a separate tariff or tariff element for T-costs, but in the final bill it is merged with D-costs. TSO and DSO are obliged to publish their separate tariffs on their web pages.
[36] PL: Transmission costs are merged with distribution costs into the distribution tariff. The TSO and DSO are obliged to publish their separate tariffs on their web pages.
[37] E.g. Massachusetts Institute of Technology, "*Utility of the Future: An MIT Energy Initiative response to an industry in transition*" (Dec. 2016).
[38] From a conceptual point of view, the non-segmentation of a network across voltage levels can be considered as some form of reverse cost-cascading. For instance, if there is only an overall distribution tariff, covering simultaneously the costs of MV and LV, one can argue that MV users are already contributing towards LV assets. This may be interpreted as a coexistence of cost-cascading and reverse cost-cascading.
[39] IT: No clear evidence that this is needed, but the NRA is collecting data that could support a potential future reform of this approach. Reverse cost cascading hasn't been applied so far as reverse flows are still a relatively small phenomenon and its introduction would be justifiable only in the framework of a thorough redesign of allocation criteria.
[40] PT: The existence of inverted power flows is now being studied in PT. As a result, the regulatory rules foresee that in the case of the self-consumption regime the exemption from cost-cascading may be reduced (which is not the same as true reverse cost-cascading). There has not yet been sufficient evidence for following a reverse cost-cascading approach.
[41] SK: T-costs which are serving or are partially caused by the users in lower voltage level and T-costs which serve for operational security of whole electricity system as such are cascaded due to the fact, that the NRA cannot identify which market participant caused these costs or are caused by the users in distribution. The NRA has not yet identified costs that should be reversely cascaded.

(56) Although economic theory suggests that incremental or forward-looking cost models are better approaches to signal the true cost of using the network, if the residual cost is recovered in a non-distortive way, ACER observes that these cost models are less frequently applied in practice. This might be the result of a lack of knowledge regarding the advantages and disadvantages of implementing these models, including a lack of information on the effectiveness and impact of these signals, risks and barriers (e.g. due to non-availability of the necessary data or complexity in the analysis) to depart from the currently applied cost model.

(57) When incremental cost or forward-looking cost approaches are applied, there is a need to allocate what is known as the 'residual cost', corresponding to the difference between the allowed or target revenues and the revenue resulting from the price signals predicted by the cost model. From an economic perspective, the residual cost should be allocated in a way that has the least distortive effect on the price signals provided by the cost-reflective network tariffs for efficient network use (e.g. ideally via fixed lump sum charges), while also keeping a balance with other tariff-setting objectives, such as non-discrimination or sustainability.

(58) **ACER recommends that:**

a) Within the next 4 years, subject to their available resources, NRAs should evaluate the advantages and disadvantages of applying incremental or forward-looking approaches, and consult the results of such studies with their stakeholders. Special care should be given to the way the residual cost would be recovered from network users.

Cost cascading:

(59) The principle of cost-cascading is embedded into the network tariff design in all countries, (except Malta, which has only a distribution network, but no transmission network), as an important element of cost-reflectivity. In almost all countries, more than 90% of transmission costs are paid by network users connected to distribution. No country applies the option of reverse cost-cascading as a result of inverted power flows in the grid, but two countries are considering it for the future.

(60) In several instances, the lack of cost cascading within transmission and/or within distribution is explained by lack of identification of costs per voltage level (e.g. extra high voltage, high voltage, medium voltage, low voltage).

(61) ACER deems that in countries where the predominant direction of the electricity flow is from transmission to distribution, and reverse flows are a rare phenomenon, applying the cost-cascading principle from a higher to a lower voltage level (either within transmission, from transmission to distribution or within distribution) reflects the physical use of the network. Should reverse flows become more relevant in the future, a thorough review of this principle becomes necessary.

(62) Some countries have identified the practice of partial cost-cascading, where not all cost categories are cascaded to network users connected at lower voltage levels. This is the case with connection-specific services, such as metering, billing and metering-related customer service.

(63) Since some particular network users (e.g. energy communities) may only marginally require using other network levels, exemptions to cost cascading or application of partial cost-cascading may be justified.

(64) **ACER recommends that:**

a) In order to ensure more cost-reflective network tariffs, and in particular to avoid the application of postage stamp tariffs (i.e. identical across all voltage levels), network users should contribute to the costs of each network level used by them.

b) NRAs should collect network costs, where feasible and cost-effective, classified by different voltage levels of the network (extra high voltage, high voltage, medium voltage and low voltage), as this is a pre-requisite to apply the cost-cascading principle. Depending on the complexity of attributing the relevant network costs to specific voltage levels, different classifications may be justified for different cost categories.

c) NRAs should collect data on power flows (including the occurrence of inverted power flows) and the volume of injection and withdrawal per voltage level, to determine whether the applied cost-cascading is still an adequate approach for cost allocation.

d) NRAs should ensure transparency on the cost categories not subject to cost-cascading, providing the economic rationale for this decision.

e) Exemptions on the application of the cost-cascading principle should be justified and regularly re-evaluated to avoid any discrimination.

4. Injection charges

4.1. General overview

(65) An injection charge may be levied on network users in relation to the costs associated with the use of the network for injection or merely due to the fact that the network user has the possibility to inject into the grid. In this Report, ACER considers any regular network charge applied to network users that inject (or are entitled to inject) as an injection charge, even if it is not levied based on any contracted or measured energy or power injection (e.g. an annual or monthly lump sum payment which recovers only metering, administrative and/or management costs)[42].

(66) As shown in Figure 9, more than half of the assessed countries (AT, BE, BG, DK, EE, FI, FR, IE, LV, MT, NL, NO, RO, SK, SE) apply a (non-negative) injection charge[43] to at least one group of network users. In case of France (for distribution), Malta (only distribution network exists) and the Netherlands (for both transmission and distribution), the respective injection charge is only a small lump sum fee for the metering, administrative and/or management costs, which recovers a fraction of the TSO or DSO costs.

[42] The definition of the injection charge does not include the one off-charges paid for the connection to the grid or for an upgrade of that connection, neither the cost of specific TSO/DSO services on individual requests of the network users.
[43] For this section, only the charges for active energy injections are considered. Regarding charges for injection of reactive energy, please refer to Chapter 6 of this Report.

(67) In most instances, the countries apply both transmission and distribution tariffs injection (AT, BE[44], FI, FR[45], LV, NL[46], NO, SE, SK). However, there are some exceptions, where regarding injection only transmission tariffs are applied, but no distribution tariffs (BG, DK, IE, RO) or where only distribution tariffs apply, but no transmission tariffs (EE).[47]

(68) Further, Germany is the only assessed country that applies a "negative injection charge" only to account for avoided network charges, as DSOs can avoid drawing the amount of electricity from the upstream grids that is injected into their grid by decentralised generators. In such case, non-intermittent decentralised generators receive the so called "avoided network charges" in turn for their system-beneficial impact (i.e. avoided network costs at upper voltage levels). The network users receiving the "avoided network charges" are paid according to the regular network tariff sheet (for withdrawal) of the respective upstream voltage level.[48]

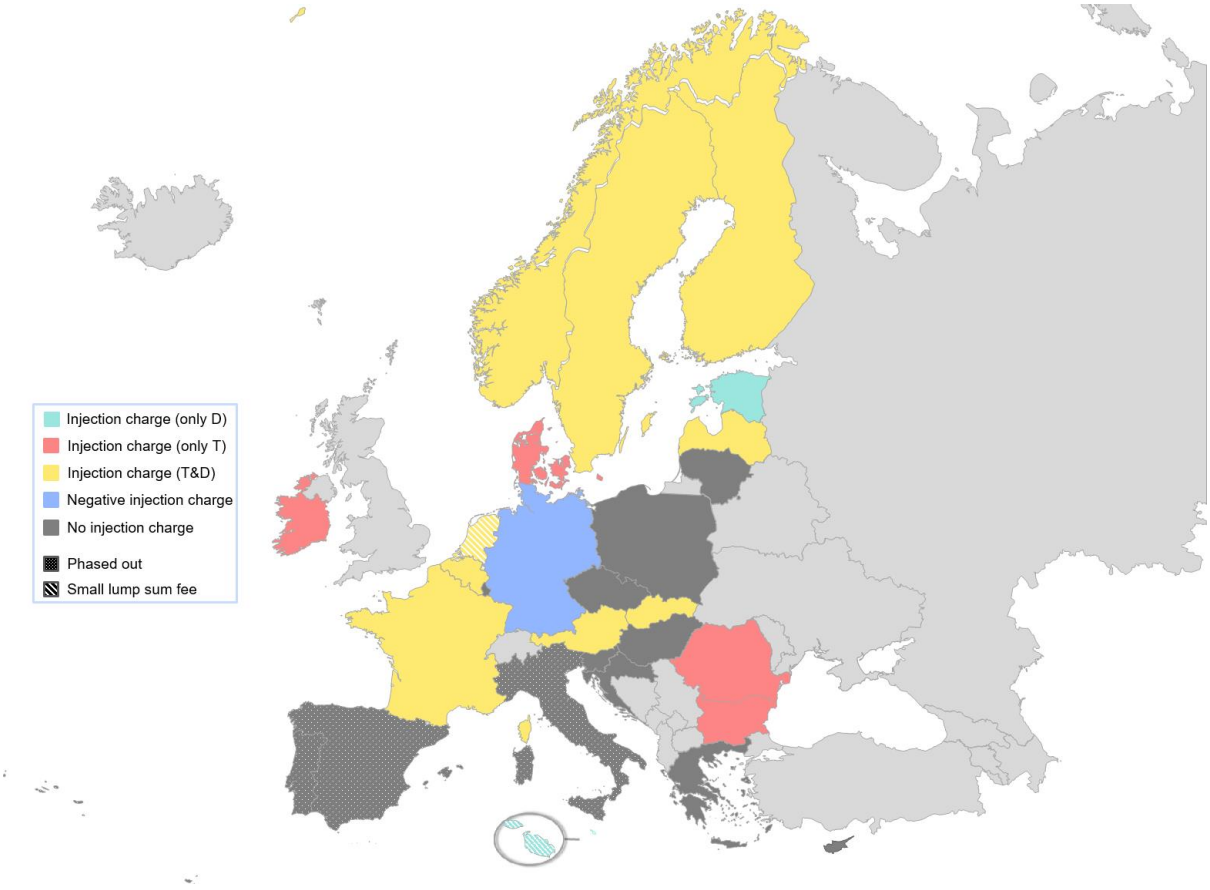
(69) In Sweden, distribution-connected producers also get paid an amount when a reduction in losses (and thus actual network benefits) is identified[49], but in contrast to Germany, the producers are also subject to non-negative injection charges.

(70) In most instances the injection charge has been already in use for several years, while in Latvia it has recently been introduced. From 1 January 2023, an injection charge also applies in Croatia (for both transmission and distribution). From the same date, in Denmark, the application of the injection charges is expanded to distribution as well.

(71) The remaining 10 countries (CY, CZ, GR, HU, IT, LT, LU, PT, SI, ES) do not apply any injection charge for the recovery of any transmission or distribution costs. In most of these countries, such charges have never been applied, while in Italy, Portugal and Spain they have been phased out[50]. In Lithuania, there are initial discussions on the use of an injection charge in the future.

[44] BE: Except in Brussels region, where due to very few injection sites, the injection charge was not deemed to be needed by the regional regulator.
[45] FR: In terms of the distribution tariff the producers only pay a small management fee.
[46] NL: Small lump sum fee for administrative costs
[47] Malta is not accounted for this statistics as it has no transmission network, thus no T-tariff.
[48] DE: E.g. the payment to the concerned generator at LV level is calculated according to the network tariffs for electricity withdrawal of the MV/LV level.
[49] SE: In the case of the largest DSO, the Swedish NRA indicated that producers which provide generation that reduces losses in the grid get paid an amount that is based on the energy price (SEK/kWh), since network losses are based on the energy cost. Since they reduce the cost of the grid they get reimbursed for that cost by the grid operators.
[50] In Italy it was phased out already in 2010, in Spain and in Portugal only in recent years, i.e. 2020 and end 2021 respectively.

Figure 9: Application of injection charges in Europe (2022)



Note: In France (in distribution), Malta and the Netherlands, the respective charge is only a small lump sum fee for metering, administrative and/or management costs. In Belgium, injection charge in distribution applies only in Flanders and Wallonia regions, but not in Brussels region. From 1 January 2023, injection charge also applies in Croatia (for both transmission and distribution) and in Denmark the application of the injection charges is expanded to distribution as well.

Motivations behind the application or non-application of injection charges:

(72) NRAs typically motivate the use of injection charges by referring to the principle of cost-reflectivity. In the countries where the injection charges apply, either only to the transmission-connected (T-connected) network users or only to the distribution-connected (D-connected) network users, one NRA explains this difference by the different choice of the respective system operators (EE) and another NRA, by the aim not to discourage distributed generation, which is not yet sufficiently developed and has beneficial effects on the networks (RO).

(73) The most frequently reported reasons by NRAs for non-application of an injection charge are:

- Risks of creating distortions in competition (and disadvantages for national producers) in the EU internal market (CZ, PT, LU);
- Cost reflectivity, i.e. the network costs caused by producers are already recovered through other means (e.g. through licence-holder charges or deep connection charges), lack of generation surplus in the network (LT) or lack of significant structural inefficiencies due to location of generation and demand (GR);

- Support for higher penetration of renewable energy (RES) generation and energy storage (CY) or due to concerns of adequacy of conventional generation (HU).

(74) In some countries (DE, PL[51], SI), the NRA reported that the application of an injection charge is prohibited by the law[52], while in some other countries (RO, ES), the injection charge is allowed by the national law, but its design is significantly restricted by it (e.g. no locational differentiation is allowed to ensure the same network tariffs within the country irrespective of the place of network use)[53]. It can also result in distortions between new and existing producers, if the latter are protected by "grandfather clauses".

Consultations and studies:

(75) In most instances, the design of injection charges has been discussed with system operators and network users as part of the tariff consultation or via a dedicated consultation. However, only in one instance (LV) were they discussed with NRAs of other (neighbouring) countries.

(76) Similarly, ACER notes that only in a few countries (BE, FR, LV, NO) was a study carried out to assess the costs triggered by the generators and the ultimate impacts (e.g. cost efficiency of the system) of introduction, change or phase-out of injection charges.

(77) None of the NRAs identified any remarkable competitive disadvantage for the producers within the country vis-à-vis producers of other countries due to the applied injection charges. The NRAs typically explained the lack of distortions with the marginal impact of injection charges on the electricity price due to their relatively low level allowed by EU law[54]. One country (BE) applies an explicit measure, i.e. via the use of international benchmark for injection charges, to prevent distortions in cross-border competition.

(78) Similarly, none of the NRAs reported any distortion in competition within the country, by often referring to the fact that the same injection charges are applied to all producers.

(79) For more information on the application of injection charges across Europe and actions that preceded the decisions on them, please refer to Table 8 in Annex 1.

Cost recovery:

(80) As discussed in Chapter 3 of this report, following the application of the cost-cascading method, transmission costs are either paid by both transmission- and distribution-connected users or only by transmission-connected users, while distribution costs are paid only by distribution-connected users (in lack of reverse cost-cascading).

[51] PL: The NRA is not allowed to introduce the injection charge, as such charge is not provided in the relevant national law.
[52] NL: National law in the Netherlands also prohibits the application of an injection charge, but adopts a definition that differs from the one in this Report. Dutch law considers an injection charge to be a charge based on the amount of energy injected. The small lump sum fee for the administrative and/or metering costs charged to all network users is considered an injection charge in this Report but not under Dutch law.
[53] RO: In Romania, variation of transmission charges for injection based on generators' location was removed in 2017.
[54] Regulation 838/2010 sets a EUR/MWh cap on transmission charges paid by generators, excluding costs of connection, specific losses and ancillary services.

(81) As shown in Figure 10 below distribution-connected users who inject into the grid pay for both transmission and distribution costs in five countries (AT, BE[55], FI, NO, SE).[56] In the remaining countries the distribution-connected network users either pay a small fee for the possibility of injection (FR, MT, NL), pay only distribution costs for injection (EE, LV, SK) or pay only transmission costs for injection (DK[57], RO, IE).

Figure 10: Payment of network costs by distribution-connected network users who inject into the grid (2022)

	AT	BE[58]	BG	DK[59]	EE	FI	FR	DE	IE	LV	MT	NL	NO	RO	SK	SE
Transmission costs	●	●	●	●		●			●				●	●		●
Distribution costs	●	●			●	●	●			●	●	●	●		●	●

Note: Cells in grey indicate cases where a non-negative injection charge does not apply for that network tariff. In the case of FR, NL and MT, the distribution-connected producers only pay a small lump sum charge.

(82) As described in Table 9 and Table 10 in Annex 1, the assessed countries apply different practices with regard to which cost categories are recovered via injection charges. They may contribute to the recovery of specific cost categories, such as infrastructure costs (SK); losses and/or system services (AT, BE (transmission), FR (transmission), RO); or only metering, administrative and/or management costs (FR (distribution), MT, NL).

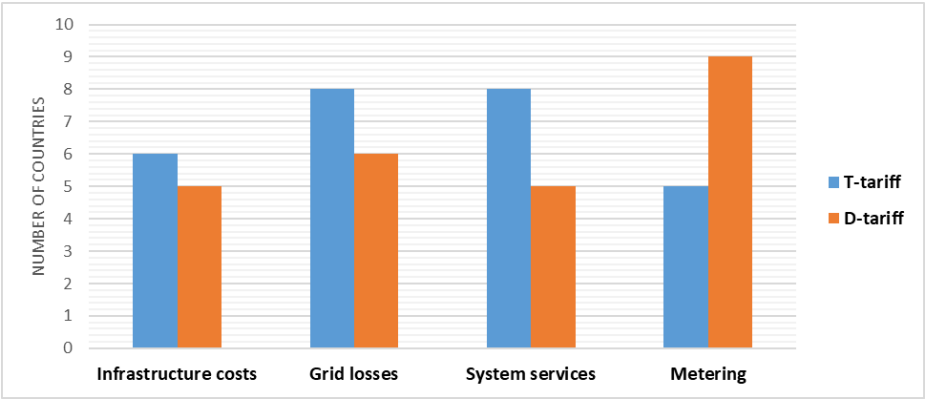
(83) Alternatively, in several countries (BG, DK, EE, FI, LV, NO, SE) the injection charges are used to recover multiple cost categories or to recover part of the TSO and/or DSO costs without any segmentation of the injection charge for specific cost categories (e.g. based on their main cost drivers).

(84) In none of the countries were non-network related policy costs reported to be recovered via injection charges from 2023. ACER finds one instance (BE's Flanders region) where non-network related costs (i.e. pension costs) have been recovered via injection charges, but it will be phased out from 1 January 2023.

(85) As shown in Figure 11 below, it is slightly more frequent that the injection charge is related to the payment of (short term) variable costs, such as losses and system services than for the recovery of infrastructure costs (CAPEX, OPEX).

[55] BE: Flanders and Wallonia regions
[56] The finding is valid as of 2022. Denmark is not listed, as the injection charge applies for the distribution costs only from 1 January 2023. The countries listed pay transmission and distribution costs, either in the form of separate transmission and distribution tariffs (BE's Flanders and Wallonia regions) or in the form of distribution tariffs only, which bundle transmission and distribution costs (AT, FI, SE).
[57] DK: The finding is valid as of 2022. Injection charge applies also for distribution costs from 1 January 2023.
[58] BE: Flanders and Wallonia regions
[59] DK: Injection charge applies also for distribution costs from 1 January 2023.

Figure 11: Recovery of specific cost categories via injection charges



(86) As shown in Figure 12 below, in several countries the network users (or at least some of them) who inject into the grid pay deep-connection charges, they are subject to "in-kind" payments for losses (BE) or they have to provide some free system services (FR, IT, PT, ES). This implies that these network users contribute to the recovery of network and system costs, despite the lack of injection charges or in addition to them. Similarly, network users who both inject into and withdraw from the grid are often subject to withdrawal charges as described in Section 4.3 and Section 4.4 below.

Figure 12: Not injection charge related cost burdens on network users injecting into the grid

		BE[60]	HR	DK	EE	FI	FR[61]	DE	GR	HU	IT[62]	LV	LT	MT	NO	PT[63]	RO	SK	SI	ES[64]	SE
Transmission	Deep connection charges		●		●					●		●	●		●	●	●		●	●	●
	Losses related	●																			
	System services related						●				●					●				●	
Distribution	Deep connection charges	●	●	●	●	●		●	●	●		●		●	●	●	●	●		●	●
	Losses related																				
	System services related										●					●					

Note: The table does not include reactive energy charges, which are described in a separate section or additional cost burdens related to withdrawal[65]. MT has no transmission network.

Generation vs. load split:

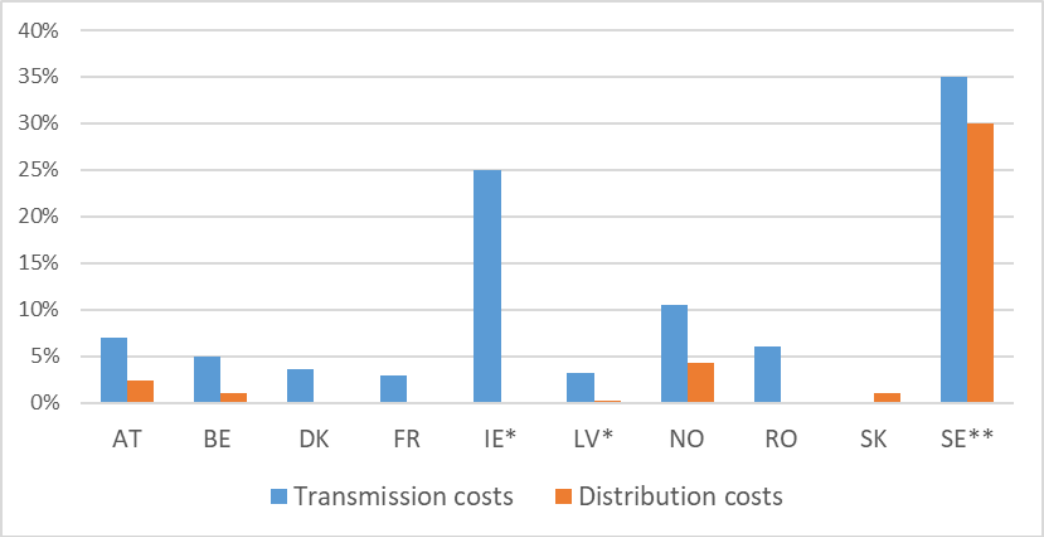
(87) As shown in Figure 13 below, the injection charges tend to recover only a small part of the transmission and distribution costs.

[60] BE: Balance responsible parties (BRP) have to provide energy "in-kind" to compensate losses at transmission level (around 1% of their portfolio net injections).
[61] FR: Producers have some obligations related to ancillary services
[62] IT: Producers have to provide some ancillary services (frequency containment reserve "primary" and voltage control) for free.
[63] PT: Producers have to provide some system services for free.
[64] ES: The costs of the ancillary services are included in the commodity price
[65] For example, if a prosumer pays a withdrawal charge or pays an in-kind, i.e. as additional energy bought in the energy market, for losses, these charges are not account for in the table.

(88) The share of injection charges in transmission cost recovery is rather low (for the vast majority of the countries it is below 7%). At the same time it has a great variation across the countries, ranging from 3% of the transmission costs up to 35%.

(89) In case of distribution costs the share of injection charge is even less (i.e. below 5%) than in the case of transmission costs, except in Sweden (although the data, i.e. 30%, refers only to one DSO's regional grid).

Figure 13: Share of network costs recovered via injection charges



*Note: *data as of 2020, **Distribution costs data is valid for one of the largest DSOs for regional grid only (40-130 kV). In some countries the data was available/provided only for transmission or only for distribution. For some other countries the data was not available or provided.*

(90) The split of the costs allocated to generation can be obtained in various ways, as summarised below (for more information please refer to Table 14 and Table 15 in Annex 1):

- The split can start by setting the level of the injection charges, while the remaining costs are allocated to withdrawal charges: administratively set injection charge at the value of the ceiling set by the Commission Regulation (EU) No 838/2010 (in Latvia); determined based on an international benchmarking method (e.g. using the weighted average of the injection charges applied in neighbouring countries, in Belgium's Wallonia region) or; calculated by using some formula (Denmark).

- The split can be based on a decided fixed percentage of the relevant costs (i.e. ancillary services reservation costs in Belgium are allocated 50-50% to injection and withdrawal);

- The split can result from identifying the costs directly related to injection (for distribution costs in Belgium's Flanders region, for transmission costs in Romania) or the costs directly related to injection for certain purposes (e.g. exports in France);

- The split can be made by using the same unit prices of charges for injection and withdrawal, (e.g. in Slovakia the energy-based and the power-based unit prices of the charges are the same for injection and withdrawal, but for the power-based charges in case of injection only 15% of the contracted capacity is taken into account in the calculation; in Estonia the same level of power-based and lump sum charges are applied for both producers and consumers in distribution).

Tariff basis:

(91) Injection charges may be levied on the network users based on different bases[66]:

- energy-based injection charges are charges payable on every unit of energy produced and/or injected into the grid (e.g. €/MWh);
- power-based injection charges are charges payable on the capacity connected to the grid, on yearly or multi-year peak output or output under peak conditions (e.g. €/MW);
- lump sum injection charges are charges that are fixed at the start of the relevant charging period (e.g. €/year) and do not depend on capacity connected, on yearly or multiyear peak output or on output under peak conditions, unless these are taken into account in the form of an average over a past period of at least 5 years. Moreover, lump sum injection charges may take into account the average annual load factor or the average of other output related factors, as long as such averages are calculated over a minimum of 5 years. The level of the lump sum injection charge may be differentiated between small and large plants, or based on generator characteristics.

(92) The tariff basis applied in the assessed countries for injection charges is shown in Figure 14 below. ACER notes that in transmission, six country (AT, BE, BG, DK, FR, RO) apply only energy-based charge, three countries (IE, LV, SK) apply only a power-based charge, while three countries (FI, NO, SE) apply a mix of energy-based charge with a power-based and/or lump sum charge[67]. In distribution, one jurisdiction (BE's Flanders region) applies only an energy-based charge, three jurisdictions (LV, SK, SE) apply only a power-based charge, while the remaining jurisdictions (AT, BE's Wallonia region, EE, FI, NO) apply a mix of tariff basis.

Figure 14: Tariff basis for injection charges

		AT	BE	BE BRU	BE WAL	BE FLA	BG	DK	EE	FI	FR	IE	LV	MT	NL	NO	RO	SK	SE
Transmission tariff	**Power-based**									●		●	●					●	●
	Energy-based	●	●				●	●		●	●					●	●		●
	Lump sum														●	●			
Distribution tariff	**Power-based**				●				●	●			●					●	●
	Energy-based	●				●				●						●			
	Lump sum	●			●				●	●	●			●	●	●			

Note: In DE, the negative injection charge (in distribution) is energy-based; MT has no transmission network; 2019 data for IE.

(93) Table 9 and Table 10 in Annex 1 show which tariff basis is used for the recovery of which cost categories. In most of the concerned countries, energy-based injection charges apply for the recovery of the cost of losses and/or the system services (AT, BE, BG, DK, FR, NO, RO, SE), which typically show correlation with the volume of injected energy. However, ACER also notes

[66] Cf. ACER Opinion 09-2014 (p.2)
https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2009-2014.pdf
[67] In Sweden, the TSO charge for injection was 61% capacity-based vs. 39% energy-based in 2021; in Norway the lump sum charges was 80% while the energy-based charge was 20% in 2020. In Finland the share between the energy- and power-based injection charges was not available to the NRA.

some deviations from this practice, where costs of losses or system services are recovered by power-based injection charges (LV, EE).

(94) For the recovery of the infrastructure costs (CAPEX, OPEX), which typically show correlation with the system peak, the application of energy- and power-based charges are more balanced, with power-based charges being the more common: Energy-based charges apply in two countries (BG, DK) power-based injection charges are applied in four countries (EE-distribution, LV, SK, SE) and one country (NO) applies a lump sum charge based on 10 year historical average of production.

(95) The metering, administrative or management costs, which are mainly unrelated to the injected volume of energy or the level of capacity, are either recovered via the same energy- and/or power-based tariff element as other network costs (BG, FI, LV, SE) or they are recovered via a lump sum charge (AT-distribution, EE[68], MT, NL).

(96) The power-based injection charges are set either based on the installed capacity (LV), annual capacity subscriptions/contracted power (EE, SE[69]), yearly peak power (SE[70]) or both rated power and the maximum output capacity (SK).

Injection tariff variation:

(97) As shown in Table 16 and Table 17 in Annex 1, some injection charges are differentiated between voltage levels, and vary in few instances also based on time-of-use or location. The main reason for such differentiation is to provide appropriate economic signals for efficient dispatch of energy generators.[71] In the remaining instances uniform injection charges (i.e. without any variation) apply[72].

(98) Injection charge variations, in particularly, based on voltage levels, are more frequent for distribution (AT, BE[73], EE, FR[74], DE, NL, SK, SE) than for transmission (NL)[75], which may partially be explained by the fact that the transmission network has typically less sub-networks than the distribution grids. In some instances (FR-transmission, BE's Flanders region), while the tariff does not vary across the different voltage levels, the voltage level can still play a role, i.e. an exemption applies for network users under certain voltage levels.

(99) Injection charge variation based on location (not related to different DSO areas)[76] is observed in three countries (AT, IE, NO, SE) and one additional country (DK) reported that it is considering

[68] EE: The lump sum includes all the costs of metering but partly also other costs (for example, the costs of administration, management and maintenance of the distribution network).
[69] SE: the transmission tariff for injection and the distribution tariff for injection in some of the DSO areas are set based on the annual subscribed capacity.
[70] SE: distribution tariff for injection in some of the DSO areas are set based on yearly peak power.
[71] ACER also notes that in several countries the network tariff is also differentiated by the type of network user or some network users receive an exemption, a partial exemption or a discount. These instances are not considered under the tariff variations and they are discussed in sections 4.2-4.4 below.
[72] Before 2017, France and Romania have also applied such variations for the T-charges for injection - the former based on the voltage level, the latter based on the location - but they have been phased out.
[73] BE: Flanders and Wallonia regions. In Brussels region no injection charge applies.
[74] FR: Yearly management charge, which aims to cover costs related to the management of producers by the DSO.
[75] NL: The lump sum fee for generators is different across the voltage levels and reflects the administrative costs at the relevant voltage level
[76] Some countries reported that injection charges vary across network areas operated by different DSOs, although this practice per se does not qualify as locational variation for the purpose of this Report. In these cases the different tariff levels are the result of different tariff methodologies (e.g. SE) or the result of the same methodology applied for the recovery of different levels of revenues across different network operators (e.g. DE).

to apply geographical differentiation to better reflect the difference in costs incurred depending on the location of new production capacity:

- in Austria, the energy-based distribution tariff is different in different network areas, which are unrelated to the DSO areas;
- In Ireland, the power-based transmission tariff provides a locational signal regarding losses;
- in Norway, marginal pricing for losses apply[77];
- in Sweden, the transmission tariff is set based on nodes, and the distribution tariff also provides locational signals in some of the DSO areas of SE.

(100) Injection charge variation based on the time-of-use was hardly observed in any of the assessed countries[78]. However, it was applied in at least one country in the past.[79]

Level of G-charges:

(101) Recital (10) of Commission Regulation (EU) No 838/2010 stipulates that the variations of transmission charges faced by producers across the EU should not undermine the internal market and should be kept within a range which helps to ensure that the benefits of harmonisation are realised.

(102) The legal ranges of annual average transmission charges paid by producers is set by Annex B of the Commission Regulation[80]. The range, which is not identical for all countries, applies only to the so called "G-charge", which does not include the charges paid by producers for physical assets required for connection to the system or the upgrade of the connection, the charges paid by producers related to ancillary services and the specific system loss charges paid by producers. For such costs, NRAs can set any cost-reflective charge without a ceiling.

(103) The Commission Regulation requires ACER to monitor the appropriateness of the ranges of allowable transmission charges paid by electricity producers (i.e. G-charges) in each Member State. ACER, in its Opinion No 09/2014 considered that the monitoring activity should be based on NRAs' reports regarding the level and the structure of G-charges and the average G-charge value in each year as well as on NRAs' notifications on any proposal or decision taken to amend the national G-charging methodology, submitting relevant information such as a detailed reasoning and evidence of cost reflectivity. The results of the monitoring of the G-charges applied in 2011 and 2012 is provided in the Annex to the ACER Opinion No 09/2014. The relevant results of the monitoring carried out for years 2013-2021 is provided in Tables 11-13 in Annex 1.

(104) Application of G-charges (as defined above) has been reported for eight countries (DK, FI, IE, LV, NO, RO, SK, SE) for this Report. In the other countries which have reported injection charges at transmission: they cover only costs related to system losses and/or ancillary services (AT, BE,

[77] NO: G-charge is lump sum and uniform, the energy charge to cover losses differs on basis of related losses associated to the node where the producer is connected.
[78] In Sweden, there are some DSOs which have tariff elements that are subject to some kind of time-of-use differentiation.
[79] Portugal used to apply peak and off-peak transmission charges for injection, but injection charges have been phased out in the country in 2021.
[80] Decision of the EEA joint Committee No 7/2011 sets a legal range of the annual average transmission charges paid by producers also in Norway.

FR) or such charges are marginal lump sum fees (NL, MT) for administrative and/or metering costs, well under the ceilings for G-charges.

(105) The annual average G-charge is calculated by dividing the annual total transmission tariff charges paid by producers by the annual total energy injected by producers into the transmission system. In this regard, ACER notes that, in most of the concerned countries (including DK, FI, IE, RO, SE), the calculation of annual total transmission tariff charges paid by producers includes both the relevant payments by producers connected at transmission level as well as those connected at the distribution level, while in the other countries, transmission costs are not paid by the distribution-connected network users or the calculation was not specified.

4.2. Producers

(106) In the vast majority of the countries applying injection charges, producers - i.e. network users, who only inject into the grid[81] - are subject to a tariff for injection, regardless whether they are connected to the transmission or the distribution grid (AT, BE, BG, FI, IE, LV, NL, NO, RO, SK, SE)[82].

(107) However, as shown in Table 18 in Annex 1, in most of the concerned countries (AT, BE's Wallonia region, BG, DK, FI, FR, IE, MT, RO, SK, SE)[83] the tariff methodologies provide some exemptions, discount to some of the producers or make other differentiations between them, mainly related to the size of the generators, the voltage level of the connection and/or the technology of generators (i.e. whether RES or not):

- In Austria, the producers up to 5 MW installed capacity do not pay any network tariff for injection (i.e. exemption from paying the transmission and distribution charge for network losses and system service charges);
- In Belgium's Wallonia region, the producers which inject electricity on the LV level and whose power is less than 10 kVA are exempted from the distribution tariff for injection;
- In Denmark, some RES producers have been exempted through legislative acts, not as part of the tariff methodology. However, these exemptions are not available anymore for new producers;
- In Finland, some DSOs do not apply injection tariff for small producers;
- In France, producers connected to voltage levels lower than 150 kV do not pay any network tariff for injection;
- In Malta, the metering, administrative and management fee is different for the RES producers compared to the two non-RES producers having a PPA with the DSO;
- In Romania, producers whose installed capacity is lower than 5 MW do not pay any network tariff for injection;

[81] Producers include both renewable energy sources (RES) and Non-RES producers, which do not withdraw electricity from the network except for the purpose of feeding the auxiliary services of their power plant, when needed.
[82] In France only the T-connected producers are subject to non-negligible injection charges, while the D-connected producers pay only a small lump sum fee. In Malta there is no transmission network, i.e. no T-connected producers.
[83] For Bulgaria the difference in injection charges for RES and non-RES producers was not specified.

- In Ireland, the producers whose installed capacity is lower than 5 MW do not pay any network tariff for injection either. However, this is not a different treatment *per se* as all producers are exempted from this amount and pay only the incremental capacity from 5 MW on (e.g. a 7 MW generator is charged for 2 MW (7-5 MW)).

- In Slovakia, power-based tariff for access to the grid is not paid by ancillary services providers.

- In Sweden, producers below 1.5 MW are exempted from part of injection charges according to the national law. DSOs may apply some other differentiation, exemption or discount to some producers, e.g. depending on the size of the producer.

(108) In a few instances, these exemptions, discounts and/or other differentiations have been justified by cost impacts (e.g. the injection of small producers at distribution level is consumed at the same level, thus payment for transmission costs is not justified), in other instances no such justification has been provided and they appear to be motivated by non-network related policy reasons (e.g. incentivising certain generation technologies).

4.3. Storage facilities

(109) As shown in Figure 15 below, in the vast majority of the countries, the storage facilities – i.e. pumped-hydro energy storage (PHES) or other storage facilities (e.g. batteries), who both inject into and withdraw from the grid - regardless whether they are connected to the transmission grid or the distribution grid, are subject to network charges. However, in four countries (CY, IT, SI[84], ES[85]) the storage facilities do not pay any network tariffs for injection/withdrawal (or they would not pay if there were any connected to the grid)[86]. Additional countries apply exemption only to some of the storage facilities under certain conditions.

(110) The practices regarding the treatment of storage (where not exempted) also varies among the countries:

- In most countries (BE's Brussels region, BG, HR, CZ, FR [87], DE, GR, HU, IE, LT, MT, NL, PL, PT, SK) transmission and/or distribution storage facilities are, in general, only subject to the withdrawal charges. In these countries, either the same withdrawal charges are applied to consumers (i.e. the gross withdrawal is considered and they are charged by the same withdrawal tariff, without any charge on injection) or the withdrawal charge is set differently from the one for consumers (e.g. discounted tariffs apply or they pay only based on the net balance of injection and withdrawal);

- In about one third of the countries (AT, BE's Flanders and Wallonia regions, DK, FI, FR[88], IE, SK, NO, RO, SE) transmission and/or distribution storage facilities are, in general, subject to both injection and withdrawal charges (with or without cost offsetting)[89].

[84] SI: In the new tariff methodology, which is under consideration, storages are subject of network charges for withdrawal.
[85] ES: Storage facilities are exempted for tariff for withdrawals and there is no tariff for injection. All network user groups are subject to connection charges, with the same rules.
[86] No storage facilities are connected to the grid yet in Cyprus.
[87] FR: distribution-connected storage facilities
[88] FR: transmission- connected storage facilities
[89] The finding does not account for negative injection charges.

(111) However, ACER notes that in none of the countries are the storage facilities subject only to the injection charges applied to producers. For more information on the treatment of storage facilities please refer to Table 19 in Annex 1.

Figure 15: Application of network charges to storage facilities

	Subject to withdrawal charge	**NOT subject to withdrawal charge**
Subject to injection charge	AT, BE (FLA and WAL), DK, FI, FR[90], IE, NO, RO[91], SK, SE[92]	
NOT subject to injection charge	BE (BRU), BG[93], HR, CZ, FR[94], DE, GR, HU, IE, LT, LU, MT[95], NL, PL, PT	CY, IT, SI, ES

Note: No storage facilities are connected to the transmission grid in: CY, EE, LV, LU, RO, SE; No storage facilities are connected to the distribution grid in: BG, CY, EE, GR, LV, LT, LU; Some countries appear multiple times in the Figure (e.g. due to differences between transmission and distribution); Negative injection charge is not accounted for the Figure.

(112) As shown in Table 20 in Annex 1, the transmission or distribution tariff methodologies also make some differentiations or exemptions in some countries between storage facilities. ACER notes that these differences show more variety than for producers and observes differences based on the storage technology (AT, PT), the commissioning date of the storage facility (BE), the size of the storage (LT), its efficiency (PL) or its purpose (SK):

- In Austria, the PHES facilities pay reduced network charge compared to other storage facilities (e.g. batteries);
- In Belgium, the transmission-connected storage facilities which are commissioned after July 2018, receive a full exemption of all network tariffs during 10 years. The transmission-connected storage facilities with a substantial capacity increase after July 2018 receive a 80% discount on all Access Transmission tariffs during 5 years;
- In Lithuania, distribution-connected batteries under 1 MW are exempted from any network tariffs;
- In Poland, transmission-connected PHES facilities pay a reduced transmission charge based on the efficiency of the storage, while distribution-connected energy storage facilities have no special rates;

[90] FR: transmission-connected storage facilities
[91] RO: Injection charge only for transmission costs
[92] SE: No T-connected storage, if there were any it would pay charges both for injection and withdrawal. D-connected storage, in some DSO area they are not connected, in other DSO areas they are subject to both injection and withdrawal charges (some exemptions exist in some DSO areas).
[93] BG: only for transmission costs
[94] FR: distribution-connected storage facilities
[95] MT: only for distribution costs

- In Portugal, PHES facilities are exempted from both transmission and distribution charges for withdrawal charges. Autonomous storage facilities (e.g. batteries) pay withdrawal charges same as consumers, except what regards the energy policy costs[96];

- In Slovakia, storage facilities providing solely regulation energy (ancillary services) to the TSO (no commercial injection or withdrawal of electricity) do not pay any transmission tariff. Network users operating a hydroelectric power plant with a total installed capacity up to 5 MW are also fully exempted.

(113) The reason for these differences between the storage facilities have not been substantiated by NRAs, with few exceptions: the difference between PHES and autonomous batteries in Portugal is explained by reflecting the particular role of PHES for the balance of the system.

(114) In those countries where only withdrawal charges, but no injection charges, are applied to storage facilities, the non-discrimination of storage facilities was typically argued by the fact that they are subject to the same withdrawal charges as consumers, while in many instances no explanation was provided.

(115) In those countries where both injection and withdrawal charges apply to storage facilities, in most instances the non-discrimination is claimed to be ensured by the fact that the tariffs do not offer any specific treatment for electricity storage and/or that the injection charge is very small and as such does not create concerns of discrimination.

(116) In those countries, where no injection or withdrawal charge applies to the storage facilities (or at least some of them), the exemption is explained mainly by the beneficial impact to the system / increase of security of supply (ES), to avoid discrimination vis-à-vis auxiliary generation services (IT) or such exemption is provided by the national law (SI).

(117) Considerations for cost-offsetting of the different network uses by the storage facilities have been reported only by a few countries.[97] In most countries the need for cost-offsetting is not identified by the NRAs, as only an injection or a withdrawal charge is applied, the injection charge is very small or because the storage facilities are exempted.

(118) ACER notes that several recent and under consideration changes[98] reported by NRAs concern network charges for storage facilities, which may flag the need for revision of the network charges currently applied to them (e.g. whether to differentiate from those applied to producers and consumers due to their impacts on the network).

[96] PT: In Portugal there is a different treatment for storage facilities in what regards the allocation of energy policy costs, which is performed through the "network access tariff" (this tariff includes the T-tariff and D-tariff, as well as energy policy costs). As a storage facility corresponds to intermediate consumption, and not final consumption, and in order to avoid that these energy policy costs are paid twice by final consumption, the intermediate consumption at storage facilities is exempted from these energy policy costs (in order to avoid a double burden, it only applies to final consumption). Autonomous storage facilities pay withdrawal charges for T-costs.
[97] In Poland there is a specific calculation of the transmission tariff for storage facilities, taking into account its efficiency (i.e. Energy storage entities pay a reduced fixed charge in the transmission tariff. In the formula for calculating the fixed charge, there is a reduction factor proportional to the efficiency of the energy storage, which reduces the contracted capacity.) For instances of reported cost off-setting, please refer to Table 24 in Annex 1.
[98] Cf. Table 25 in Annex 1.

4.4. Prosumers

(119) In this Report, non-storage network users who can both inject into and withdraw from the grid are labelled as “prosumers”.

(120) Prosumers can use the grid in both directions, but not necessarily in a balanced way, unlike storage facilities, who have a balanced profile of injection and withdrawal, if the internal energy losses are ignored.

(121) As shown in Table 21 in Annex 1, in the countries where injection charges apply, prosumers typically pay both injection and withdrawal charges (either for transmission and/or distribution costs), with a few exceptions, where they pay only an injection charge (BG) or only a withdrawal charge (FR-distribution[99], MT[100], NL[101])

(122) In none of the assessed countries the prosumers are exempted from all injection and withdrawal tariffs. The different treatment of prosumers, compared to storage facilities, which are exempted in several countries, is typically explained by NRAs due to their different nature (i.e. final energy users) and their role in the system (i.e. where they do not offer system services).

(123) As shown in Table 22 in Annex 1, ACER notes that there are tariff differentiations or exemptions in the national practices across prosumers as well. The differences or exemptions are based on the type of prosumer (FR), the connected power (BE’s Flanders and Wallonia regions, HU) or the relative position of the generation and consumption facilities (LV, PT):

- In Belgium’s Flanders region, prosumers up to 10 kW of production capacity are exempted from injection charges;
- In Belgium’s Wallonia region, prosumers connected at LV level, whose connected power is less than 10 kVA, do not pay injection charges;
- In France, there is a difference between individual prosumers (that produce for themselves) and collective prosumers (that produce for others according to a contract and a perimeter criterion). Individual prosumers are only charged with withdrawal charges for the withdrawn energy, whereas collective prosumers are also charged with the tariff of their voltage level for the self-consumption part;
- In Hungary, for network users with micro power plants (under 50 kW) net metering is available, meaning they are charged for the net withdrawal;
- In Latvia, if the self-consumption load is higher or equal to the production capacity, the prosumer does not have to pay the capacity fee for injection;
- In Portugal, in the case of the self-consumption regime, a full or partial exemption from transmission and distribution tariffs may apply, depending on the relative position of the generation and consumption facilities.

[99] FR: Distribution-connected prosumers do not pay any injection charge. Transmission-connected prosumers pay both an injection charge and a withdrawal charge.
[100] MT: prosumers do not pay the small administrative fee paid by producers, in addition to the withdrawal charge.
[101] NL: idem.

(124) Applying different or specific tariffs for prosumers, due to cost-offsetting impacts triggered by the injection and the withdrawal by the same prosumer, was deemed unnecessary by most NRAs. Similar to the reasoning in case of storage facilities, NRAs explain it by the fact that only withdrawal charges apply for prosumers or the level of injection charges is very low.

(125) Some kind of cost-offsetting and/or a differentiation of the injection or withdrawal charges paid by prosumers, when compared to those applied to producers or consumers, have been reported or observed only in six countries (LV, MT, NL, LU, PL, SK):

- In the Netherlands and Malta, prosumers do not pay the small administrative fee paid by producers;
- In Latvia, if the self-consumption load is higher or equal to the production capacity, the prosumer does not have to pay the capacity fee for injection;
- In Luxembourg, RES self-consumers are exempted from network charges on the part of the production consumed by themselves. The exemption also applies to energy produced on the basis of RES and shared in the same building or in communities;
- In Poland, the energy-based component of the transmission tariff is charged on net withdrawal, while regarding the distribution tariffs (for the so called "quality charge")[102] there is a discount for prosumers and prosumers are allowed to withdraw up to 70 or 80% of the injected energy for free;
- In Slovakia, network users who both inject and withdraw pay costs for the access to the grid only based on the capacity that is higher (injection or withdrawal).

(126) For more information on charging of network users who are both injecting into and withdrawing from the grid, please refer to the following tables in Annex 1:

- Table 23 in Annex 1 shows whether charging of storage and/or prosumers based on gross or net injection/withdrawal in case of energy-based charging.
- Table 24 in Annex 1 shows cost-offsetting for storage and/or prosumers in case both injection and withdrawal charges are applied in the country.
- Table 25 in Annex 1 includes any significant change regarding injection charges since the previous ACER tariff reports or any change currently considered and the reasons behind.

4.5. Conclusions and recommendations

Charges for users that only inject:

(127) More than half of the countries apply an injection charge to at least some network users. In most instances, both transmission and distribution tariffs apply to injection. However, there are some exceptions, where injection charges only apply at the transmission level.

[102] PL: Quality rate is part of the TSO as well as the DSO tariff. It covers costs of maintaining the system (i.e. costs of maintaining system standards of quality and reliability of current electricity supplies).

(128) In most instances, the design of injection charges has been discussed with system operators and network users as part of the tariff consultation or via a dedicated consultation. However, only in one instance were they discussed with other NRAs.

(129) Similarly, only in a few countries a study was carried out to assess the costs triggered by the generators and the ultimate impacts (e.g. cost efficiency of the system) of introduction, change or phase-out of injection charges.

(130) The non-use of injection charges is often argued by concerns about cross-border competition, harm of previous investment decisions, distortion between new and existing producers if the latter are protected by a "grandfather clause", by the aim to provide incentives to particular generation technologies contributing to achieve the national energy and climate goals or by practical difficulties (e.g. identification of associated costs).

(131) Countries apply different practices with regard to which costs are recovered via transmission and distribution tariffs for injection. It is slightly more frequent that the injection charge is related to the payment of (short term) variable costs, such as losses, system services and metering and/or management costs and it is slightly less frequent that it is used for the recovery of infrastructure costs (CAPEX, OPEX).

(132) In none of the countries will non-network related policy costs be recovered via injection charges from 2023. Since such costs show no correlation with any tariff basis, they can distort tariff signals and/or lead to distributional effects between different groups of network users. ACER welcomes this finding.

(133) In several Member States, producers pay deep-connection charges, "in-kind" for losses or provide free system services, as such contributing to the recovery of network and system costs, despite the lack of injection charges or in addition to them.

(134) In most of the concerned countries energy-based injection charges apply for the recovery of the cost of losses and/or the system services, which typically show correlation with the volume of injected energy. For the recovery of the infrastructure costs (CAPEX, OPEX), which typically show correlation with the system peak, the application of energy- and power-based charges are more balanced, with power-based charges being the more common.

(135) Injection charges in most countries recover only a fraction of the transmission and distribution costs and the split between generation and load is often a result of an administratively set tariff (i.e. no particular assessment of the costs corresponding to injection). At the same time the split has a great variation across Member States, ranging from covering a residual fraction of the network costs in a country up to over a third of them.

(136) While network charges on producers may be passed through to a different extent to the final consumers via the energy price, the initial allocation of the TSO/DSO costs on network users can in principle improve overall system efficiency, in particular, if there is a scarcity at certain times and/or locations in the network. In such case, the injection charges may provide appropriate economic signals[103], while the lack of injection charges may result in that case in unintended

[103] The price signals (e.g. due to location) provided by the injection charges may be weak in some countries or areas depending on the actual network conditions

distortions (regarding cost efficiency of the network) in decisions around investments in generation and storage because the true cost of using the network is not signalled to them.

(137) Commission Regulation (EU) No 838/2010 sets a range for the annual average value of transmission charges (excluding connection charges, charges related to ancillary services and specific system loss charges) paid by producers (i.e. G-charges). ACER acknowledges that the cap provided by the Regulation can mitigate the potential negative impacts arising from differences of injection charges between Member States. At the same time, it also creates a barrier for effective cost signals coming from network tariffs. In its ACER Opinion No 09/2014 on the appropriate range of transmission charges paid by electricity producers, ACER considered it unnecessary to propose restrictions on cost-reflective power-based and on lump sum G-charges, while energy-based injection charges should not be used to recover infrastructure costs.

(138) **ACER recommends the following:**

a) Increasing interconnection and integration of the European electricity market implies an increasing risk that different levels of injection charges could distort competition and investment decisions in the internal market, if injection charges are not set in a cost-reflective way across Europe. In order to ensure cost-reflectivity and avoid market distortions, the cost caused by a network user should be properly reflected in its tariffs. If a network user only withdraws from or only injects into the transmission or distribution grid, in principle, only the costs relevant for withdrawal or the costs relevant for injection should be attributed to this network user.

b) In order to avoid discrimination across network users connected to the transmission network and those connected to the distribution network, the injection charges should be consistently defined in the transmission and the distribution tariff methodologies. Network tariffs should not incentivise generation to connect to the transmission network, instead of the distribution network (or vice versa), unless justified by the associated network efficiencies.

c) Due to the potential cross-border impact, NRAs should consult at least the NRAs of the neighbouring countries of any substantial change regarding injection charges in advance.

d) When setting injection charges, all network-related cost-burdens on the concerned network users should be considered, including those recovered via withdrawal charges, connection charges, or other means (e.g. in-kind payments or mandatory free services provided by the producers to the system operators), to avoid any double-charging (i.e. recovery of costs which have been already recovered via other means).

e) Since different system operator costs show correlation with different cost drivers (e.g. infrastructure costs show correlation with peak capacity, while losses and system costs show correlation with injected energy), energy-based injection charges (expressed in €/MWh) should not be used to recover infrastructure costs from network users, while they can provide efficient signals for recovering the costs of losses and system services. Power-based injection charges (expressed in €/MW) or lump sum injection charges (as defined in this Report), as long as they reflect the costs of providing transmission and distribution infrastructure services to network users, can be appropriate, to better reflect their main cost drivers. Costs, which do not show correlation with neither capacity nor energy, but rather with the number of network users or the number of meters (e.g. billing, metering or administrative costs), in principle, should be recovered via lump sum charges.

Charges for users which inject and withdraw:

(139) In most countries, storage facilities are subject only to withdrawal charges and in about one third of the countries they are subject to both injection and withdrawal charges. In four countries, storage facilities do not pay any network tariffs.

(140) In some countries, the tariff methodologies make differentiations or exemptions by the type of storage facility, for example based on commissioning date, technology, size or efficiency.

(141) When a network user both injects and withdraws from the grid, a cost-offsetting effect may take place in what regards the associated costs to the network use (e.g. the bidirectional use of the network may not require additional need for development compared to unidirectional use). Application or considerations of cost-offsetting between the different network uses by the storage facilities have been reported only by a few countries.

(142) ACER underlines that the fact that a network user pays a charge for both injection and withdrawal is not an unjustified double-charging per se. Similarly, applying only injection charging (or only withdrawal charging) for storage facilities or prosumers under the same terms as for producers (or for consumers), does not necessarily ensure non-discrimination across network users.

(143) In the countries where injection charges apply, prosumers typically pay both the injection and the withdrawal charge. In none of the assessed countries prosumers are fully exempted.

(144) The different treatment of storage facilities and prosumers may be justified by the different cost impacts they respectively trigger to the network. However, this topic requires further investigation.

(145) **ACER recommends that:**

a) If a network user both withdraws from and injects into the grid, both network uses should be considered when setting the tariffs, by properly taking into account the potential cost-offsetting effect and the overall cost-impact to the network.

b) In this regard, where volumetric charges apply, net-metering (i.e. payment based on the net balance of injected and withdrawn energy) should be avoided as it is not cost-reflective and shifts costs to those users who only inject into or only withdraw from the grid.

5. Connection charges

5.1. General overview

Cost recovery:

(146) Connection charges are typically one-off charges covering the costs (or part of the costs) of connecting new users to the transmission or distribution networks. Since the reinforcement of the network due to new connections can also benefit other grid users, part of those costs are often socialised, i.e. covered by “use of network charges”, creating thus a link between connection charges and the use of network charges.

(147) Connection charges may be “shallow” or “deep”, depending on whether a network user pays only for its own direct connection costs or, beyond that, also pays for network reinforcement deemed

necessary by the network operator.[104] Connection charges, if well designed, can provide incentives to the network users to connect at points of the network which are more cost efficient from a system point of view.[105] However, the effectiveness of this kind of one-off cost signals regarding the location of production was not assessed by this Report.

(148) As shown in Figure 16 below, out of 28 countries in 10 countries (AT, BG, CY, CZ, FR, IE, IT, LU, NL, PL), only shallow connection charges are applied, while in 5 countries (HR, NO, PT, ES, SE) only deep connection charges are applied for all network users in both transmission and distribution. In the remaining 13 countries (BE, DK, EE, FI, DE, GR, HU, LV, LT, MT, RO, SK, SI) both shallow and deep charges are applied, with 11 countries employing both forms at distribution level, but only 2 countries using both forms at transmission level.

Figure 16: Application of shallow and deep connection charges

		AT	BE	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GR	HU	IE	IT	LV	LT	LU	MT	NL	NO	PL	PT	RO	SK	SI	ES	SE
Transmission	**Shallow**	●	●	●		●	●	●		●	●	●	●		●	●			●		●		●		●	●	●		
	Deep				●				●					●			●	●				●		●	●		●	●	●
Distribution	**Shallow**	●		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●		●	●	●		
	Deep		●		●			●	●	●		●	●	●			●	●		●		●		●	●	●		●	●

Note: MT has no transmission network.

(149) On the one hand, the need for locational signals and increasing cost-reflectivity are amongst the most frequently reported reasons for the application of deep connection charges. On the other hand, countries which apply shallow connection charges appear to value its simplicity, more certainty and visibility for the network users.

(150) As described above in about half of the countries both shallow and deep charges apply, while in the other half either only shallow charges or only deep charges apply. The choice to apply different charges for different network levels, may consider that at higher voltage levels the connection costs are typically higher and vary more across the network users compared to lower voltage levels, which increases the need for more differentiated connection charges to ensure cost-reflective charges. At the same time, at lower voltage levels the number of network users is significantly higher, which may create too high administrative burden for the system operators to calculate connection charges individually. For some other countries (DK, GR, RO) it was reported that the shallow (or "semi-deep") charges apply for consumers, while the deep charges for producers.

(151) Connection charges may be levied based on actual costs of the connection, which is calculated on a case-by-case basis, or they may be pre-determined (with or without differentiation among various network user groups). The pre-determined charge may be a standard lump sum charge per connection, a unit charge per connected capacity, a unit charge per distance and/or it may

[104] See the definition of 'connection charges' in paragraph (23) for a more detailed distinction between deep and shallow connection charges.
[105] It should be added that connection charges may play a small role in the decision of choosing a location for a new production or load due to several other constraints and factors to consider (e.g. availability of natural resources, permitting, taxes, logistics, etc.).

be set based on other criteria (i.e. cost driver). The charging basis may be different for different network user groups, voltage levels, geographic locations, firmness of the connection and/or based on other dimensions. It is also possible that part of the charge is based on actual costs of connection, while the other part is pre-determined by specific criteria.

(152) In transmission, the connection charges are typically based on actual costs, while in distribution the pre-determined connection charges are more common. The most frequently used dimensions to set those pre-determined (standardised) charges are the voltage level, the connected capacity and distance to the network.

(153) In some instances, while the same type of connection charges (i.e. shallow or deep) apply for all or most network users in a jurisdiction, there are certain differences among depending on whether the network user only injects into the network, only withdraws from the network or does both (HR, FI, GR, IT, LT, PL, PT):

- In Croatia, the producers always pay actual connection costs, while consumers pay a "unit fee per capacity (Euro/MW)", if the actual cost of the connection works is less than 1.2 times the cost of the unit fee[106];
- In Finland, costs are charged differently between production and consumption in relation to the capacity reservation charge. Concerning production, the average benefits relating to connecting production to the network must be considered;
- In Greece, producers' deep connection charges are based on actual cost of realised network expansion and reinforcement due to the connection (i.e. charged for 100% of the cost of works required), but under certain conditions they are entitled to receive refunds in case new producers are connected to network infrastructure they have paid for. In contrast, the calculation of the consumers' deep connection charge considers unit costs related to expansion and reinforcement as well as parameters associated with the capacity of the needed connection. The Greek NRA explained that this methodology brings efficiency and objectivity in addressing the issue of "free-riding" (especially in densely populated areas) and the issue of a relatively high number of customer connection requests;
- In Italy, connection charges in distribution for passive users and active users are different. For passive users the connection charge is always based on a standardised formula, different from the one for active users. For active users either a standardised or a specific estimate by the DSO is used;
- In Lithuania, the distribution-connected prosumers (i.e. consuming and producing at the same place) are charged 50% of the connection costs.
- In Poland, several differences were reported between consumers, producers and storage facilities (e.g. different discounts for RES or co-generation plants, micro-installations, storage facilities and EV charging infrastructure);
- In Portugal, the value of the network reinforcement component varies between users withdrawing from and injecting into the transmission and distribution network since the

[106] HR: In Croatia the new methodology for determining the fee for connecting to the electricity grid entered into force in July 2022. The price for a particular voltage level is the same regardless of the customer category.

expected benefits of the new connections are considered when calculating the reinforcement component.

(154) Exemptions, discounts or other different treatments within a network user group are described from Section 5.2 to Section 5.5 below. For more information reported by NRAs on connection charges at transmission and distribution level, please refer to Table 26 and Table 27 in Annex 1.

Variation of connection charges by voltage, location and firmness of the connection:

(155) In several countries, the connection charge is based on individually estimated or actual costs, so that the level of charges ultimately depends on the situation in the grid and provides an incentive (location signal) to connect to the grid, where the grid is strong (i.e. the accompanying connection costs are low)[107]. In some other instances the tariff methodologies may provide cost signals via variation of the connection charge (or one of its components) on certain basis, such as voltage level, geographical location or firmness of the connection.

(156) In this Report, the variation of the connection charges does not account for the user-type based differentiations (e.g. producers vs. consumer or RES vs. non-RES producers), which are described later in this chapter, neither for differences across different DSO areas in the same country.

(157) Variations of connection charges based on the voltage level are implemented in most countries, more frequently at the distribution level, than at the transmission level, which is largely explained by the fact that in transmission, typically individual actual costs are charged to the network users at transmission level, while pre-defined unit charges are more often applied in distribution.

(158) As pointed out by some NRAs, the variations per voltage level often reflect the actual differences between costs of connection. In this regard, either a lower unit value or discount applies at lower voltage levels compared to higher voltage levels (LV) or the structure of the connection charge is different based on the voltage levels (HU, LU, PL):

- In Latvia, if the connection voltage does not exceed 400V and some other predefined criteria are met[108], only 50% of the connection charge has to be paid by the particular user;
- in Hungary, Luxembourg and Poland the users connecting to high-voltage and/or medium-voltage level often pay actual costs of the connection, while lower levels are charged lump sum or based on predefined parameters (capacity, distance).

(159) Variation of the connection charge by geographical location has been identified for more than third of the assessed countries (AT, BE's Wallonia region, CY, CZ, DK, FI, FR, GR, LT, LU, NO, PL), in most instances only when connecting to the distribution network. Some of these variations concern rural vs. urban areas or differences in the terrain (e.g. offshore, coastal, etc.).[109]

(160) A flexible or interruptible connection agreement is considered in this Report as a contract where the network user is not guaranteed with a firm connection over the entire period. Less than one third of the countries reported that they apply such contracts and out of them, only four reported

[107] In these instances, the variation of the connection charge is implicit and not considered in the statistics of this section.
[108] LV: I.e. if the nominal current of the input protection appliance of the connection does not exceed 100A.
[109] Other countries reported that the payment for the connection is higher depending on the necessary connection distance. However, these are not considered as a variation based on location, as long as the same unit price (e.g. EUR/m) is applied.

specific rules for setting the network charge for connected users with this type of contracts. They either provide discounts on connection charges (FR, DK), discounts on use-of-network charges (BE's Wallonia region[110]) or the terms and discounts are subject to mutual agreement by TSO and network user (NO).

Cost sharing problem of connection:

(161) In case of deep connection charges, a cost sharing problem may arise. Extending and reinforcing the network to serve one particular network user may lead to high connection costs for that user, but may ultimately reduce the connection costs to connect further users in the future.

(162) As shown in Table 29 in Annex 1, in order to address this problem more than a third of the assessed countries (FR, GR, HU, IE, LV, LT, NO, PT, RO, SI, ES, SE) apply certain refunds or cost sharing methods between network users. In the remaining countries, such problem was not identified by the regulator[111], it is under consideration[112] or no information was provided.

Split of connection charge revenues between DSOs:

(163) Only four NRAs (DK, FR, HU, NO) reported any explicit transfer or split of some of the connection charge revenues between DSOs, while in other countries such transfer is done implicitly through tariff equalisation between DSOs (LU) or not applied.

(164) The description of the applied revenues transfers among DSOs regarding connection charges are provided in Table 30 in Annex 1.

5.2. Producers

(165) In all countries the producers are subject to connection charges, both the producers connected to the transmission and the producers connected to the distribution network.

(166) The connection charges for producers, while more often deep than the ones for consumers, are still in most instances shallow and based on individual actual costs.

(167) Two countries (PT, FI) reported that expected benefits of the new connections are taken into account when setting the connection charges:

- In Portugal, while deep connection charges apply to the users, in the calculation of the producers' charges for the reinforcement of the existing network (both transmission and distribution), the expected benefits of the new connections (e.g. anticipated tariffs paid by the user, reduction of technical losses or impact on the market price formation) are considered.

- In Finland, the benefits related to distribution-connected production should be considered when calculating the capacity reservation charge, which is one of the components of the connection charge.

[110] BE (WAL): injection tariff for flexible capacity is 0 EUR/kVA.
[111] BE (BRU): This is not considered an issue in Belgium's Brussels region, since due to the urban environment the network is widely available and extensions are only short.
[112] BE (FLA): The issues may lead to applying shallow connection charges.

(168) In six countries (AT, BG[113], FI, FR, HU, PL), connection charges for RES producers are different compared to other producers, either due to exemptions, dedicated discounts or caps:

- In Austria, small RES producers (below 20 kW) connected to the transmission grid are exempted from the connection charge, while RES producers connected to the distribution grid receive a discount;
- In Finland, small producers are exempted from the capacity reservation charge, which is one of the components of the connection charge;
- In France, onshore RES producers benefit from a reduced connection charge, while offshore producers are exempted. Moreover, both in case of connection to the transmission and distribution networks, RES producers are subject to specific criteria, i.e. their network reinforcement costs are shared with future network users;
- In Hungary, a discount in connection charges applies to RES producers (hydro, wind, solar, geothermal) – without a capacity threshold - in both transmission and distribution.
- In Poland, the RES producers with installed capacity below 5 MW and co-generation facilities with installed capacity below 1 MW are entitled to a charge reduction (50% of the connection CAPEX). The connection of micro-installations is free of charge.

(169) As regards particular approaches, three NRAs (DK[114], FR, SE) reported some tariff related measures in place that are meant to facilitate offshore production development (one of them with the highest share of offshore RES within the current generation mix and two of them are among the three countries with the highest planned offshore production capacity, in MW):

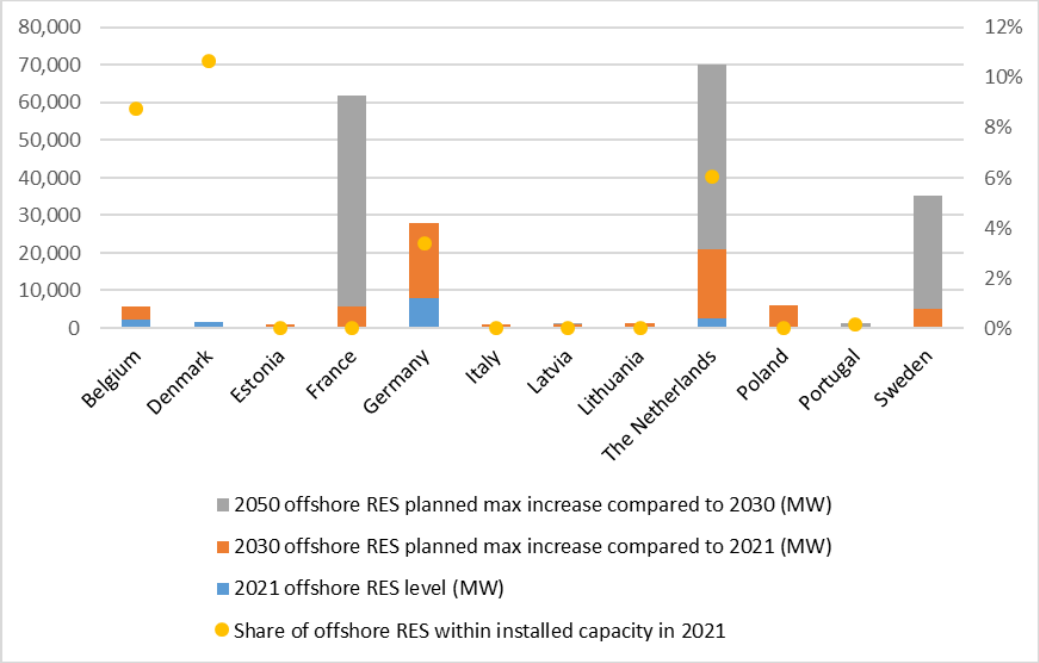
- In France, offshore RES producers are not subject to connection charges.
- In Sweden, the transmission grid is planned to be extended offshore, which will result in a reduction of connection charges paid by producers.

(170) In the other countries no specific or different schemes (e.g. conceptual or structural difference) for offshore RES producers' connection charges have been reported by the NRAs. However, in some of these countries (e.g. BE, IT) the resulting connection charge values of the same methodology still differ between offshore and onshore, reflecting for example the supplementary costs for network upgrades, which are likely higher for offshore RES.

(171) Figure 17 below shows for each coastal Member State the offshore capacity planned by 2030 and 2050 in accordance with the National Energy and Climate Plans (NECP) based on NRAs' responses. For more information please refer to Table 28 in Annex 1.

[113] BG: The difference has not been specified by the NRA.
[114] For Denmark, the difference of offshore RES via-a-vis onshore RES producers has not been specified by the NRA.

Figure 17: Planned offshore RES capacity by 2030 and 2050 (in MW)



Note: Share of offshore renewable energy (RES) capacity within installed capacity in 2021 is based on data from ENTSO-E transparency platform. The other data has been provided by NRAs. In some instances (BE, FR, SE) the NRAs indicated some range of planned offshore capacity. In these cases the upper range has been taken into account for the figure.

5.3. Consumers

(172) In all countries, consumers are subject to connection charges, both the consumers connected to the transmission network and the consumers connected to the distribution network.

(173) In most instances, the connection charges for consumers (similar to other network users) are shallow and based on individual actual costs. However, for distribution-connected consumers it is more frequent to have pre-determined lump sum or standardised unit charges than for other network users.

(174) Specific rules apply for some groups of consumers in several countries (AT, CY, HU, LV, LT, MT, PL, SI), mainly regarding the charges of connection to the distribution grid[115]. These countries either apply specific elements in the calculation of charges that are meant to reflect particularities of consumers' connections, or provide exemptions or discounts:

- In Austria, power-to-gas facilities with a minimum capacity of 1 MW are exempted from connection charges in transmission, if their grid connection quotient does not exceed certain threshold.
- In Cyprus, the NRA reported differences of setting the connection charges in distribution, based on the type of customers (i.e. households vs. industrial customers).

[115] Differences between distribution connection charges vs. transmission connection charges are not accounted for this finding.

- In Hungary, some discounts are designed for consumers' connections to distribution network (connection to LV up to 32A capacity as well as overhead line (MV, LV) and underground cable (MV, LV) up to certain length is free of charge). Additionally, the connection charges for consumers are calculated differently, depending on voltage level (i.e. HV consumers pay 70% of the actual total costs, while consumers at lower voltage levels are charged based on capacity and distance).

- In Latvia, smaller network users, i.e. those with a nominal current of the input protection appliance of the connection that does not exceed 100A and a connection voltage that does not exceed 400V, are charged with 50% of the connection costs.

- In Lithuania, the distribution-connected household and non-household consumers (who only withdraw from the grid), pay 50% of the connection costs. Vulnerable users pay 20% of the connection costs.

- In Malta, up to 60 Amps, connections are charged a lump sum charge. Over 60 Amps, the charges for connections extended from an existing substation are based on the actual cost and capacity.

- In Poland, EV charging points (parks) are charged with a discounted connection charge, which equals to 6.25% of connection CAPEX (for other consumers it is 25% of the connection CAPEX).

- In Slovenia, in distribution, specific connection charges in (EUR/kW) are calculated for different types of users (commercial vs. households) depending on the voltage level of the connection.[116]

5.4. Storage facilities

(175) Four NRAs (AT, LT, PL, SK) confirmed the establishment of specific regimes concerning connection charges for (at least some) storage facilities:

- In Austria, there is a specific exemption for PHES at the transmission level, i.e. these users do not pay a connection charge.[117]

- In Poland, the non-PHES storage facilities are subject to specific rules. The connection charge for storage is reduced by 50% of the connection CAPEX for both transmission and distribution.

- In Lithuania, a 50% discount for distribution-connected storage units is applied if they only withdraw from the network to recharge, but they do not inject (i.e. the stored electricity is used at the same location). Otherwise, the storage facilities pay 100% of the costs.

- In Slovakia, distribution-connected storage facilities which inject the electricity only for the purposes of providing the ancillary services do not pay connection costs.

[116] SI: HV - consumption at 110 kV, MV-consumption at 35, 20 and 10 kV, LV - commercial above 43 kW, LV - commercial up to 43 kW, LV - household

[117] AT: In contrast, at distribution level, they are not exempted from connection charges, but they are entitled to a discounted use of network charge.

5.5. Prosumers

(176) In the vast majority of the countries prosumers are subject to the same connection charges as consumers. Only two NRAs (IT, LT) confirmed the establishment of specific regimes concerning connection charges for (at least some) prosumers:

- In Italy, small RES/Combined heat and power (CHP) generators are charged based on a standardized formula while for the others a specific estimate by the DSO is needed.
- In Lithuania, prosumers are subject to a 50% discount on the connection charge.

5.6. Conclusions and recommendations

(177) Responses provided by NRAs show a great variety in the national practices regarding connection charges. The differences between the approaches concern the depth of the connection charge (i.e. shallow or deep), cost drivers (i.e. based on predetermined unit values or individual actual costs) as well as the exemptions or discounts applied to certain network-user groups.

(178) In 10 out of 28 countries, only shallow connection charges are applied for all network users in both transmission and distribution. In comparison, only 5 out 28 countries apply only deep connection charges across all networks. In the remaining 13 countries a combination of deep and shallow connection charges are applied, with 11 countries employing both forms at distribution level, but only 2 countries using both forms at transmission level.

(179) In transmission, the connection charges are typically based on actual costs, while in distribution the pre-determined connection charges are more common. The most frequently used dimensions to set those predetermined charges are the voltage level, the connected capacity and distance.

(180) In case of deep connection charges, a problem may arise that reinforcing the network to serve one particular network user leads to high connection costs for that user, which may ultimately reduce the connection costs to connect further users in the future. In order to address this problem in some countries certain refunds or cost-sharing methods between network users are applied.

(181) NRAs' responses indicate limited interest in offering interruptible or flexible connection agreements to the network users, i.e. less than one third of the countries apply these, and out of them, only four provide discounts to the connection or use-of-network charges.

(182) **ACER recommends that:**

a) Where deep connection charges apply and the connection of a network user serves future network users, it should be considered whether cost-sharing is necessary to ensure a fair and non-discriminatory treatment of the network users, also taking into account the administrative costs for the TSOs and DSOs.

b) Within the next 4 years, NRAs should evaluate the advantages and disadvantages of enabling interruptible or flexible connection agreements, having due regard of the countries that already worked on this topic.

6. Reactive energy charges

(183) One of the effects of the energy transition and the related increase of renewable generation is the reduced availability of traditional thermal generation units and capabilities to control network voltages.

(184) As a consequence, in many EU Member States[118], the costs related to controlling network voltages and managing reactive power increased over the last years.

(185) Regarding network users, voltage control and reactive power management mainly consists of:

- setting requirements for the reactive – or voltage control - behaviour of network users (reactive exchange limits)
- setting charges for the reactive energy exchanged by network users outside the allowed behaviour (reactive energy exchanges)

(186) This chapter provides a review of current practices about reactive requirements and reactive charging. For more information on reactive energy charges, please refer to Table 31 and Table 32 in Annex 1.

6.1. General overview

(187) As shown in Figure 18 below, charges for reactive energy at the distribution level are applied in 19 out of 27 countries (around 70%).

(188) At transmission level, charges for reactive energy are applied in 14 out of 26 countries (slightly above half).

(189) When reactive energy charging is in place, in most instances (around 75% for distribution, around 65% for transmission), it is applied to both reactive injections and reactive withdrawals.

Figure 18: Application of charges for reactive energy

Country	Transmission charges	Distribution charges
Austria	Yes, reactive withdrawals only	No
Belgium	Yes, reactive withdrawals and injections	Brussels: reactive withdrawals only Flanders: reactive withdrawals and injections Wallonia: reactive withdrawals only
Bulgaria	Yes, reactive withdrawals and injections	No data
Croatia	Yes, reactive withdrawals only	Yes, reactive withdrawals and injections
Cyprus	No	No
Czech Republic	No	Yes, reactive withdrawals and injections
Denmark	No	No
Estonia	No	Yes, reactive withdrawals and injections
Finland	No	Yes, reactive withdrawals and injections
France	Yes, reactive withdrawals and injections	Yes, reactive withdrawals and injections
Germany	No	No

[118] Belgium (due to RES increase), France (slight cost increase, due to increasing impacts of high voltage constraints), Greece (due to the decrease of thermal generation), Hungary, Italy (due to the decrease of thermal generation and changes in the reactive exchange patterns of network users), Lithuania, the Netherlands (due to increases in volumes and in prices), Slovakia (due to the change of consumption features), Spain (significant increase due to RES integration).

Country	Transmission charges	Distribution charges
Greece	No	No
Hungary	No	Yes, reactive withdrawals and injections
Ireland	No data	Yes, reactive withdrawals only
Italy	Yes, reactive withdrawals only until March 2023	Yes, reactive withdrawals only until March 2023
Latvia	Yes, reactive withdrawals and injections	Yes, reactive withdrawals and injections
Lithuania	Yes, reactive withdrawals and injections	Yes, reactive withdrawals and injections
Luxembourg	No	No
Malta		No
The Netherlands	No	Yes, reactive withdrawals and injections
Norway	Yes, reactive withdrawals only	Yes, reactive withdrawals only
Poland	Yes, reactive withdrawals and injections	Yes, reactive withdrawals and injections
Portugal	Yes, reactive withdrawals and injections	Yes, reactive withdrawals and injections
Romania	Yes, reactive withdrawals and injections	Yes, reactive withdrawals and injections
Slovak Republic	No	Yes, reactive withdrawals and injections
Slovenia[119]	Yes, reactive withdrawals and injections	Yes, reactive withdrawals and injections
Spain	Yes, reactive withdrawals only	Yes, reactive withdrawals only
Sweden	No	No
Total	**9 reactive withdrawals and injections** **5 reactive withdrawals only** **12 no charges**	**14 (+1 BE region) - withdrawals and injections** **4 (+2 BE regions) - reactive withdrawals only** **8 no charges**

(190) The reasons for setting reactive energy charges are significantly differentiated across the countries which apply them.

(191) Taking into account that in a few instances no clear answer was provided (including because of lacking information as the rules were set many years ago), the reasons of reactive charging at distribution level include the following ones:

- Costs of compensating devices / contribution to costs for compensating reactive exchanges (BE's Flanders region, FR, IE, LT, LV)
- Impact of reactive exchanges on network losses (CZ, IT, LV, RO, SK)
- Impact of reactive exchanges on use of infrastructures (IT, NL)
- Incentive to correct users' behaviour (HR, SI)

6.2. Structure of reactive energy charges

(192) When applied, reactive charges are addressed to distribution-connected consumers (in all countries but Finland), to distribution-connected producers (slightly above half of the countries), to distribution-connected storage (slightly below half of the countries), and to distribution-connected small DSO connection points (one instance, Italy).

(193) At transmission level, reactive charges are addressed to transmission-connected consumers (all 14 countries), to DSO connection points (in 9 countries out of 14: AT, BE, BG, FR, IT, LV, NO,

[119] SI: Mandatory only for users above 43 kW.

PT, SI) and, to a smaller extent, to transmission-connected producers (in 6 countries: AT, BE, FR, LV, RO, SI) and to transmission-connected storage (in 4 countries: AT, BE, FR, SI).

(194) In several countries, capacity thresholds or the voltage connection level are used to differentiate consumers who are subject to reactive energy charges from those who are not subject to them (the smallest consumers and/or the consumers connected to low voltage networks: consumers at 43 kW and below in Slovenia, households below 30 kW in Romania, all households in Italy, 15 kW and below in Italy and Spain are not subject to reactive charges. Low voltage connected users are not subject to reactive charges in Belgium's Brussels region and in Czech Republic, usually not in Portugal).

(195) In the vast majority of countries, charges are set on the basis of reactive energy exchanges, which exceed the thresholds for withdrawals and, where applicable, for injections.

(196) The limit power factor (or limit percentage) varies across countries. For reactive energy withdrawals, the most frequently used value (in six countries, half of those which provided such information) is a power factor of 0.95, which is broadly equivalent to a 33% percentage of active power. In two countries, there is a narrower limit, while in four countries the limit is less stringent.

(197) For reactive energy injections, the most frequently used requirement (in nine countries and one jurisdiction, out of 13 countries which provided such information) is not allowing any reactive injection (= power factor 1). In three countries and one jurisdiction, a power factor limit different than 1 is used.

6.3. Values and differentiation of reactive energy charges

(198) The actual value of reactive charges for distribution-connected users varies across countries, as described in Table 32 in Annex 1.

(199) In about half of the countries, the same values apply to reactive withdrawals and reactive injections (when charged), while in the other half of the occurrences, the charges are differentiated, without a common pattern in these five countries.

(200) With very few exceptions, the values of reactive charges applied to distribution-connected users range from 3 Euro/Mvarh to 20 Euro/Mvarh. The actual values of reactive charges for transmission-connected users show a similar behaviour. In four instances (HR, LV, RO, ES) the reactive charges for transmission-connected users are the same (or very similar[120] to those) applied to distribution-connected users. In other four instances (IT, LT, SI, PT), the reactive charges for transmission-connected users are different.

(201) In a few countries, the reactive charges are differentiated by voltage level (higher values for lower voltages, lower values for users connected to high voltage grids where such grids are defined as distribution grids).

(202) In three countries (IT, PT, ES), the charges for reactive withdrawals are applied step-wise, with increasing values when the reactive exchanges are significantly higher than the first threshold.

[120] In two instances, a very small difference in values communicated to ACER may be due to exchange rate used in converting to Euro/Mvarh.

(203) In the same three countries (IT, PT, ES) and in the Brussels jurisdiction of Belgium, the charges are differentiated between day time and night time (or between peak and mid-peak vs. off-peak hours), where reactive withdrawals are charged in the peak- and mid- conditions, while not relevant and critical in off-peak hours[121].

6.4. Conclusions and recommendations

(204) In many EU Member States, according to information reported by NRAs, the costs related to controlling network voltages and managing reactive power increased over the last years.

(205) Charges for reactive energy at the distribution level are applied in around 70% of the surveyed countries. At transmission level, charges for reactive energy are applied in slightly above half of the countries.

(206) Out of these, all countries apply charges to the reactive energy withdrawals and the large majority of countries apply charge to reactive energy injections.

(207) In the vast majority of countries, charges are set on the basis of reactive-energy exchanges which exceed the threshold for withdrawals and, where applicable, the thresholds for injections.

(208) At both transmission and distribution level, reactive charges are applied to consumers, while the application to transmission-connected DSO points, to producers and to storage varies across the countries.

(209) The most frequently used thresholds across the countries are:

- Power factor of 0.95 or, in broadly equivalent terms, reactive power withdrawal at 33% of the active power;
- No reactive injection allowed.

(210) With very few exceptions, the values of reactive charges range from 3 Euro/Mvarh to 20 Euro/Mvarh.

(211) In a few countries, the charges are differentiated by voltage level, by time-of-use and are constructed by step-wise increases of the unitary value, where reactive withdrawals increase.

(212) **ACER recommends that:**

a) NRAs should monitor the evolution of costs due to voltage control and reactive energy management, including due to risks of overvoltages in off-peak hours.

b) Where such costs are deemed significant by the NRA, the NRA should consider a review of reactive energy charging, taking into account the principles in Article 18 of the Electricity Regulation, in particular, cost reflectivity, transparency, consideration of network security and support to system efficiency through signals to network users.

[121] However, the information reported here may be partly incomplete due to some missing information regarding time-differentiation.

c) When evaluating possible adaptations of its regulatory framework, each NRA should in particular take into account the frequently used thresholds for reactive charging and the frequently used values across Europe.

7. Time-of-use network charges

(213) Time-of-use network tariffs (or tariff time elements) mean charges for network service(s) that vary according to when the service is used (e.g. by peak/off-peak, season, month, weekdays/weekends, hour). They could take different forms depending on the basis used for charging[122]:

- Energy-based: EUR/kWh in period t,
- Power-based: EUR/kW in period t.

(214) Time-of-use charges give signals to network users to use the network less in some periods in the day, week or year and use it more in other periods. The charges should be higher in periods when network utilisation is closer to the technical limits and lower otherwise. For instance, the use of the network could be discouraged in the time window when the local or system peak is forecasted to occur. The coincident and rising use of the network during peak periods may induce the need for network reinforcement, thus justifying a higher network charge. Use of the network in off-peak periods, on the other hand, does not lead to additional costs and thus a lower charge is justified to encourage the use in those time windows.

(215) Time-of-use charges can be static, where the different time periods are defined well in advance (e.g. when setting the tariff methodology or annually) or they can be more dynamic, for example, where the peak period is set only at short notice, close to real time[123] (e.g. few days in advance or within the day), which better reflects the actual system conditions, but becomes less predictable for the network user.

7.1. General overview

(216) As shown in Figure 19 below[124], 21 out of 28 countries[125] (i.e. 75%) apply time-of-use tariffs, while 7 countries (BG, CY[126], DE, HU, IT, LU, RO) do not apply them. Static time-of-use signals are more frequently used at distribution level compared to transmission level: all 21 countries apply them in distribution tariffs, while only 10 (i.e. BE, HR, EE, FI, FR, GR, IE, PT, SI, ES) apply them also in transmission tariffs.

(217) Dynamic tariffs or market based elements in network charging have been reported for three countries (FR, NO, SE)[127]:

[122] In theory, time-of-use lump sum charges could be also imagined, but ACER did not find them applied in practice in any country according to the reported information.
[123] In alternative, the peak period applicable to network users may also be determined on an ex-post basis, after observing the real load pattern.
[124] For more details please refer to Tables 33-36 in Annex 1.
[125] AT, BE, HR, CZ, DK, EE, FI, FR, GR, IE, LV, LT, MT, NL, NO, PL, PT, SK, SI, ES, SE
[126] CY: The network charge has currently no time differentiation (i.e. the same rates apply), but the framework allows for time differentiation by seasons, day of week and peak/off-peak within a day. Time periods: June - September (High Demand Season) vs. October - May; weekdays vs. weekends and holidays; daily peak (June - September: 16:00 - 23:00; October - May: 09:00 - 23:00).
[127] PT: In early 2019, in Portugal the NRA also approved rules for a pilot project with dynamic pricing elements. However, there were not enough candidates for the pilot to be carried out.

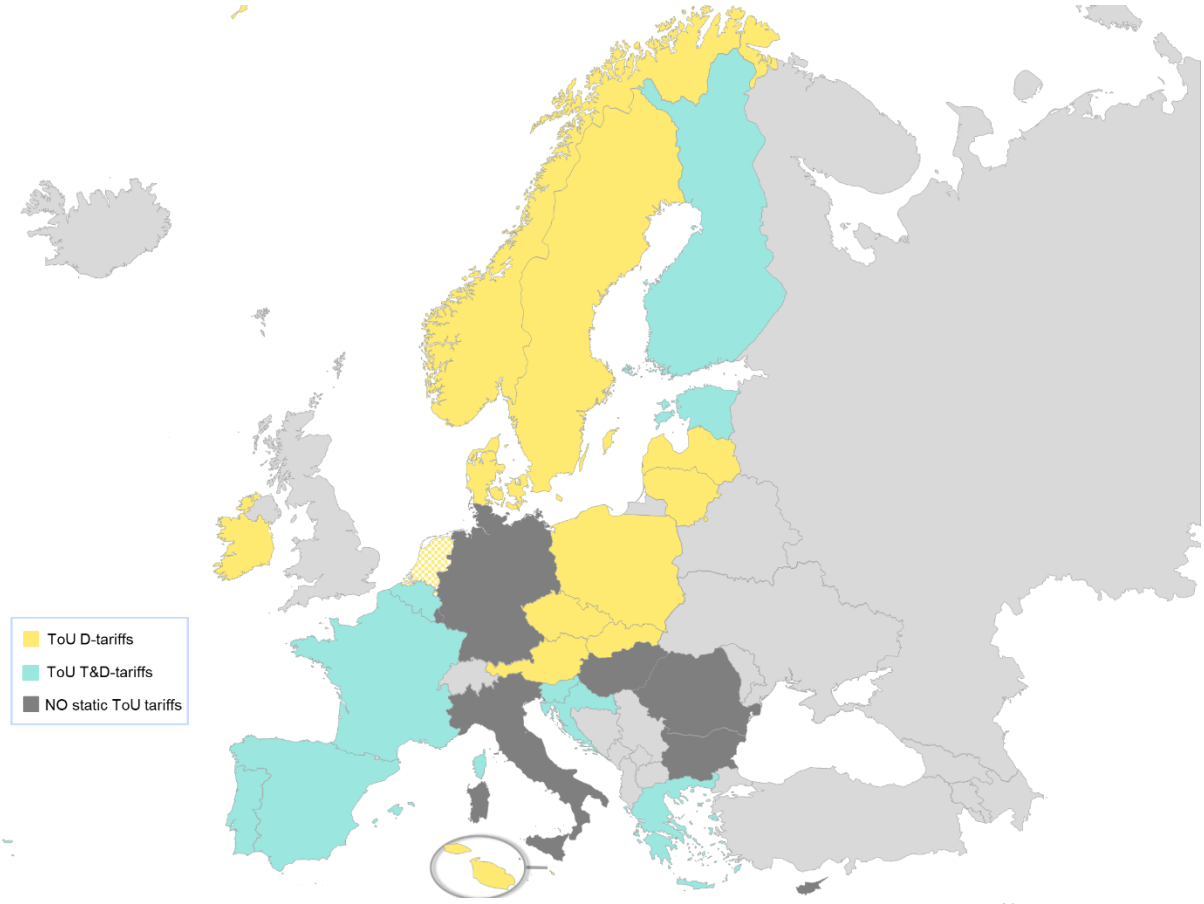
- In France, at medium voltage level, a "mobile" peak period option is available for the network users. This option is composed of a given number of "peak days" that are not set long beforehand. Network users who have subscribed to this option only know the day before when a peak period (with the highest price) will happen, depending on TSO's forecast, in order to match as close as possible with actual congestions.

- In Norway, a network tariff element is set based on marginal loss in each node. The price of marginal losses is the marginal loss percentages for each node multiplied with the actual spot-price for the area in the actual hour. Marginal loss percentages in each node are calculated each week differentiated day/night and weekend. This tarification aims at providing a more correct price signal in each node reflecting the changes in overall losses in the system by a marginal input/output.

- In Sweden, the transmission tariff has a time-differentiated energy-based component, which is based on actual hourly market prices per bidding zone.

(218) Time-of-use charges are typically embedded in the withdrawal charges, and they are hardly used for injection charges[128].

Figure 19: Application of static time-of-use (ToU) network charges in Europe (2022)



Note: In the Netherlands (NL), time-of-use distribution tariffs apply, but to a very limited extent[129].

[128] In Sweden, there are some DSOs which have tariff elements that are subject to some kind of time-of-use differentiation.
[129] NL: Network users that are connected to LV, non-households and connection is larger than 3x80A, but not large enough to get MV connection. This category of users is very limited in numbers.

(219) The main reason for applying time-of-use signals is cost-reflectiveness of the network charges. The considerations on why not to apply time-of-use includes doubts about the efficiency and effectiveness of the time signals or incapability of meters.

(220) In the countries where time-of-use signals are not applied in the transmission and/or the distribution tariff structures the following reasons have been reported:

- Disputing the effectiveness of time-of-use signals in network charges: energy prices by the market provide better signals for the network and the signal embedded in the network tariff may contradict the signal embedded in the energy price. There are also doubts concerning the willingness of network users to react to time-of-use in the network tariff;
- Disputing the efficiency of time-of-use signals in network charges: the complexity of implementing time-of-use network tariffs may not outweigh the benefits;
- Technical reasons: low penetration of smart metering systems (or other capable meters able to record time-of-use, e.g. different time bands).

(221) In order to have a better understanding of the effectiveness and efficiency of time-of-use signals before implementing or revoking time-of-use signals, NRAs may carry out pilot studies, impact assessment studies or consultations, forecasting or evaluating the (likely) effects of the time signals on the use of the network and on the network costs.

(222) Out of those countries where time-of-use is applied in the transmission tariffs three reported that study work (beyond stakeholder consultations), was carried out before the implementation:

- In Greece, the new methodology was tested and compared to the previous one using recent demand data.
- In Portugal, a pilot project was carried out between June 2018 and May 2019 to study changes to the time-of-use structure of the network tariff for large consumers (VHV, HV and MV). The new time-of-use that resulted from the project is characterized by a stronger signal in the peak periods and time-of-use schedules with regional differentiation (separating the grid into three areas). Based on the CBA, a net benefit of 50 million euros was estimated to take place over a time horizon of 23 years, because of a demand response of 2.2%. The main drivers of the net benefit were the reduction or postponement of network investments.
- In Spain, an impact assessment was carried out before implementing the most recent tariff structures.

(223) Out of those countries where time-of-use is applied in the distribution tariffs, about half reported that study work was carried out before the first implementation or when making a change to the time-of-use framework:

- In Belgium’s Wallonia region, simulations of impact and fairness considering typical customers were run.
- In the Czech Republic an impact assessment was carried out before the introduction of time-of-use and the results indicated that with time-of-use tariff reduce congestion.

- In France, an impact assessment was carried out before the introduction or the latest change of the time-of-use tariffs.
- In Greece, no dedicated time-of-use assessment per se, but the new tariff methodology was tested and compared to the previous one, using the same (recent) demand data set, to determine potential changes in allocated costs per user category, e.g. recovering more costs from peak users (and capacity-based charges). It was shown that an increase in allocated costs to MV customers and LV domestic customers could be expected (under the new tariff methodology).
- In Ireland, the annual tariff-setting process includes an assessment of the change in all tariffs on a number of different types of customers[130].
- In Portugal, a pilot project was carried out, as explained in more detail for the case of the transmission tariffs above.
- In Slovakia, there were analyses carried out by the particular DSOs.
- In Slovenia, a study was carried out in 2000, prior to the introduction of the current tariff methodology. A new tariff methodology is under consideration for introduction in 2024, introducing 2 seasons and 5 time blocks for both transmission and distribution costs. As part of the impact assessment, the current methodology was evaluated.
- In Spain, in the elaboration of the latest tariff methodology[131], an impact assessment was carried out. The impact assessment included the economic impact of different tariffs.

(224) Of those Member States that do not apply time-of-use in the transmission tariffs and/or distribution tariffs, few reported any kind of pilot or impact assessment to support that decision:

- In Cyprus, a capacity demand study analysed the hourly production cost. An economic and network impact assessment based on different periods and rates revealed the tariff structures[132]
- In Italy, time-of-use was applied before the regulatory period 2008-2011 and the decision to remove the time-of-use element was taken ‘in support of the opening of the market’.
- In Poland, the TSO had carried out a preliminary analysis in 2014 to introduce time-differentiated transmission tariffs, but it did not happen since the study found that the metering of DSO customers was not compatible with the TSO time-differentiated tariffs.

7.2. Design of time-of-use network charges

(225) The main design feature of (static) time-of-use tariffs are the periods to which different (unit prices of) energy-based or power-based charges apply.

[130] IE: this impact assessment is included in the NRA’s final Decision Paper.
[131] ES: Circular 3/2020
[132] CY: Currently the network charge has no time differentiation (i.e. the same rates apply), but the framework is in place.

(226) As shown in Figure 20 below, time-of-use signals are more often embedded in the energy-based component than in the power-based component.

(227) Regarding transmission tariffs, ACER notes that five countries (i.e. HR, FR, PT, SI, ES) apply the time-of-use signals for both components, while two countries (i.e. EE, FI) apply the time-of-use signals only for the energy-based component. In two countries (BE[133], GR) only the power-based component is time differentiated (and not the energy-based).

(228) In the case of distribution tariffs, about 40% of the concerned countries (i.e. HR, CZ, DK, FI, FR, PT, SI, ES, SE) apply the time-of-signals for both components and more than half (i.e. AT, BE[134], EE, IE, LV, LT, MT, NL, NO, PL, SK) apply the time-of-use signals only for the energy-based component. One country (GR) applies the time-of-use signals only for the power-based component (the charge is based on demand during pre-defined system peak periods).

(229) The fact that power-based charges are less frequently time-differentiated compared to energy-based charges, may be partially explained by a potentially more complex design of power-based ToU tariffs, different metering capabilities for measuring energy and capacity or due to the fact that cost recovery still heavily relies on energy-based charges, at least in distribution.

Figure 20: Tariff basis embedding the time-of-use signal

		AT	BE[135]	HR	CZ	DK	EE	FI[136]	FR	GR	IE	LV	LT	MT	NL	NO	PL	PT	SK	SI[137]	ES	SE
Transmission	**Energy based**			●			●	●	●							●		●		●	●	●
	Power based		●	●					●	●								●		●	●	
Distribution	**Energy based**	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
	Power based			●	●	●		●	●	●								●		●	●	●

Note: No ToU tariffs apply in BG, CY[138], DE, HU, IT, LU, RO. Grey dots in case of NO and SE signal the market based elements.

(230) Typically, time-of-use tariffs are static and vary within-day by defining (blocks of) hours during which a higher or lower unit price is charged for using the network. It is also common to distinguish weekend days (and sometimes holidays) from other days of the week, with a lower tariff applying

[133] BE: The ToU signal is only used to lower the synchronous peak of the network. Lowering the synchronous peak reduces the need for new lines (transportation capacity). Decision to build new lines is related to power peak more than energy flows. ToU on Annual peak offers the long term signal needed to have an impact on users' decisions.
[134] BE: In Flanders region, until end 2022, there was day/night differentiation in the energy charge. From 2023, only the 'exclusive night' tariff for accumulation heating (energy-based) remains as a sort of ToU. In Brussels region, the peak tariff (€/kW measured) is only applicable to the peak time of use (weekdays 7am - 10pm) for MV.
[135] Idem.
[136] FI: ToU variation typically apply in the energy-based withdrawal charge, but there are DSOs that apply time elements in the power-based withdrawal charge.
[137] SI: For network users up to 43 kW, the time signal is in the energy charge. For network users above to 43 kW, the time signal is also embedded in the capacity charge calculated based on monthly average of three highest peaks in peak periods
[138] CY: Currently the network charge has no time differentiation (i.e. the same rates apply), but the framework is in place.

to all hours of non-working days. Further variation is introduced in some Member States through a seasonal element that makes unit charges vary with the months.

(231) Seasonal signals are in most instances divided into 2 seasons, but in some countries the seasonal differentiation is higher (i.e. in France there are 3 seasonal periods and in Spain there are 4 seasonal periods). As shown in Figure 21 below, the peak months are typically from November till end March.

Figure 21: Peak months in the time-of-use schedule for transmission and distribution tariffs

	AT	BE	EE	FI	FR	PL	PT	ES
January	◑	◐	◐	●	●	◑	●	●
February	◑	◐	◐	●	●	◑	●	●
March	◑	◐	◐	◑	●	◑	●	
April		◐						
May								
June								
July								●
August								
September								
October	◑					◑		
November	◑	◐	◐	◑	●	◑	●	
December	◑	◐	◐	●	●	◑	●	●

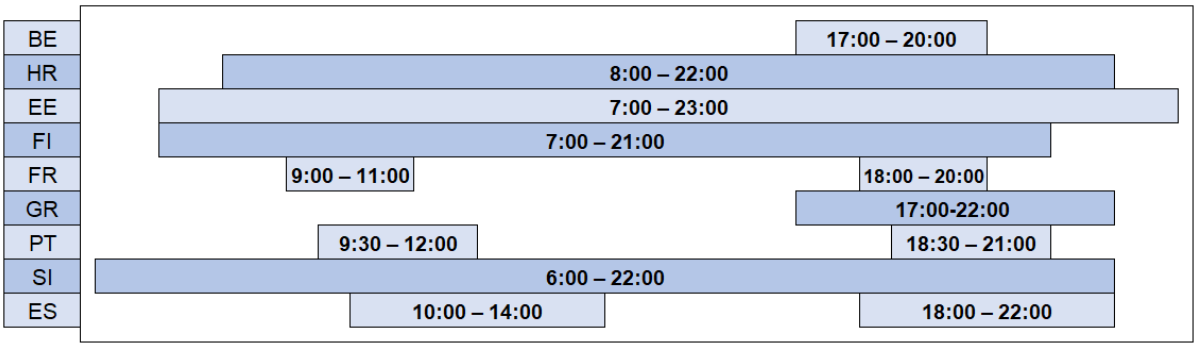
◐ Transmission-only, ◑ Distribution-only, ● Transmission and Distribution

Note: For the purpose of the Figure, specific conditions apply to FR[139], PT[140] and ES[141].

(232) As shown in Figure 22 and Figure 23 below, the within-day signals are in most instances divided into 2 periods (day/night or peak/off-peak period), where the periods may range from a few hours up to several hours. However, ACER also observes that more than 2 periods within the day are defined in five countries (FR, IE, PT, LV, ES) (cf. Table 33 and Table 35 in Annex 1)

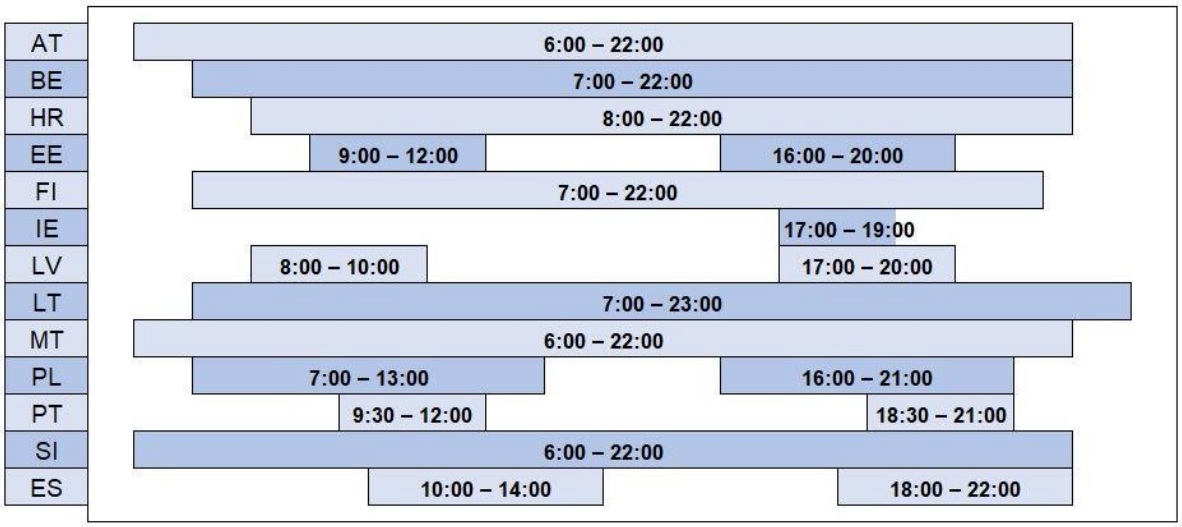
[139] FR: For the transmission tariff in FR, a super peak period exists from 1 December - 28 February.
[140] PT: The peak months in PT correspond to winter time (from last Sunday in October until last Sunday in March).
[141] ES: The year is classified into four seasons (high, medium-high, medium and low) and months included in each season vary between the peninsula and the islands. The results presented in the table for ES correspond to the high season for the peninsula.

Figure 22: Peak hours in the time-of-use schedule for transmission tariffs



Note: For the purpose of the Figure, specific conditions apply to FR[142], GR[143], PT[144], ES[145]

Figure 23: Peak hours in the time-of-use schedule for distribution tariffs



Note: Specific conditions apply to BE[146], EE[147], PL[148], PT[149], ES[150]

(233) The time-of-use signals may be the same to all network users who are subject to ToU tariffs, or they may also differentiate among the network users. For example, different signals apply for households and non-households or different signals apply depending on the contracted capacity

[142] FR the peak hours in the table correspond to the super peak period.
[143] GR: the peak hours in the table refer to the winter schedule, applicable from October till March. During the summer schedule, the peak hours are between 19:00-23:00.
[144] PT: The peak periods indicated in the figure correspond to the peak hours during winter time applied in the weekly schedule available to all customer groups. The peak periods are different during summer time and can be different in the time schedules available for specific voltage levels.
[145] ES: The peak hours in the table correspond to the peak schedule, applicable to the energy-based charges for households (period P1 of the three-period schedule). The time schedule is the one for the peninsula.
[146] BE: the peak hours in the table correspond to the regions of Brussels and Flanders (for the Wallonia region times are defined by the DSO and may vary within the geographical area of the DSO).
[147] EE: the peak hours in the table correspond to the winter schedule, applicable from November till March, on working days.
[148] PL: the peak hours in the table correspond to the winter schedule, during the summer schedule the peak hours are between 19:00-22:00.
[149] PT: The peak periods indicated in the figure correspond to the peak hours during winter time applied in the weekly schedule available to all customer groups. The peak periods are different during summer time and can be different in the time schedules available for specific voltage levels.
[150] For ES: the peak hours in the table correspond to the peak schedule, applicable to the energy-based charges for households (period P1 of the three-period schedule). The time schedule is the one for the peninsula.

level. The time-of-use tariffs may also differ within the country due to some DSO's freedom to choose their own time-of-use signals and/or because the network users are allowed to choose from different time-of-use tariff options offered to them. There are also some instances where the time of use signals vary by location of the network user (e.g. the peak period starts or ends at a different time).

7.3. Mandatory vs optional use of time-of-use signals

(234) The application of time-of-use signals requires a meter that is capable of recording network use in different time bands. The availability of time-of-use capable meters varies: the roll-out of smart metering systems (or smart meters) is advancing at a different pace across the countries and network users may have the right to request or to refuse a time-of-use capable meter/smart meter.

(235) As shown in Figure 24 below, network users who connect at the transmission level typically dispose of meters capable of recording time-of-use bands (i.e. all countries where the information was available to the NRA, reported use by more than 90% of the users). As shown in Figure 25, the respective meters typically use 15 or 60 minutes intervals.

(236) In all countries where time-of-use is applied, it is mandatory for the network users, who are withdrawing from the network, thus these users cannot opt out of being exposed to the time signal. In a limited number of cases, specific network users are excluded from time-of-use tariffs: In Estonia and in France, network users connected to the 330 kV and 400 kV networks, respectively, are not exposed to time-of-use because peak use is considered not to be the main cost driver of the network at those voltage levels in those countries and the time-of-use signal would not be cost-reflective.

(237) Network users connected at the distribution level do not always have meters capable of recording time-of-use bands (i.e. most countries where the information was available to the NRA, reported use by more than 90%, but about third of them reported use by less than 50%, in some instances even below 10%). The lack of such meters is the main reason to often exclude some distribution-connected users from exposure to the time-of-use signals.

(238) Even in those instances where ToU capable meters are or could be available to them, the distribution-connected network users can decide in most instances whether to have ToU tariffs or not (i.e. BE's Brussels and Flanders regions, HR, CZ, FR, LV, LT, MT, PL, PT, SK, SI). In other countries or jurisdictions (AT, BE's Wallonia region, HR[151], EE, GR, NL, PL[152], PT[153], SI[154], ES), time-of-use signals are mandatory to at least some of the distribution-connected network users. For two countries (FI, SE), where distribution tariffs include a time-of-use element, the respective NRAs could not provide information on the mandatory versus optional nature of the time-of-use element. For more information on optional and mandatory use of ToU tariffs please refer to Table 37 and Table 38 in Annex 1.

[151] HR: mandatory for users with a capacity rating of 20kW and higher, less than 10% of users.
[152] PL: mandatory for users in areas where only a time-of-use tariff group is offered, less than 10% of users.
[153] PT: mandatory for HV customers, MV customers and LV customers with contracted power above 41.4 kVA, less than 10% of users
[154] SI: mandatory for users with a capacity rating above 43kW. The share of users subject to mandatory time-of-use was not reported.

Figure 24: Share of the network users with meters capable of measuring withdrawal from the grid for different time-of-use

	Below 10%	At least 10%, but below 25%	At least 25%, but below 50%	At least 50%, but below 75%	At least 75%, but below 90%	At least 90% or all	Information is not available
Transmission-connected network users						HR, CY, DK, EE, FR, GR, IT, LV, LU, NO, PT, RO, SK, SI, ES	AT, BE, BG, EE, FI, DE, HU, LT, NL, PL, SE
Distribution-connected network users	GR, HU, LT	CY, RO	AT, BE (BRU), IE, SK	PT, CZ, BE (WAL)	BE (FLA)	HR[155], DK, EE, FI, FR, IT, LV, LU, MT, NL, NO, PL, SI, ES, SE	DE

Figure 25: Default metering intervals applied to withdrawal in Europe

	15 minutes	30 minutes	60 minutes	1 minute
Transmission-connected users	AT, BE, BG, HR, CZ, DE, GR, HU, IT, LU, NL, PL, PT, RO, SK, SI, ES	CY, LV	BG, EE, FI, LT, NO, PL, SK, SI, ES, SE	FR
Distribution-connected users	AT, BE, HR, CZ, DE, HU, IT, LT, LU, MT, NL, PL, PT, RO, SK, SI, ES	CY, IE, LV	DK, EE, FI, GR, LT, NO, PL, SK, SI, ES, SE	

Note: Information is missing for BG, IE (transmission)

7.4. Other measures to provide time signals to the network users

(239) There exist a number of alternative or complement measures (to time-of-use network tariffs) to offer time signals to network users. Examples of such incentives include discounts for shifted load or a less varying withdrawal profile, options to contract different power levels at different times or direct/remote control by a system operator of the consumption by activating specific appliances (e.g. heat boilers), as shown in Table 39 in Annex 1.

(240) Local flexibility mechanisms (including "local markets", i.e. where service providers offer products for system operation services) aim to mitigate local congestion in a cost-efficient way (e.g. instead of network reinforcement or expansion) and as such they may also form an alternative or complement to using time-of-use network tariffs for charging network utilisation. Local markets have been implemented in less than a third of the Member States (BE[156], CZ, FR, IT, LU, NL, PT, SE). Legislative work or effective implementation of such markets is ongoing in an additional third of the Member States (AT, DK, HU, IE, LT, PL, SK, SI). In the remaining Member States the local markets are not implemented yet or the information on the status of such markets was not provided. For more information, please refer to Table 40 in Annex 1.

[155] HR: Only a small number of users still have old meters without time-of-use capabilities (i.e. only a single tariff is available). The vast majority of those users are households.
[156] BE: flexibility markets have been implemented only in Flanders region, while the implementation is ongoing in Wallonia region. No plans for implementation of the flexibility market has been reported for Brussels region.

7.5. Effective impacts of the usage of time-of-use network charges

(241) While the purpose of time-of-use signals is to reflect the long-run marginal costs of using the network, NRAs may follow-up on the effectiveness and efficiency of the signals through evaluation studies.

Studies at transmission level

(242) Evaluation studies covering time-of-use at transmission system level have been carried out in five Member States (BE, FR, PT, SI, ES), who all apply time-of-use at the transmission level.

- In Belgium[157], the study found that time-of-use reduced the system or local peak load compared to a counterfactual assuming no time signals. A slight reduction of transmission-connected clients' evening peak was observed, but overall, including distribution-connected load, no significant change in the peak was observed;

- In France[158], the study found that time-of-use reduced the system or local peak load compared to a counterfactual assuming no time signals. It reduced the network development cost and it reduced the loss of load cost (security of supply);

- In Portugal[159], a pilot project was carried out between June 2018 and May 2019 to study changes to the time-of-use structure of the network tariff for large consumers (VHV, HV and MV). The new time-of-use scheme that resulted from the project is characterised by a stronger signal in the peak periods and time-of-use schedules with regional differentiation (separating the grid into 3 areas). Based on the cost-benefit analysis, a net benefit of 50 million euros was estimated to take place over a time horizon of 23 years, as a result of a demand response of 2.2% during the super peak period (approximately the 300 hours per year of highest usage). The main driver of the net benefit was the reduction or postponement of network investments. When analysing customers connected at VHV (transmission) and HV (distribution), it appears that peak consumption of these network users is spread out to avoid prices of peak periods. Especially in VHV, the lowest consumption level is observed in the peak period, contributing to a reduction in the system peak.

- In Slovenia[160], the study found that time-of-use reduced the system or local peak load compared to a counterfactual assuming no time signals and it reduced the network development cost. The goal of the new methodology is to send efficient economic signals to network customers, charges are allocated to predefined time-blocks according to the contribution of each time-block to the system load peak, so that network usage on off-peak periods is more incentivized than on-peak periods, through time-block energy and capacity charges. The identification of time-blocks is carried out by the classification of hours of the whole system load curve under electrical seasons, labour or no labour days, and different intra-day blocks.

[157] BE: Study on provision of electricity to large consumers in Belgium in 2020 (9 December 2021), https://www.creg.be/sites/default/files/assets/Publications/Studies/F2285FR.pdf
[158] FR: Internal study, not publicly available.
[159] PT: Information is available in Annexes 1-4 of the Public Consultation n. 101: https://www.erse.pt/atividade/consultas-publicas/consulta-p%C3%BAblica-n-%C2%BA-101/abertura/ (in Portugal)
[160] SI: https://www.agen-rs.si/documents/10926/283610/EIMVComillas_DisseminationImpactAnalysis_20211201_v0.6.pdf/1596b195-daa7-47c9-9db2-0ca18d9aa410

- In Spain, in the elaboration of the latest tariff methodology[161] an impact assessment was done and a public consultation was carried out. The impact assessment included the economic impact for the different tariffs[162].

(243) In the five remaining Member States where time-of-use is applied at transmission level (HR, EE, FI, ES, GR), no evaluation study had been reported.

(244) In the remaining Member States, time-of-use is not applied at the transmission level and correspondingly no evaluation activities were reported for those countries.

Studies at distribution level

(245) Studies to evaluate the effectiveness and efficiency of time-of-use at the distribution level have been carried out in five Member States (BE's Brussels region, NL, PT, SI, ES).

- In Belgium (Brussels region)[163], time-of-use reduced the system or local peak load compared to a counterfactual assuming no time signals and it reduced the network development cost. The existing HI/LO tariff has not been investigated since it was inherited.

- In the Netherlands[164], in 2019, an impact assessment was set out to analyse possible alternatives for more dynamic network tariffs. Although dynamic network tariffs offers a big advantage in terms of encouraging system flexibility, the complexity and uncertainty about the effectiveness are disadvantages that led to the conclusion that in practice encouraging local flexibility via competitive procurement seems a better way forward. No specific studies to evaluate the effectiveness of (static) time-of-use have been performed.

- In Portugal[165], a pilot project was carried out, as explained in more detail in the case for the transmission tariffs above.

- In Slovenia[166], a study was carried out, as explained in more detail in the case for the transmission tariffs above.

- In Spain, in the elaboration of the latest tariff methodology an impact assessment was done and a public consultation was carried out as explained in more detail in the case for the transmission tariffs above.

(246) Three Member States reported ongoing evaluation or impact assessment studies:

- In Belgium, in Flanders region the DSO will carry out an assessment by 2023. No further information is available yet. In Wallonia region, the regional regulator (CWaPE) is studying the elaboration of a new incentive-based tariff structure for the period 2024-2028.

[161] Circular 3/2020
[162] ES: Cuadro 46 (p.105) 02-Memoria-de-la-Circular-3_2020-peajes-TD-eléctricos-WEB.pdf
[163] BE (BRU): A study was realised in 2017, regarding the ideal capacity based tariff. It might be updated before the start of the next tariff methodology (2025);
[164] NL: https://www.acm.nl/sites/default/files/documents/2019-11/d-cision-ecorys-flexibilisering-nettarieven-23-mei-2019.pdf
[165] PT: Information in Portuguese available in annexes 1 to 4 of the Public Consultation n. 101: https://www.erse.pt/atividade/consultas-publicas/consulta-p%C3%BAblica-n-%C2%BA-101/abertura/
[166] SI: https://www.agen-rs.si/documents/10926/283610/EIMVComillas_DisseminationImpactAnalysis_20211201_v0.6.pdf/1596b195-daa7-47c9-9db2-0ca18d9aa410

- In Hungary (not applying ToU), a study was conducted last year prior to possibly introducing time-of-use. The examination continues this year.

- In Luxembourg (not applying ToU), currently assessing the different options for a future proof tariff method. Time of use tariffs are one of the possible options. As the impact assessment is not finished and talks with DSOs are ongoing, no decisions have been taken yet in this respect.

7.6. Conclusions and recommendations

(247) Costs might vary according to time or other reasons. To reflect the cost variation according to time, a cost-reflective tariff could be time-differentiated. The use of time signals can be a useful tool for reducing network peak-load, which is the main driver for network investments, thereby promoting network efficiency. Not all users may be capable to react to such signals to the same extent.

(248) More advanced differentiation in time and location through dynamic tariffs could further increase tariffs' cost-reflectivity and incentivise efficient network behaviour. However, such differentiation is rather complex, requires a sufficient level of automation, and may therefore contradict other principles, such as simplicity, predictability and transparency, if not implemented effectively.

(249) Time-of-use signals are more frequently used at distribution level compared to transmission level: 21 out of 28 countries (i.e. 75%) apply static time-of-use charges in distribution tariffs and about one-third in transmission tariffs. Time-of-use charge is not applied at all in 7 countries.

(250) Time-of-use charges are typically embedded in the withdrawal charges. However, in a few countries they are also applied to injection charges. Time-of-use differentiation exists mainly in energy-based charges.

(251) The main reason for applying time-of-use signals is cost-reflectiveness of the network charges. The arguments presented by NRAs on why not to apply time-of-use tariffs includes the lack of efficiency and effectiveness of their time signals on users' behaviours or incapability of meters.

(252) Typically, time-of-use tariffs are static and vary within day by defining (blocks of) hours during which a higher or lower unit price is charged for using the network. It is also common to distinguish weekend days (and sometimes holidays) from other days of the week, with a lower tariff applying to all hours of non-working days. Further variation is introduced in some Member States through a seasonal element that makes unit charges vary with the months. Time-of-use tariffs with some dynamic elements have been reported only by two countries.

(253) In several distribution systems, in which time-of-use signals are applied, network users have the possibility to opt-in or opt-out to being exposed to the time signals.

(254) Alternatives or complements to time-of-use tariffs exist, but NRAs have not indicated a wide use of such instruments so far. Examples are discounts for shifted load or a less-varying withdrawal profile, options to contract different power levels at different times and the remote control of devices by a system operator to restrict their use in system peak periods. Local markets for system operation services are another tool to deal with peak loads and congestion and have been implemented so far in less than a third of the Member States. Yet, it is too early to report on the experiences given the nascent nature of such markets.

(255) With regard to the effectiveness and efficiency of time-of-use tariffs as a signalling instrument, pilots and impact studies before introducing or revoking time-of-use tariffs have been performed in about half of the countries. Evaluation studies of the effectiveness of time-of-use schemes (e.g. how time-of-use has changed the behaviour of network users and the corresponding network costs) have been performed in less than third of the concerned Member States.

(256) With the introduction of vast intermittent generation and increasing demand from e.g. electric heating and electric vehicles and with the increasing capability of some network users to respond to time signals, time-of-use might gain a higher importance than in the past as a tool to facilitate cost-reflectivity of the network tariffs and/or to promote load shifting in order to mitigate the need for network investments.

(257) While care should be given to the potentially conflicting time signals between dynamic wholesale energy prices and static time-of-use network tariffs, the latter can still be a useful tool for reducing system peak load, which is a main driver for network investments, thereby promoting network efficiency. The effectiveness of such signals depends on the network user's ability to adapt its behaviour to such signals and the difference between the time-of-use tariffs.

(258) **ACER recommends that:**

a) Where time-of-use tariffs are introduced to reflect system costs, the network tariff structures and the signals should be mandatory for all network users, without a possibility to opt-out from them. Optionality may be temporarily reasonable when transitioning to a new time-of-use schedule in order to limit tariff impacts on network users.

b) Where no time-of-use signals are applied, NRAs should investigate the need from cost-efficiency and/or network congestion point of view to introduce such signals. Such studies should aim to identify which elements (that may be local) affect the effectiveness and efficiency of time-of-use signals in order to justify a decision to apply such signals or not in a given context. Where time-of-use is already applied, the NRAs should evaluate their impacts and the appropriateness of the applied time bands and tariff signals on a regular basis.

c) NRAs should improve data collection and analysis regarding individual network users, subject to the rollout of fit-for-time-of-use meters (i.e. meters which are capable to record time-of-use, e.g. different time bands), in order to support the design of more cost-reflective time-of-use tariffs, by also allowing higher granularity in their temporal differentiation.

d) Where fit-for-time-of-use meters are largely missing, as a temporary solution, NRAs may design network tariffs by determining for different user profiles their contribution to the system peak.

8. Other network tariff topics

8.1. NRAs role in tariff setting

(259) Based on current legal frameworks, in 24 Member States and in Norway the NRA sets or approve both the transmission and distribution tariff methodologies. In Finland and Sweden, each system operator individually defines the tariff methodology based on the legal framework, but it is not subject to NRA's approval. In Germany, the relevant Ministry has defined the tariff methodologies so far, while the NRA has supervised the compliance of the tariff calculation by the system

operators with the law and the tariff methodology. According to the ECJ ruling (C-718/18) on 2 September 2021, the network tariff methodology cannot be set in ordinances, but it will have to be under the German NRA's jurisdiction (more information on NRAs' role in tariff setting is available in Table 41 and Table 42 in Annex 1).

(260) ACER finds that in the Member States with multiple TSOs the same transmission tariff methodology is applied to each of them, while in the vast majority of the assessed countries the same distribution tariff methodology is applied to all DSOs. In the remaining Member States, either the NRA sets different methodologies for different DSOs or the DSOs are free to choose their own tariff structure under certain legal restrictions.

(261) ACER welcomes that the German NRA will be granted powers to decide on network tariffs. ACER considers that in order to ensure that tariffs are set efficiently in line with network users' interest, NRAs should have sufficient leverage and regulatory control over the tariff as stipulated by Article 59(1)(a) of Directive (EU) 2019/944.

(262) ACER is of the view that there are compelling reasons to have NRAs directly set the transmission and distribution tariff methodology or as a strict minimum approve the methodology proposed by the respective system operators, in order to ensure that methodologies are free from any political or commercial interest which is ensured by NRAs' independence legally guaranteed by the EU law. ACER recalls that NRAs shall be ensured adequate human and financial resources for this purpose, pursuant to Article 57(5) of Directive (EU) 2019/944.

8.2. Tariff setting principles

(263) Electricity tariff design, in general, aims at recovering the costs incurred by a monopolistic system operator while stimulating efficiency. Cost recovery is the core objective of tariffs. Efficiency mainly relates to cost-reflectivity and the economic signals sent to the network users for optimal use of the network. Since charges related to transmission and distribution networks can constitute a considerable cost to the network users, the way how tariffs are set can provide additional incentives (additional to those given by energy pricing) to the network users to adapt their behaviour. The effectiveness of such signals depends on factors such as the type of network user and the share of the network costs in the final bill.

(264) Other principles, such as non-discrimination, transparency, non-distortion, simplicity, stability, predictability and sustainability, are usually also pursued. In practice, it is difficult to meet all of the principles simultaneously and fully. Therefore, when setting tariffs, the NRAs aim to achieve a balance between these principles or they have to make certain trade-offs according to priorities, while also respecting legal boundaries.

8.3. Frequency of tariff methodologies revision and of tariff value updates

(265) In most Member States, the transmission and distribution tariff methodologies are set for a fixed period of time, typically 4 or 5 years, while the tariff values are updated on a yearly basis (more information on frequency of tariff methodology revision and tariff values update is available in Table 41 and Table 42 in Annex 1).

(266) The past review of national tariff frameworks showed that stability appeared as key objective being pursued when setting network tariffs so far. Further, electricity networks are in general

evolving in Europe due to vast volumes of intermittent energy sources, innovative technologies, such as smart grids, distributed generation, penetration of electric vehicles (EV), demand side response, etc., which justifies longer tariff methodology periods which allow sufficient time to the regulated entities and network users to adapt and reduce uncertainties regarding their investment decision.

(267) ACER is of the view that setting the tariff methodology for multiple years can allow appropriate analysis of the possible actions to be taken and more effective stakeholder involvement and can support tariff predictability and save resource, while a regular update of the tariff values can result in better cost-reflectivity, and, if done based on a pre-defined methodology, preserve a level of predictability.

(268) **ACER recommends that:**

a) The length of the tariff methodology period is at least 4 years, considering users' calls for stable tariff methodologies, the need for discussion and consultation before setting the methodology and the time needed to implement new tariff structures (the set methodology may be subject to revision before, due to rapid changes in the sector, if duly justified); and

b) Network tariff values are updated at least yearly based on variations of the drivers defined by the tariff methodology and on inflation.

c) A multi-year transition process should be preferred when changes in the tariff methodology / tariff design significantly impact the tariff values for individual grid users.

8.4. Stakeholder involvement

(269) In the context of the energy transition, ensuring a transparent and effective stakeholder involvement is of paramount importance.

(270) In the vast majority of the assessed countries, a public consultation or more consultation rounds take place before setting or approving a tariff methodology. In some additional Member States, the consultation is limited to some key stakeholders, while in 3 Member States (FI, MT, SE) the setting of the distribution tariff methodology is not accompanied by any systematic consultation (only the transmission tariff methodology is consulted upon) (more information on frequency of tariff methodology revision and tariff values update is available in Table 41 and Table 42 in Annex 1).

(271) ACER considers that, in the context of the energy transition, where the role of DSOs and the manner in which distribution grids are operated are likely to be significantly impacted by increased integration of renewable energy sources, increased electrification (including demand by electric vehicles, industrial energy demand and heating), more active role of some network users as well as deployment of smart meters, effective consultation of stakeholders and transparency in deciding the distribution tariff methodologies is required for well-informed regulatory decisions and better public acceptance.

(272) **ACER recommends that:**

Public consultations are used systematically to interact transparently and inclusively with stakeholders.

8.5. Transparency in tariff setting

(273) In the vast majority of the assessed countries, the (decision of the) tariff methodology as well as the network tariff values to be paid by different network users are publicly available. Information about the cost categories and the respective amounts recovered by transmission and distribution tariffs is available most assessed countries. For more information on transmission and distribution cost recovery please refer to Table 43 and Table 44 in Annex 1.

(274) ACER is of the view that the availability of fundamental tariff-related information is of utmost importance in order to ensure transparency and comparability in distribution tariff setting and to facilitate an efficient internal energy market.

(275) **ACER recommends that:**

a) Taking stock of the provisions in Article 59(9) of Directive (EU) 2019/944, at least the following information is published in each Member State:

- the detailed methodology which is applied to set distribution tariffs, including in particular the cost categories covered by them;
- at least when the tariff methodology is set, the amounts recovered by each tariff element; and
- each year, the distribution tariff values for each network user group.

8.6. Tariff structure and cost recovery

(276) The structure of the tariffs has implications for the use of the grid and the costs of the grid, potentially supporting overall system efficiency, in line with Article 18 of Regulation (EU) 2019/943.

(277) The tariff structure covers all allowed costs of the system operators and consists of a single tariff or several regulated tariffs or tariff elements. According to the pursued principles, the most suitable tariff basis (capacity, energy and/or lump sum) and targeted user groups should be determined in order to send appropriate signals. Finding the right balance between volumetric, capacity and lump sum design elements is crucial.

(278) ACER finds that the categories of costs recovered by network tariffs vary across the Member States. The variety of tariff structures, including the different scope of cost categories which are recovered by them, makes the comparison of network tariffs in Europe a difficult task and risks of being misleading.

(279) With the aim of facilitating a common understanding, transparency and comparability, it needs to be clear what cost categories are included in each of the charges for the use of the network.

(280) The request for a common terminology on network charges and the terms to be used has already been made in the previous ACER reports on network tariffs[167].

[167] Cf. ACER Report on Distribution Tariff Methodologies in Europe (p.32-33)

(281) For more information on transmission and distribution cost recovery please refer to Table 45 and Table 46 in Annex 1.

(282) **ACER recommends that:**

a) When setting or approving the next tariff methodology in each EU Member State, NRAs should differentiate (when applicable[168]) the following cost categories paid by network users for the use of the network:

- transmission infrastructure costs, such as return on capital, depreciation and operational expenditures (including costs related to cross-border payments related to cross-border cost allocation decisions, if any);
- costs of transmission losses (including costs related to the Inter-TSO compensation mechanism);
- distribution infrastructure costs (such as return on capital, depreciation and operational expenditures);
- costs of distribution losses;
- costs of metering services;
- costs of TSO and DSO purchases of system services (e.g. reserves, congestion management, voltage control and reactive power support, black-start capability and system balancing);
- costs for withdrawing and/or for injecting reactive power outside the allowed limits (i.e. reactive energy charges)

b) In order to set cost-reflective network charges, NRAs should identify for each of these cost categories the most appropriate cost drivers to allocate these costs to the tariff structure. For this purpose, NRAs should obtain sufficiently granular data on network development and system operation (e.g. load profiles, utilisation rate of the grid (average and peak), location and time of frequent congestions, number of users, etc.).

c) For the purpose of comparability, NRAs should be able to differentiate at the level of individual network charges the share of each cost category listed above.

8.7. Withdrawal charges

(283) In the vast majority of the assessed countries, the transmission and distribution tariffs for withdrawal have a combined tariff basis (i.e. an energy-based component and a power-based or lump sum component). For transmission tariffs, 6 countries (BG, CY, DK, EE, HU, RO) apply only an energy-based component and one country (NL) applies a combination of a power-based component and a lump sum component. For distribution tariffs, 2 countries (CY, RO) apply only

[168] ACER notes that some of the costs listed are not applicable in some Member States, because they are recovered by other means.

energy-based charges. None of the assessed countries apply only a power-based or only a lump sum transmission or distribution tariff for withdrawal.

(284) For distribution, energy-based charges have a significantly higher weight in the cost recovery in most countries, albeit in 6 countries (CZ, IT, NL, PT, SK, ES), power-based charges have a larger weight. For transmission, the weight of the energy- and power-based charges are more balanced. Lump sum play a relatively small role in all assessed countries.

(285) As already indicated in the CEER Guidelines of Good Practice for Electricity Distribution Network Tariffs and witnessed by some answers regarding the recent and ongoing changes in some national tariff frameworks, ACER considers appropriate a gradual move to increasingly power-based distribution tariffs to recover those costs which show correlation with contracted or peak capacity.[169]

(286) Still, it is worth reminding that power-based distribution tariffs, especially when referred to actual maximum power during peak load periods, may feature a higher complexity than energy-based charging[170] and can have a negative impact on some tariff principles, such as simplicity, predictability and transparency. It must also be kept in mind that some costs (e.g. infrastructure costs) show strong correlation with capacity usage, while other costs (e.g. losses) may significantly depend on the volume of energy withdrawn from the grid.

(287) Distribution tariffs for withdrawal in all assessed countries are subject to variation. The main factors for variations are the voltage level and the integration of a time element in the tariff (on ToU tariff see Chapter 7 of this Report). On the contrary, variation by location (unrelated to the location of a specific DSO to which network the network user connects to) is applied only in few countries (AT, NO, SE).

(288) For more information on transmission and distribution withdrawal charges please refer to Table 47 and Table 48 in Annex 1.

8.8. Emerging network users linked to the energy transition

(289) In the context of the energy transition, power-to-X facilities, publicly accessible recharging points for electric vehicles (EV) and energy communities have gained attention for their potential to improve overall system efficiency. For instance, EV charging can contribute to system efficiency by smartly charging and potentially discharging EV batteries, but may also increase the capacity needs in distribution grids and thus the costs.

(290) In its report on distribution tariffs of February 2021, ACER carried out a first review of the tariff treatment of power-to-X facilities, publicly accessible EV recharging points and energy communities.

[169] Conceptually, time-differentiated tariffs with sufficient granularity may achieve similar cost reflectivity as contracted-capacity or peak-based tariffs

[170] Time-differentiated energy-based charges can also feature relatively high complexity, e.g. when granularity is high.

Power-to-gas facilities

(291) In 2020, no NRAs reported that power-to-X facilities (including power-to-gas) are treated differently than other network users (of the same country) regarding distribution tariffs for withdrawal.

(292) The only update provided in this data collection is from Austria, where P2G facilities do not pay withdrawal charges[171] for the first 15 years after their installation.

Publicly accessible recharging points for EV and private EV charging

(293) In 2020, the vast majority of NRAs reported that the same tariff structure for withdrawal applied to the operators of publicly accessible re-charging points for electric vehicles, as applied to other network users (of the same country). Specific tariffs were introduced in Italy, Portugal and Spain (in Italy and Spain as an option), providing either a different tariff structure to other network users (i.e. energy-based for public EV charging compared to mixed, with the largest part being power-based) or providing similar structure, but the energy component has greater weight.

(294) In 2022, regarding operators of publicly accessible re-charging points for electric vehicles, the NRAs provided the following updates:

- The Czech NRA reports some updates regarding the tariffs for EV charging, including the possibility for the DSO, under defined conditions, to interrupt EV charging in case of network congestion. The EV charging benefits from a peak/off-peak withdrawal charge, where in the off-peak period (from 22:00 till 06:00) the charge is significantly lower than during the peak period.

- The Maltese NRA reports that for EV charging points there are specific off-peak tariffs: on daily basis between midnight – 6am and midday- 4pm; and all day on Sundays. Considering the specific features of the Maltese system, a bundled energy-network tariff covers also energy and supply costs.

- The Slovak NRA reports that for EV recharging points a separate tariff is provisionally introduced (regarding the system access component and the electricity distribution component), while waiting for possible further updates in the implementation of the Electricity Clean Energy Package Directive.

(295) Regarding private EV recharging, NRAs provided the following updates:

- In Italy, since July 2021, following up to the proposals described in the previous ACER distribution tariff report, an experimental initiative has been launched by ARERA. Low voltage consumers with a contractual capacity not higher than 4.5 kW are allowed for a special increase of “technically available capacity” to 6.0 kW only during night hours (from 23:00 to 7:00), plus all the hours on Sundays and holidays, i.e. when network usage is lower; such capacity extension is granted only when a "smart wallbox" for private EV charging is installed.

- The Dutch NRA reports that the tariff structure is currently being revised. Proposals consist of differentiating the current capacity-based tariffs, so that consumers have an incentive to

[171] I.e. any grid utilisation charge or charge for network losses.

limit their peak capacity use (e.g. charge EV overnight instead of fast charge when arriving home).

- In Portugal, a vehicle-to-grid (V2G) pilot project took place in the autonomous region of Azores. It involved 10 EVs charging at 10 dedicated charging stations, installed at the power utility of the island, during 90 weeks and ended in December 2021. The 10 EVs injected during the 43 000 hours of operation more than 100 MWh into the grid and allowed savings of 15.2 tons of CO2 emissions. Also, each EV observed savings in the electricity bill up to 50 EUR per month, without damaging the EV battery due to V2G usage. Overall, the conclusion is that V2G charging can improve the stability of the grid, can absorb excess RES during the night and can even generate additional income for the EV owner.

(296) Ongoing or soon-to-start reviews/consultations or studies are reported by Belgium (for the Brussels and Wallonia regions), Croatia, Cyprus, Ireland, Italy, Luxembourg and Romania.

Energy Communities

(297) The previous ACER distribution tariff report concluded that, in 2020, for all Member States, a tariff regime for energy communities was not yet implemented at national level, except Portugal.

(298) In 2022, regarding the energy communities, the following updates were reported by the NRAs:

- In Austria, reduced system utilisation charges for participants in renewable energy communities have been introduced in November 2021.

- In Luxembourg, self-consumers are exempt of network tariffs for the part of energy produced by renewable energy resources and consumed by themselves, at the same building or within communities.

- Last, regarding pilot projects, in the Brussels jurisdiction of Belgium, the law established a framework for energy communities as innovative projects, allowing the regional regulator to grant tariff exemptions for a limited duration. A few projects have been allowed and are being followed up.

(299) Ongoing or soon-to-start reviews or studies are reported by Belgium (for the Brussels and Flanders regions), Croatia, Cyprus, Hungary, Ireland and Luxembourg.

Annex 1: Summary tables of national tariff practices

Table 1: Further details on countries adopting an incremental or forward-looking cost model

Country	Description of the cost model
Croatia	**Forward-looking cost model**. The main objective of the approach is to take into account costs change in the next regulatory period (year) and ensure their coverage through network tariffs in next regulatory year. For transmission the main billing variables to recover network costs are load-based charge (measured in €/MWh) and power- based charge (measured in €/MW). Just two groups of network users (with connection capacity under 22 kW) have only one billing variable which recovers network cost and that is load based charge (measured in €/MWh). The unit prices per group of network users are computerized based on the data provided by operator when requesting approval for tariffs change. For DSO's network charges the unit price is distinguished for medium voltage connections and for low voltage connections and differ across groups of network users.
Estonia	**Forward-looking cost model**. The main objective of the approach is to take into account costs that are changing during the implementation of network charges (e.g. additional costs resulting from a new legal obligation imposed on the network operator) and ensure their coverage through network tariffs. Costs that have already changed in the operation of network service are also taken into account (e.g. changes in the transmission tariff charged by the TSO on DSOs affects the calculation of the distribution tariff). For transmission, the main billing variable to recover network costs is a load-based charge, measured in EUR/MWh. The unit price of the main billing variable differs across groups of network users. The unit price is distinguished in relation to the level of voltage (330 kV, 110 kV and 110 kV low-voltage side of a transformer). In terms of computation, per group of network users, an incremental unit price is determined from an analysis that is based on the data provided in the request for approval of network charges of the TSO. The difference between the allowed revenues of the network operator and the revenues obtained from the incremental unit price is not reconciled by applying any additive or multiplicative adjustment. For distribution, the following differences apply: while TSO's network charges apply only to consumers, DSO's network charges apply to the consumers and the electricity producers. The unit price is distinguished for medium voltage contact points (on the undervoltage side of a 110 kV substation and 6-35 kV on the line and 35 kV on the undervoltage side of the substation) and low voltage contact points (over 63 A and up to 63 A).
France	**Incremental cost model**. The main objective of the approach is to be cost-reflective and to be geographically uniformised. For transmission, the main billing variable to recover network costs is a withdrawal-based charge, measured in EUR/MW and EUR/MWh. The unit price of the main billing variable does not differ across groups of network users although it differs with the voltage level to which the user is connected. In terms of computation, per group of network users, an incremental unit price is determined from an analysis that deduces a cost function from variables, to obtain marginal costs compared to the different cost drivers. Subsequently, the difference between the allowed revenues of the network operator and the revenues obtained from the incremental unit price is reconciled by applying a multiplicative adjustment to the withdrawal component, which is applied to the main billing variable at the beginning of the regulatory period. In subsequent periods the unit price is adjusted based on the evolution of the allowed revenue for each year. For distribution, there are no differences.
Norway	**Incremental cost model**. The main objective of the approach is to contribute to efficient development and utilisation of the network. Allowed revenue is based on historic costs and covered by a fixed and variable tariff charge. For transmission, the main billing variable to recover network costs is a fixed power-based charge, measured in NOK/kW. The unit price of the main billing variable differs across groups of network users. When tariffing consumption, a distinction is made between large consumption and other consumption. Large consumption is individual companies with power consumption over 15 MW and annual energy consumption over 100 GWh.[172] The other tariff charge is a variable marginal cost charge. In terms of computation, per group of network users, an incremental unit price is determined from an analysis of marginal losses in each connection point. Then, the TSO and regional DSOs charge an energy charge based on marginal losses in each node. The residual cost is recovered through a fixed charge and a power charge. For distribution, the following differences apply: Tariff structure is similar as in transmission, but the fixed tariff charge differs across voltage levels (ex. 0.4 kV and 22 kV) in addition to across groups of users (ex. Industry and households).

[172] NO: Large network users pay a lower tariff rate to the transmission network. Differentiation of tariffs between network customers is accepted according to the legal regulations and must be based on "objective, non-discriminatory criteria". The reason to have a reduced tariff for large consumption is that they reduce system costs. Without large consumption using electricity in the summer period, the cost of providing system services would be higher.

Country	Description of the cost model
Portugal	**Incremental cost model**. The main objective of the approach is to signal to network users the cost of using the network during the system peak and to reflect also the cost of the individual peak of each network user. For transmission, the main billing variables to recover network costs are power-based charges, measured in EUR/kW, and are denominated as peak power and contracted power. The unit price of the main billing variables differs across groups of network users, since network users at VHV only pay towards the VHV assets of the transmission grid, while network users at lower voltage levels also pay for the HV assets of transmission. In addition, when applying the transmission tariff to users connected at normal low voltage (≤ 41.4 kVA), the unit price of the peak power variable is converted into a peak energy charge, as the peak power variable is not part of the tariff structure for these users. In terms of computation, per group of network users, an incremental unit price is determined from an analysis that evaluates the long run average incremental cost (LRAIC), based mainly on historic network expansions but also based on future investment plans. This analysis is performed at the beginning of every regulatory period. The difference between the allowed revenues of the network operator and the revenues obtained from the incremental unit price is reconciled by applying a multiplicative adjustment to the main billing variables, which is applied every year according to the demand forecast and the allowed revenues. The other billing variables of the T-tariff (active and reactive energy) are not affected by the multiplicative adjustment. For distribution, the following differences apply: the LRAIC analysis is performed separately for each voltage level in the distribution network (HV, MV, LV); for each of these three voltage levels, a separate multiplicative adjustment is applied to the main billing variables.
Sweden	**Forward-looking cost model**. The main objective of the forward-looking approach, applied to capacity-based charges, is to signal to network users the cost of using the network during the peak hours. Overall, the cost model is a combination of different cost approaches, depending on the specific tariff element. For example, the forward-looking costs are capacity-based, and will be charged with a capacity charge (preferably during the peak hours), and the variable costs for the network losses will be charged with an energy charge. Overall, there are four components that make up the tariff, one energy charge (based on the variable costs), one power-based charge (based on forward-looking costs), and two fixed charges (one for customer related costs, and lastly a semi-fixed component for the residual costs).

Table 2: Allocation of residual costs

Country	Description
Croatia	No further information was provided.
Estonia	In order to address residual costs, the tariff is set on the forward-looking cost model. If the costs increase, the network operator has the right to submit a request for approval of new network charges that cover the increased costs. Any additive or multiplicative adjustment is not allowed to use to reconcile the difference between the allowed revenues of the network operator and the revenues obtained from the incremental unit price by the law that sets out the rules for calculating and approving network charges.
France	The coefficients are adjusted proportionately to recover the charges for historical infrastructure, which deviate from the marginal cost of infrastructure development.
Norway	The TSO and regional DSOs charge an energy charge based on marginal losses in each node. The residual cost is recovered through a fixed charge and a power charge. The consumption tariff is priced based on how much power consumers use during the peak load hour. The peak load hour is the hour of the year where consumption is highest. The consumption tariff is calculated on the basis of average consumption (MW) during the peak load hour over the last 5 years.
Portugal	The residual cost, understood as the difference between allowed revenues and the revenues resulting from a tariff equal to incremental costs, is allocated uniformly through a multiplicative factor. This approach preserves the relative importance of the two main price signals (peak power vs contracted power). Other theoretical approaches, such as Ramsey pricing, are difficult to implement and more difficult to justify (e.g. it would increase prices more for inelastic users).
Sweden	Overall, there are four components that make up the tariff, one energy charge (based on the variable costs), one power-based charge (based on forward-looking costs), and two fixed charges (one for customer related costs, and lastly a semi-fixed component for the residual costs).

Table 3: Details on cost cascading applied to transmission tariffs

Country	Description of cost cascading / reason for non-application or non-applicability
Austria [173]	**From transmission to distribution:** The costs of the transmission system are also paid by network users connected to the distribution network.
	From transmission to transmission: The costs for the transmission network are reduced by the costs for secondary control, network losses and Network Level 3[174], and then the following shares of the remaining costs are cascaded following the gross cascading method according to total energy volume supplied to consumers (kWh): in eastern Austria (55%), in Tyrol (40%), and in Vorarlberg (55%). The residual shares are apportioned to the withdrawing parties directly connected at transmission level in each area, reflecting their load and their energy consumption. The approach in what regards Network Level 3 is a special Austrian mechanism, as it corresponds to shared assets (shared between transmission and distribution).The transmission costs on Network Level 3 (110-kV-lump sum for shared assets) are charged directly to the DSO itself. They are included in the total costs of the DSO and in a further step they are included in the distribution tariffs.
Belgium	**From transmission to distribution:** The costs of the transmission system are also paid by network users connected to the distribution network.
	From transmission to transmission: 3 network levels: 380-110 kV, 70-30 kV, transformation to Medium Voltage (mostly DSOs). Different cascading keys are used for different costs categories: (1) network development costs are cascaded according to the power use of each user category; (2) network management costs are cascaded according to the energy use of each user category.
Bulgaria	**From transmission to distribution:** The NRA reported its application, but no further description was provided.
	From transmission to transmission: The NRA reported its application, but no further description was provided.
Croatia	**From transmission to distribution:** The costs of the transmission system are distributed to all network users on all voltage levels, including distribution and transmission.
	From transmission to transmission: Not applicable, as all T-connected network users are connected to 110 kV (There are three T voltage levels 400, kV 220 kV and 110 kV)
Cyprus	**From transmission to distribution:** The transmission tariff applies to all loads on the Cyprus electricity network, including to D-connected users. The transmission tariff of the only transmission voltage level (HV), in EUR/kWh, is cascaded to distribution-connected users at MV and LV. The capacity and energy component applied to an end user's metered load shall be adjusted for average annual network losses at the voltage level to which the user is connected and average annual network losses at all voltage levels above that level. An adjustment shall also be made to reflect the contribution of the customer class to coincident peak demand, as derived from the class load curve.
	From transmission to transmission: Not applicable, as there is only one transmission level (no EHV)
Czech Republic	**From transmission to distribution:** There is one TSO and cost cascading exists from transmission to distribution. The majority of costs of transmission system are paid only by connected distribution system operators, no customer is connected to transmission system. Producers pay only for losses by electricity withdrawal-based charge.
	From transmission to transmission: Not applied
Denmark	**From transmission to distribution:** For the grid tariff there is a 3DKK/MWh discount if connected at T-level to reflect savings with regard to transformers towards lower levels. This gives a typical discount of approximately 5-10 % for T-connected consumers with regard to the grid tariff. For all other tariffs there is no differentiation.
	From transmission to transmission: Not applied, based on the information of the NRA.
Estonia	**From transmission to distribution:** The transmission cost is cascaded through a single price in EUR/MWh applied to all D-connected users.
	From transmission to transmission: The Estonian TSO has 3 network levels (330 kV, 110 kV and 110 kV low-voltage side of a transformer). The costs that can be directly related to a specific voltage level are

[173] AT: The electricity network is divided into seven different levels: Level 1 (extra high voltage grid, 380 kV - 220 kV, incl. transformation); Level 2 (transformation extra high voltage – high voltage); Level 3 (high voltage, 110 kV); Level 4 (transformation high voltage – medium voltage); Level 5 (medium voltage); Level 6 (transformation medium voltage – low voltage); and Level 7 (low voltage, 1 kV and lower). The transmission network corresponds to Levels 1 to 3. Customers are only connected to Level 3 to 7 – level 1 and 2 are operated by TSOs and only DSOs are connected to these network levels.
[174] AT: "Network level 3" is high voltage in Austria: voltage higher than 36 kV and lower than 220 kV (in reality, 110 kV).

Country	Description of cost cascading / reason for non-application or non-applicability
	counted as costs of the corresponding voltage level. Costs that cannot be linked to a specific voltage level and costs of higher voltage level to lower voltage level are applied on the basis of the electricity consumption volumes of the consumers of the corresponding voltage level. Such a principle ensures that the consumer of 330 kV voltage level does not have to pay for the costs of 110 kV voltage level network, because the mentioned consumer does not use the 110 kV voltage level network to consume electricity. The consumer of 110 kV voltage level pays for the costs of 330 kV and 110 kV voltage level network according to the electricity consumption volume (does not include the costs paid by the consumers of 330 kV voltage level). The consumer of 110 kV low-voltage side of a transformer pays all remaining costs (does not include the costs paid by the consumers of 330 kV and 110 kV voltage level).
Finland	**From transmission to distribution:** The costs not paid by T-connected users will cascade to D-connected users. All T-costs are allocated to all network users across all voltage levels proportionally. D-connected network users at different voltage levels bear the cost of losses on the network they are connected to and on upstream (higher voltage) networks.
	From transmission to transmission: Not applicable.
France	**From transmission to distribution:** The user of the lower voltage level is considered - in the methodology - as a user of the higher voltage level. The marginal cost of the upstream level is added to the marginal cost of the lower level. The cascading of the variable cost from transmission to distribution results, in the model, in a different price in EUR/kWh per pocket, i.e the D-connected users get the same cascading variable cost if there are in the same distribution network pocket. At the end, since the French network tariff is geographically uniformised this difference in the cascading cost is not reflected in the tariff.
	From transmission to transmission: Same logic as transmission to distribution.
Germany	**From transmission to distribution:** The difference between the costs allocated to the network level and the expected network charge revenues of the level (in other words the block of costs not covered at that level) is passed on to the next network level and added to the costs of that next level. There is no separate tariff element for TSO-costs passed on to DSO-connected network users. These costs become part of the DSOs allowed revenues and as such are passed on to the network users via tariffs.
	From transmission to transmission: This form of cost-cascading exists as well, as the transmission network includes more than one voltage level.
Greece	**From transmission to distribution:** All T-costs are allocated to all network users across all voltage levels proportional to demand, at system level, during system peak periods. D-connected network users at different voltage levels bear the cost of losses on both the network they are connected to and on upstream (higher voltage) networks. Therefore, D-connected users at LV are charged a higher transmission tariff (EUR/kWh or EUR/kW of demand during peak hours for users with time-of-use meters) compared to D-connected users at MV. Accordingly, D-connected users (at MV and LV) are charged higher transmission tariffs (EUR/kWh or EUR/kW of demand during peak hours for users with time-of-use meters) compared to T-connected users, since the latter do not bear the cost of losses on the distribution network.
	From transmission to transmission: Not applicable as all transmission costs are effectively recovered by HV connected transmission demand users and by demand users connected to downstream distribution networks. (Transmission system consists of EHV and HV. However, there are no demand customers connected at EHV, whereas injection users connected at EHV or HV are not charged with use of system charges)
Hungary	**From transmission to distribution:** Distribution-connected users pay explicitly a transmission tariff related to the transmission costs (via a transmission tariff element in their final electricity bill).
	From transmission to transmission: Based on benchmarking to distribution tariffs in order to decrease the difference between distribution and transmission tariffs at the same (HV) voltage level.
Ireland	**From transmission to distribution:** Based on the information provided by the NRA in 2019, this form of cost cascading applies in the country. However, no further description was provided.
	From transmission to transmission: No information was provided whether it applies or not.
Italy	**From transmission to distribution:** The (transmission only) network charges for EHV and HV consumers are largely power-based and to a small extent energy-based. The charging of DSO tariff payments by the TSO (amounts collected from distribution-connected network users) is also a combined power-based and energy-based tariff, with the largest part - 90% - of transmission allowed revenues coming from the power-based component. When excluding the correction coefficients which account for higher losses in LV grids, the energy-based payment of distribution-connected users is 10 times higher than the energy-based part of the payment by HV users. This corresponds to all network users virtually paying the same Euro/MWh value (if charges were virtually energy-based for everybody).

Country	Description of cost cascading / reason for non-application or non-applicability
	From transmission to transmission: There is no cascading from transmission to transmission, the transmission voltage levels (380-220-150 kV) are considered as a bundle and the users connected to 380-220-150 kV grids are subject to the same network tariff (except a minimal difference in the energy component for users connected to 150 kV grids, to account for slightly higher losses).
Latvia	**From transmission to distribution:** Initially the basic tariff, which is the tariff for the highest capacity level, is calculated, the tariff of each subsequent capacity step shall cover by the costs of the previous higher capacity level (starting from the basic) + of its own costs level.
	From transmission to transmission: Only one TSO and it operates the grid in 330 kV and in 110 kV. Tariffs are calculated only for 110 kV users, so all costs from 330 kV are allocated to lower voltage transmission levels.
Lithuania	**From transmission to distribution:** The costs of the transmission system are also paid by network users connected to the distribution network.
	From transmission to transmission: No cost cascading because costs are not collected per voltage level
Luxembourg	**From transmission to distribution:** The cascading method used in Luxembourg includes all voltage levels for transmission (1 level) and distribution (3 levels). Allowed costs are computed for each voltage level and are aggregated for all the DSOs/TSO at national level. The cascading is made by using the average of the past four measured annual peaks at each voltage level. As a result, D-connected users pay a single network tariff which covers distribution and transmission costs.
	From transmission to transmission: Not applicable, as there is only one transmission level.
Malta	Not applicable in lack of transmission network.
The Netherlands	**From transmission to distribution:** For the cost allocation to users, costs of a network at a higher voltage level are allocated to a network at a lower voltage level in proportion to the share of the latter network in the total consumption of energy and/or power of the former network. The transmission tariffs are paid by the DSOs. This means that consumers pay indirectly for these tariffs through the DSO tariffs.
	From transmission to transmission: For the T-costs in 2021, this resulted in 91.3% of the costs of the extra high voltage level being allocated to the high voltage level.
Norway	**From transmission to distribution:** The recovery of the T-costs are included in the allowed revenue on the lower voltage levels. It is not a uniform price for all customers. The customer pay for costs related to their voltage level and higher voltage levels.
	From transmission to transmission: No cost cascading
Poland	**From transmission to distribution:** T-charges transferred by variable and fixed rates are taken into account in DSO rates calculation.
	From transmission to transmission: No cost cascading
Portugal	**From transmission to distribution:** D-connected users are charged with a uniform T-tariff, adjusted for network losses across the different voltage levels in distribution. That T-tariff is mainly composed by a power price, in EUR/kW, charged during the peak period. D-connected users pay on average a higher T-tariff than T-connected users, since the latter are connected at VHV, while the former are using not only the VHV level, but also the VHV/HV transformers, which are part of the transmission assets.
	From transmission to transmission: No cost cascading in the absence of separate voltage levels for T-connected users. The T-grid is operated at VHV and HV. The D-grid is operated at HV, MV and LV. However, all HV users are connected to the D-grid. Moreover, information from the T-grid is collected separately for VHV and HV assets, and a D-connected user pays for all of them due to the cost-cascading, while a T-connected user only pays for the VHV assets.
Romania	**From transmission to distribution:** The TSO operates a single voltage level (EHV), while DSOs operate three voltage levels (HV, MV, LV). The T-tariffs apply to all users, including to D-connected users; all users pay the T-tariffs separate from D-tariffs, through the electricity bill to the supplier.
	From transmission to transmission: No cost cascading because costs are not collected per voltage level
Slovak Republic	**From transmission to distribution:** Tariff for transmission system access (including network development costs), transmission system losses and Tariff for system services (costs for providing system services and procured ancillary services) is shared by D-connected users as well. This is justified on the ground that these users are causing losses in transmission system and are using the balancing services.
	From transmission to transmission: No cost cascading

Country	Description of cost cascading / reason for non-application or non-applicability
Slovenia[175]	**From transmission to distribution:** All distribution-connected users pay a transmission tariff according to the cost-cascading model. The network usage costs for a particular customer group based at a particular voltage level are determined as a ratio between the peak power of that customer group and the sum of all peak powers which are directly or indirectly connected into this or subordinate voltage level(s). This is a so called "gross" cost division method, which was justified for the Slovenian system due to a relatively low level of production on MV and LV at the time of introduction (up to 93 % of all production has been on HV level).
	From transmission to transmission: No cost cascading, because costs are not collected per voltage level
Spain	**From transmission to distribution:** The remuneration allocated to each voltage level is allocated to the voltage level itself and to lower voltage levels considering both the energy balance for the energy tariff and the power balance for the power tariff. This allocation is done for each time period.[176]
	From transmission to transmission: No cost cascading as the transmission network is one network level
Sweden[177]	**From transmission to distribution:** The costs not paid by T-connected users will cascade to D-connected users. There is not any defined method so there are not predetermined shares. Cost-cascading exists across the three different network levels (transmission, regional distribution, local distribution), since the costs of a higher voltage level is paid by the adjoining lower voltage level. However, within these levels it is up to the actual network company to decide how the costs are allocated. Many companies have some kind of cost-cascading where customers (e.g. 40 kV) don't pay capital costs for the lower voltage levels, but this is not a regulated principle.
	From transmission to transmission: The information on the details of this form of costs cascading was not available to the NRA.

Table 4: Details on cost cascading applied to distribution tariffs

Country	Description of cost cascading / reason for non-application or non-applicability
Austria[178]	**From distribution to distribution:** The costs of the higher voltage levels are distributed to the lower voltage levels to the extent of the separate direct costs of each lower voltage level, which means that the cascaded costs are added to the direct costs of the corresponding network level. The share depends on the energy directly used by customers connected to each voltage level - there is no fixed share.
Belgium	**From distribution to distribution:** Brussels: Medium/Low voltage distribution costs are precisely identified and collected, and a set of keys (e.g. Volume, EAN, meters, etc.) is defined to split the costs which are not directly related to a specific level of voltage. Keys are defined using historical data and/or technical data. Flanders: All depreciation and operational expenditures directly related to a certain voltage level are cascaded. The shares depend on the peak load per network user group. The shares differ per DSO. Wallonia: The distribution costs that are identified by tension level are allocated to the corresponding tension level. For the other distribution costs, a set of multiple keys is defined to split the costs which are not directly related to a specific level of voltage. The keys are based on kWh, on kW and on the depreciation cost per tension level.
Bulgaria	From distribution to distribution: No information was provided whether it applies or not.
Croatia	**From distribution to distribution:** Part of the distribution costs incurred at higher voltage level are reflected in the distribution tariffs at the lower voltage level. The distribution network includes the MV and LV levels. The price of the distribution tariff is not uniform and depends on the users' category.
Cyprus	**From distribution to distribution:** Separate distribution tariffs apply at MV and LV. The former applies to all loads connected to the Cyprus electricity distribution network, while the latter only applies to loads connected at LV. The unit charges are corrected for losses across voltage levels.
Czech Republic	**From distribution to distribution**: Costs are partly distributed from higher voltage level to the lower voltage level. In distribution system are costs cascaded from 110 kV to usually 22 kV (from 35 kV to 1.5 kV) and subsequently to LV.

[175] SI: For users ≥110 kV only transmission tariffs are set, regardless whether they are connected to transmission or to distribution.
[176] ES: These shares are available in worksheets "IIIa. Coeficientes Potencia" and "IIIb. Coeficientes Energía" of the tariff model for year 2021 (available in Excel format).
[177] SE: In Sweden there are 3 network levels: TSO, regional DSOs and local DSOs. The TSO operates on 220-400 kV, regional DSOs on 40-130 kV and local DSOs on 230 V - 40 kV.
[178] AT: For a description of the Austrian electricity network, please refer to footnote 173.

Country	Description of cost cascading / reason for non-application or non-applicability
Denmark	**From distribution to distribution:** Ideally from actual economic registrations. Alternatively, energy flow is used as a key to allocate costs.
Estonia	**From distribution to distribution:** The biggest DSO of Estonia (Elektrilevi) has 3 network levels: a) the undervoltage side of a 110 kV substation; b) 6-35 kV on the line and 35 kV on the undervoltage side of the substation; c) low voltage contact points. The costs that can be directly related to a specific voltage level are counted as costs of the corresponding voltage level. Costs that cannot be linked to a specific voltage level and costs of higher voltage level to lower voltage level are applied on the basis of the connection capacity of the consumers and electricity producers of the corresponding voltage level. Such a principle ensures that the consumer or generator of the undervoltage side of a 110 kV substation does not have to pay for the costs of lower voltage level network (lower medium voltage, e.g. 35 kV voltage and low voltage level network), because the mentioned consumer or generator does not use the lower voltage level network for electricity consumption or production. The consumer or generator of 6-35 kV on the line and 35 kV on the undervoltage side of the substation pays for the costs associated with the undervoltage side of a 110 kV substation according to the connection capacity (does not include the costs paid by the consumers and generators of the undervoltage side of a 110 kV substation). The consumer or generator of low voltage network pays all remaining costs (does not include the costs paid by the consumers and generators of the undervoltage side of a 110 kV substation and the consumers and generators of 6-35 kV on the line and 35 kV on the undervoltage side of the substation).
Finland	**From distribution to distribution:** Users at a lower voltage level pay for distribution costs of its own voltage level and for distribution costs of higher voltage levels. There are 77 DSOs and it varies by DSOs which voltage levels they operate. The voltage levels are 0.4 kV, 1-70 kV and 110 kV and the DSOs define their own tariff method, so there is no uniform price.
France	**From distribution to distribution:** The user of the lower voltage level is considered - in the methodology - as a user of the higher voltage level. The marginal cost of the upstream level is added to the marginal cost of the lower level.
Germany	**From distribution to distribution:** The difference between the costs allocated to the network level and the expected network charge revenues of the level (in other words the block of costs not covered at that level) is passed on to the next network level and added to the costs of that next level. The costs of the upstream network level are included into the allowed revenues allocated to the voltage level and subsequently they are passed on to the network users connected to that voltage level via tariffs.
Greece	**From distribution to distribution:** The distribution network comprises the MV and LV voltage levels. Costs of the MV are cascaded to LV. First application of the new methodology is planned in 2023. It is estimated that approximately 40% of total D-costs correspond to costs related or assigned to MV voltage level that are going to be cascaded downwards to LV voltage level, according to the new methodology. Cascading is achieved by a joint allocation of cascaded costs to both MV and LV user classes, in proportion to user class peak demand (capacity tariff element) or energy consumption (energy tariff element), after compensating for losses at the different voltage levels. The cost related to metering and metering related customer service is not cascaded.
Hungary	**From distribution to distribution:** There are 5 voltage levels: HV, HV/MV, MV, MV/LV, LV. The distributed energy with a weight of 66.6% and the contracted capacity with a weight of 33.3% are taken into account for the cost cascading approach. It is based on the ratio of the withdrawal from a certain voltage level to the total sum of the withdrawals from the same voltage level and the lower voltage levels. The result of the cost cascading is a different average distribution charge for every voltage level.
Ireland	**From distribution to distribution:** No further description was provided
Italy	**From distribution to distribution:** The shares of D-costs attributed to each voltage level are proportional to the shares of historical revenues obtained by DSOs applying tariffs originally built with a cost-cascading approach. As a result, on top of paying for transmission costs, due to cost-cascading from transmission to distribution, a distribution-connected MV client only pays for distribution costs in MV, while a distribution-connected LV client pays for distribution costs in MV and LV.
Latvia	**From distribution to distribution:** Initially, the basic tariff, which is the tariff for the highest voltage level, is calculated, the tariff of each subsequent voltage step shall cover the costs of the previous, higher voltage levels (starting from basic) + of its own costs level. Cost which is related to system security is allocated equally to each voltage level (according to consumption level).
Lithuania	**From distribution to distribution:** Cost cascading is not regulated by the NRA, it is part of the operators' D-tariff differentiation.
Luxembourg	**From distribution to distribution**: The cascading method used in Luxembourg includes all voltage levels for transmission (1 level) and distribution (3 levels). Allowed costs are computed for each voltage level and

Country	Description of cost cascading / reason for non-application or non-applicability
	are aggregated for all the DSOs/TSO at national level. The cascading is made by using the average of the past four measured annual peaks at each voltage level. As a result, D-connected users pay a single network tariff which covers distribution and transmission costs.
Malta	From distribution to distribution: No cost cascading because costs are not collected per voltage level
The Netherlands	**From distribution to distribution:** In general, the costs of each network level are allocated to users at lower voltage networks based on their relative share in the main cost driver of the relevant voltage level. At high and medium voltage level the cost driver is kW, at lower voltage levels the main cost driver is kWh.
Norway[179]	**From distribution to distribution:** Distribution costs are cascaded through the different voltage levels in the distribution grid. The costs are included in the allowed revenue on the lower voltage levels, and do not result in a uniform price for all customers.
Poland	**From distribution to distribution:** According to Ministry Regulation, distribution rates shall be calculated by taking into account the different voltage levels: HV, MV and LV. No further clarification was provided.
Portugal	**From distribution to distribution:** The different D-tariffs follow a cost-cascading reasoning: a HV user only pays the D-tariff for HV; a MV user pays the D-tariffs for HV and MV; a LV user pays all D-tariffs, namely for HV, MV and LV. The network charges are adjusted for network losses across the different voltage levels in distribution. The D-tariffs are mainly composed by a power price, in EUR/kW, charged during the peak period.
Romania	**From distribution to distribution:** D-tariffs are energy-based, calculated on the distribution costs and distributed energy related to each voltage level. These are specific tariffs (for low voltage, medium voltage and high voltage). The D-tariff paid by a user is calculated by summing the specific tariffs for its own connection voltage level and the higher voltage levels. The D-costs are allocated to each voltage level using allocation keys that are set according to the tariff methodology. As a result, the cascaded price is not uniform.
Slovak Republic	**From distribution to distribution:** Distribution costs are cascaded from higher to lower voltage levels.
Slovenia[180]	**From distribution to distribution:** The cascade network model among different voltage levels is used for cost allocation over 3 groups of voltage levels and two intermediate voltage levels (substation and transformer level). The network usage costs for a particular customer group based at a particular voltage level are determined as a ratio between the peak power of that customer group and the sum of all peak powers which are directly or indirectly connected into this or subordinate voltage level(s). This is a so called “gross” cost division method, which was justified for the Slovenian system due to a relatively low level of production on MV and LV at the time of introduction (up to 93 % of all production has been on HV level).
Spain	**From distribution to distribution:** The remuneration allocated to each voltage level is allocated to the voltage level itself and to lower voltage levels considering both the energy balance for the energy tariff and the power balance for the power tariff. This allocation is done for each time period.[181]
Sweden[182]	**From distribution to distribution:** Costs are cascaded at higher voltage level. However not explicitly so on lower. Lower voltage levels have the same price over large areas so any cascading would be averaged out. The D-costs are not divided by capacity or energy (as for T-costs), it is implicitly included, however not explicitly calculated as such. It is not certain that a lower voltage level always should contain costs from one higher. One of the biggest DSO does not explicitly cascade the D-costs due to complexity of the grid.

[179] NO: The distribution network in Norway is divided into the following voltage levels, in kV: 132, 66, 22, 11, 0.4.
[180] SI: For users ≥110 kV only transmission tariffs are set, regardless whether they are connected to transmission or to distribution. Distribution tariffs are set for: MV consumption at substation busbar; MV consumption at 35, 20 and 10 kV; LV consumption at transformer busbar; LV consumption at 1 and 0.4 kV. On each level there are also separation of tariffs according to yearly operation hours T (customers with T>2500h and T<2500h), except for households and small commercial customers.
[181] ES: These shares are available in worksheets "IIa. Coeficientes Potencia"" and "IIIb. Coeficientes Energía" of the tariff model for year 2021 (available in Excel format).
[182] SE: For a short description of the electricity network in Sweden, please refer to footnote 177.

Table 5: Description of any partial or differentiated cost-cascading either for transmission costs and/or for distribution costs

Country	Description
Belgium	For **transmission tariffs**, ancillary services and system integration costs are not cascaded as they cannot be differentiated according to user groups or voltage levels. It is considered that each user category equally benefits from these services, therefore each user category (3 T-voltage level, the lowest is mostly DSOs) pays the same tariff[183]. For **distribution tariffs** in the Flanders region, all costs that aren't (directly) related to a certain voltage level are not cascaded, namely: costs of system services, management costs, costs of capital, public service obligations, pension schemes and local retributions. The costs of system services at DSO-level are equally allocated to all D-users (both withdrawal and injection, based upon the energy withdrawn or injected). The costs of system services at TSO-level which are paid by the DSOs, are also equally allocated to D-users (only withdrawal).
Bulgaria	For **transmission tariffs** partial or differentiated cost-cascading was reported, but not described
Croatia	For **transmission tariffs**, partial cascading applies: Metering costs and administrative costs are not cascaded.
Denmark	For **transmission tariffs,** some partial or differentiated cost-cascading was reported, but not clarified. For **distribution tariffs**, metering costs and admin costs (paid as a monthly subscription) are not cascaded.
Greece	For **distribution tariffs**, partial cascading applies: Operating costs related to metering, billing and metering-related customer service are not subject to cascading, because no "cause and effect" relationship exists for these costs across different voltage levels.
Hungary	For **distribution tariffs**, the cost of the metering is not cascaded as metering and reading is directly connected to the meter of the network user.
Portugal	For **transmission and distribution tariffs**, there is differentiated cascading of one billing variable, namely of the contracted power, in EUR/kW, which reflects the costs of peripheral network assets that are closer to the user and used by a low number of end-users (as opposed to central assets, used by a large number of users). When cascaded to lower voltage levels, the price of contracted power is converted into the price of a different billing variable (peak power), assuming a simultaneity factor. This happens because the contracted power of a user at a lower voltage level (e.g. LV) will not be using peripheral assets of the higher voltage level based on the measurement taken at the lower voltage level. For this reason, the contracted power price is converted into a peak power price based on the expected relationship between contracted power and peak power. Another differentiation performed when applying cost cascading is to correct the prices through loss factors, reflecting grid losses. For instance, when measuring network utilisation at low voltage, a measurement of 1 kWh or 1 kW at a LV meter, means that the network user is using the higher voltage level at a value larger than 1 kWh or 1 kW. To take this into account, prices are differentiated across voltage levels.

Note: partial cost-cascading means that some cost categories are cascaded, while other cost categories are not cascaded. Differentiated cost-cascading means that different cascading criteria are applied to different cost categories and/or to different network users.

Table 6: Exemptions from cost-cascading applicable to some groups of network users

Country	Description
Austria	For **transmission tariffs**, pumped hydro-storage is exempted. As pumped hydro-storage is important for the whole energy system, these facilities have to pay a reduced network utilisation tariff. For **distribution tariffs**, network users which are participating in renewable energy communities are exempted from the D-cost cascading part, when they do not withdraw energy from the public network system outside the community.
Portugal	For **transmission and distribution tariffs**, network users participating in self-consumption, which corresponds to energy sharing of renewable energy over the public grid, is partially exempted from cost-cascading. For instance, if the generation site is connected at MV and the consumption site at LV, the withdrawal at LV does not pay network tariffs towards voltage levels above MV. In this example, there exists cost-cascading from MV to LV, but not from higher voltage levels to LV. The reason for this exemption is cost-reflectivity, as it is reasonable to assume that the energy shared over the public grid does not use upper voltage levels, since energy is measured in 15 minute intervals for injections and withdrawals, and inverted power flows are still a residual phenomenon.

Note: general tariff exemptions for some network users - i.e. not exemptions explicitly from the cost-cascading method - are not listed for this table

[183] BE: Transmission tariffs are paid by T-users and DSOs. DSOs then recover the transmission costs (of T-tariffs) they have paid through D-tariffs, so D-users also pay for these services based on their net withdrawals (but DSO withdrawals are a global net amount while individual T-user pay for their individual net withdrawals).

Table 7: Recent changes to the cost models or cost cascading or planned future changes

Country	**Recent changes (i.e. compared to last ACER reports in 2019 and 2021) or changes which are currently under consideration**
Belgium	The cost classification has changed and most network costs are allocated based upon peak load instead of energy consumption. The next tariff methodology (starting 2025) will probably not use the same principle, but new ones, which are not set yet.
Denmark	A thorough revision of the transmission tariff methodology is under way, including: introduction of capacity payment (to reflect the fact that many grid costs are fixed costs), fixed element in the system tariff to recover residual costs (to reflect that costs are not related to energy), allocation of more costs to producers for connection to the system (to establish a more cost-reflective tariff system with regard to producers, time differentiation (to incentivize a more effective use of the system). This reform will be implemented during the coming years. The described distribution tariff methodology is applied from 2023-2027. There are ongoing considerations regarding a bigger emphasis on capacity tariffs and a TSO-DSO model.
France	The marginal cost methodology has been upgraded in order to adapt to the strong growth in investments forecasted in the future. The updated methodology is based on more precise grid data collected from system operators. The updated methodology consists in defining grid pockets that includes all the grid infrastructure of a voltage range connected downstream of a transformer substation. The cost of a grid pocket is partly explained by the characteristics of the users connected to it: the methodology is based on the marginal cost of the number of users and the marginal cost of peak load. A model based on grid pockets enables to bring out a different cost per grid pocket. This could be used to apply different network tariffs for users connected to different grid pockets. However, since the French network tariff is geographically uniform, this difference in the cascading cost is not reflected in the tariff.
Germany	On 2 Sep. 2021, the ECJ ruled (C-718/18) that the so called normative regulation that is applied in Germany does not comply with EU-Law. BNetzA will have to become more independent. In particular - among others - the network tariff methodology cannot be set in ordinances, but will have to be added to BNetzA's jursidiction. BNetzA will evaluate the necessity of any changes to the tariff methodology.
Greece	A new T-tariff methodology will apply starting from 1 July 2022 (more information here). Main changes compared to the previous methodology are the following: • Change in the approach to allocate T-costs to classes of network users: According to the new tariff methodology, T-costs are allocated to network users (or classes of network users) in proportion to the actual maximum demand registered during predefined peak periods in each month. The change aims to increase cost reflectivity and fairness of the tariff (changes compared to the previous methodology include definition of extended system peak periods throughout the year), predictability of imposed charges and also to provide more effective signals to network users in order to promote demand shifting (in the new methodology, peak periods are defined ex-ante for the next year; in the previous methodology, allocation of T-costs was based on the winter and summer peak hours, determined ex-post). • Change in T-tariff basis: Transmission charges according to the new methodology are based entirely on actual power/energy withdrawn from the network (no subscribed capacity charge for low voltage users). Network users with hourly metering (currently all T-connected users, D-connected medium voltage and large low voltage users) are charged on the basis of their actual demand during system peak periods (actually the monthly charge is based on the average over the 80 highest 15 minute average demand values registered during system peak periods in each month). All other users, equipped with conventional meters, are charged on the basis of their energy consumption regardless of the time-of-use. • Use of available hourly metering data to calculate charges was extended to large low voltage customers. • Rebates are introduced for high voltage (T-connected) and medium voltage (D-connected) users having both annual energy consumption and annual average load factor above a threshold. The rebates are expressed as percentage on the monthly T-charge, ranging from 33% to 54% depending on the annual energy consumption and the annual average load factor of the network user. A new D-tariff methodology will apply starting from 1 July 2022 (more information here). Main changes compared to the previous methodology are the following: • Change in the approach to allocate D-costs to categories of network users and in D-tariff basis: • According to the previous methodology, the sum of D-costs was first allocated to MV and LV users on the basis of each category's aggregate demand during the hours of winter and summer peak demand on the distribution network. Further allocation to LV subcategories was based on annual energy consumption. D-tariffs were based on peak demand (for users equipped with electronic interval meters), on subscribed capacity (for users with conventional meters) and on energy (for all users). The split between costs recovered through demand/capacity and energy charges deviated significantly from what would be expected given the respective cost drivers. • According to the new tariff methodology D-costs are categorised as fixed, power/capacity related and energy related. They are then allocated to user categories on the basis of relevant allocation keys (number of users, peak demand, subscribed capacity, energy consumption) and recovered through corresponding

Country	Recent changes (i.e. compared to last ACER reports in 2019 and 2021) or changes which are currently under consideration
	unit charges (€/user, €/kWpeak, €/kVA, €/kWh). The changes aim to increase cost reflectivity and fairness of the tariff and also to provide more effective economic signals to network users in order to promote demand shifting and/or rationalisation of subscribed capacity requirements. • Use of available hourly metering data to calculate charges was extended to large low voltage customers. • Ex-ante definition of extended system peak periods throughout the year, as opposed to the previous methodology according to which allocation of D-costs was based on the winter and summer peak hours, determined ex-post. No changes in cost-cascading.
Latvia	NRA plans to make amendments in the tariff calculating methodology to improve the regulatory environment for current situation in 2022 (high energy prices). Improvement of regulatory account.
Luxembourg	Parallel to the search for a future proof tariff structure, the current cascading could be reviewed. NRA is open to discuss changes in the cost-cascading with TSO/DSOs.
The Netherlands	In 2022, the ACM will launch a study, including a consultation round, into the question of whether it is desirable and feasible to continue to offer the volume discounts that system operators give to the energy-intensive industry on the basis of the volume correction scheme and, if so, how.
Portugal	The analysis on inverted power flows is ongoing. If it concludes that the phenomenon is becoming relevant, the exemption from cost-cascading applied to some network users (self-consumption) will be reduced. The possibility to reduce that exemption is already foreseen in the regulatory framework, but a corresponding parameter would need to be published.
Slovenia	New tariff methodology is under consideration as improvement of the existing one. The same tariff structure based on capacity and energy charges is maintained, but increasing cost-reflectivity by identifying cost drivers separately for capacity and energy and including time-block discrimination for all costumer groups based on more detailed consumption and generation data (15 minutes).
Spain	Transmission tariffs were fixed by the Government until 2019. The Royal Decree Law 1/2019, of 11 January, established that the CNMC is responsible of establishing transmission and distribution tariffs from 1 January 2020. Transmission tariffs are now fixed according to the new methodology established in Circular 3/2020, which came into force on 25 January 2020. The first application of the new tariffs was in 2021, (exceptionally starting on 1 June).
Sweden	In 2020 the TSO changed the energy component to be dynamic, using the electricity market prices. Additional changes were made in 2021 regarding the energy component. These changes were made to give customers more correct price signals. The TSO is currently reviewing its tariff methodology, and the NRA has made changes in the overall tariff methodology. The changes that are decided by the NRA are that the tariff should have four components, energy, capacity based, customer related costs, and a fixed charge. The energy, capacity-based and customer-related charges should be cost-reflective. The residual costs are covered by the fixed component. Sweden follows a mix of the cost models: the energy component uses an incremental cost approach; the capacity component follows a forward-looking cost approach; the customer related charges are based on an average cost approach. These changes are already decided by the NRA but will not take effect before 1 January 2027, since the network operators need the new smart meters to fully incorporate these new tariffs. Regarding cost-cascading the NRA has decided through a new regulation that the network company first divides its costs between injection and withdrawal, and second divides the costs into the fore-mentioned four components. Each component is then cost cascaded down to the next grid level, and in the end, to the final customer.

Table 8: Application of injection charges, reasons behind and actions that preceded the decision on them

Country	Application of injection charge and reasons behind		Actions that preceded the decision to introduce, to change or to phase-out the injection charge	
	Transmission	Distribution	Transmission	Distribution
Austria	✓Yes (for better cost reflectivity)	✓Yes (for better cost reflectivity)	👁 Consultation of national system operators and network users	👁 Consultation of the relevant stakeholders as part of the annual tariff setting procedure
Belgium	✓Yes (for better cost reflectivity)	Brussels: ✘Never applied	👁 Consultation of national system	Flanders: 👁 Consultation of system or network operators and

Country	Application of injection charge and reasons behind		Actions that preceded the decision to introduce, to change or to phase-out the injection charge	
	Transmission	**Distribution**	**Transmission**	**Distribution**
		(due to very few injection sites does not deemed to be needed by the regulator) Flanders: ✓Yes Wallonia: ✓Yes	operator and network users[184] Impact assessment studies	concerned network users[185] Impact assessment studies Wallonia: Consultation of system or network operators and concerned network users organised by the DSOs[186]
Bulgaria	✓Yes	✗No	Consultation of national network users	
Croatia	It will be applied from 2023	It will be applied from 2023		
Cyprus	✗Never applied (to promote RES and storage there are no injection charges)	✗Never applied (to incentivise greater penetration of distributed generation)		
Czech Republic	✗Never applied (due to risks of distortions in cross-border competition)	✗Never applied (due to risks of distortions in cross-border competition)		
Denmark	✓Yes	It will be applied from 2023	Consultation with TSOs of neighbouring countries	
Estonia	✗Never applied (the TSO proposed not to apply them, to encourage investments in large RES projects)	✓Yes (DSOs proposed to apply them, for cost reflectivity and equity reasons)		The DSO provided the NRA with explanations and reasons why the application of the injection charge is fair and justified.
Finland	✓Yes (for better cost reflectivity)	✓Yes (for better cost-reflectivity)	No consultation or impact assessment	National law sets a cap for charge for injection in DSO low voltage network.
France	✓Yes (for better cost reflectivity)	✓Yes Yearly management charge, which aims to cover costs related to the management of producers by the DSO It is not considered as an injection charge by the NRA.	Consultation of national system operators and network users[187]; Impact assessment studies	

[184] BE: http://www.creg.info/pdf/Opinions/2014/Methodo/DossierAdmin/E-12-RapportConsultation-FR.pdf
[185] BE (FLA): https://www.vreg.be/nl/afgesloten-consultaties#:~:text=Consultatie%20tariefmethodologie%202021,vanaf%202022
[186] BE (WAL): https://www.cwape.be/node/177#travaux-prparatoires
[187] FR: Link to outcomes: Public consultation No.2019-011 of 23 May 2019 relating to the structure of the next tariffs, TURPE 6, for the use of the public electricity grids: https://www.cre.fr/Documents/Consultations-publiques/Structure-des-prochains-tarifs-d-utilisation-des-reseaux-publics-d-electricite-TURPE-6
Public consultation No.2020-007 of 19 March 2020 relating to the withdrawal component of the next tariffs, TURPE 6, for the use of the public electricity grids: https://www.cre.fr/Documents/Consultations-publiques/composante-de-soutirage-des-prochains-tarifs-d-utilisation-desreseaux-publics-d-electricite-turpe-6
Public consultation No.2020-015 of 1 October 2020 relating to the next tariffs for the use of the public electricity transmission grids (TURPE 6 HTB): https://www.cre.fr/Documents/Consultations-publiques/prochain-tarif-d-utilisation-des-reseaux-publics-de-transport-d-electricite-turpe-6-htb

Country	Application of injection charge and reasons behind		Actions that preceded the decision to introduce, to change or to phase-out the injection charge	
	Transmission	**Distribution**	**Transmission**	**Distribution**
		Substantial injection charge is not applied due to strong opposition by all concerned actors, (but still under consideration)		
Germany	✘Never applied (prohibited by national law)	Negative injection charge (for avoided network costs by the DSO)		
Greece	✘Never applied (no significant structural inefficiencies due to location of generation and demand in T-network)[188]	✘Never applied, but may be considered in the future[189]		
Hungary	✘Never applied (due to concerns on generation adequacy[190])	✘Never applied (due to concerns on generation adequacy)		
Ireland	✓Yes	✘Never applied (injection pays for their distribution connection at the time of connection to the D-grid)		
Italy	➡ Phased-out due to national law changes[191]	✘Never applied[192]		
Latvia	✓Yes (for better cost-reflectivity)	✓Yes (for better cost-reflectivity)	👁 Consultation of national system operators and network users[193] 👁 Consultation of NRAs of neighbouring countries[194]; 📜 Impact assessment studies.	👁 Consultation of system or network operators and concerned network users[195] 👁 Consultation of NRAs of neighbouring countries); 📜 Impact assessment studies

[188] GR: It has been demonstrated that the structural inefficiencies in the transmission system (locational unbalance of supply and demand) did not impact system operation in a significant and frequent manner, to necessitate imposing an injection charge (which would enhance signals provided to generators to situate new capacity closer to demand centres).
[189] GR: Injection pays for network extension and reinforcement through connection charges. There is also a provision for injection to pay for O&M costs related to network infrastructure that is used exclusively by injection and not to serve demand. Injection fees have never been systematically considered, but it is expected that they will need to be considered in the context of necessary network development in high DER deployment scenarios.
[190] HU: The system already lacks conventional power plants, which discourages the introduction of any non-zero injection charge.
[191] IT: No consultations, G-charge was removed from 1 January 2010 by regulatory decision 203/2009, taking into account a provision set by article 33(5) of Italian law 99/2009, which was later repealed. Injection charges have been applied till the middle of the regulatory period 2008-2011. For year 2008, Annex A to the tariff regulatory decision 348/2007 set a value of 0.256 EUR/MWh to be paid by producers
[192] IT: The payments (also by D-connected generators) which were phased out in 2009 only pertained to transmission charging.
[193] LV:
https://www.sprk.gov.lv/content/publiskas-konsultacijas;
https://www.sprk.gov.lv/sites/default/files/editor/ED/KD_par%20elektroener%C4%A3ijas%20p%C4%81rvades%20sist%C4%93mas%20pakalpojumu%20tarifu%20apr%C4%93%C4%B7in%C4%81%C5%A1anas%20metodiku.pdf (only in Latvian)
[194] LV: Before introduction of the injection tariff, the NRA presented to the EE and LT NRAs about plans and justification, as it deemed that their market areas could be affected.
[195] LV:
https://www.sprk.gov.lv/sites/default/files/editor/ED/Konsultaciju_dokumenti/Elektroenergija/2019/KD_grozijumi_elektroenergijas_metodika_22092019.pdf
https://www.sprk.gov.lv/sites/default/files/publiskas_konsultacijas/SSO_Tarif_met_Vied_apk_30092019.pdf

Country	Application of injection charge and reasons behind		Actions that preceded the decision to introduce, to change or to phase-out the injection charge	
	Transmission	**Distribution**	**Transmission**	**Distribution**
Lithuania	✘Never applied (lack of surplus of electricity generation in the network)	✘Never applied (lack of surplus of electricity generation in the network)	Initial discussions about the need for injection charge. No formal studies have been carried out yet.	Initial discussions about the need for injection charge. No formal studies have been carried out yet.
Luxembourg	N/A (no injection is connected to the T network)	✘Never applied (because D-costs in Luxembourg are driven by load; as well to keep a level playing field for producers connected in the common DE-LU market)		
Malta	N/A (no transmission network / no TSO)	✓Yes		👁 Consultation with system operator and approval by the Parliament, since electricity tariffs in Malta are established through National legislation.
The Netherlands	✓Yes Small fixed lump sum fee that only covers a very limited set of transmission costs (mainly administrative costs)[196] It is not considered as an injection charge by the national law. Substantial injection charge is not applied due to risks of distortions in cross-border competition	✓Yes Small fixed lump sum fee that only covers a very limited set of distribution costs (mainly administrative costs)[197] It is not considered as an injection charge by the national law. Substantial injection charge is not applied due to risks of distortions in cross-border competition		
Norway	✓Yes	✓Yes	👁 Consultations with system or network operators, concerned network users; 📜 Impact assessment studies	👁 Consultations with system or network operators, concerned network users; 📜 Impact assessment studies
Poland	✘Never applied (due to restriction by the national law)	✘Never applied (due to restriction by the national law)		
Portugal	➡ Phased out on 1 January 2022 due to risks of distortions in cross-border competition following neighbouring country's decision to phase out[198].	✘Never applied[199]	👁 Public consultation Most stakeholders were in favour of the phase-out, having in mind the elimination in Spain. Some raised concerns that the net effect on	

[196] NL: Grid users that only inject pay only a tariff that is fixed (independent from the energy injected). These fixed tariffs only contribute to a limited set of fixed distribution costs: administrative costs, costs for facilitating switching, costs for allocation, verification and validation and the cost of maintaining the register of connections, costs of the administrative processing of metering data and the billing costs.
[197] Idem.
[198] PT: The original implementation of the injection charge in Spain was also the main reason for introducing an equivalent tariff in Portugal.
[199] PT: What existed until 31 December 2021 was a T-tariff for injection at transmission level (VHV or HV) and at distribution level (only HV and MV, not at LV).

Country	Application of injection charge and reasons behind		Actions that preceded the decision to introduce, to change or to phase-out the injection charge	
	Transmission	**Distribution**	**Transmission**	**Distribution**
			consumers may be negative[200].	
Romania	✓Yes (cost reflectivity)	✘Never applied (not to discourage distributed generation, which is not yet sufficiently developed and have a beneficial effects on the networks)	National law change required flat charge for injection (i.e. without locational differentiation)[201]	
Slovak Republic	✓Yes. (due to better cost reflectivity)[202]	✓Yes (due to better cost reflectivity)[203]	👁 Consultation of the network users	👁 Consultation of system or network operators and concerned network users.
Slovenia	✘Never applied (due to restriction by the recently repealed national law)	✘Never applied (due to restriction by the recently repealed national law)		
Spain	➡ Phased out[204] (due to legal change injection charge could not be used to provide locational signal)	✘Never applied		
Sweden	✓Yes (due to better cost reflectivity)	✓Yes (due to better cost reflectivity and avoid subsidy for export)[205]	👁 Consultation of national stakeholders[206]	

Table 9: TSO costs (partially) recovered via transmission charges for injection

Country	Costs for building, upgrading, maintaining infrastructure	Costs for grid losses	Costs for system services	Costs for metering, administrative / management costs
Austria		X (E)	X (E)	
Belgium			X (E)[207]	
Bulgaria	X (E)	X (E)	X (E)	X (E)
Denmark	X (E)	X (E)	X (E)	
Finland[208]	No data	No data	No data	No data

[200] PT: As producers' new bidding behaviour is not likely to have an effect on the Iberian wholesale market (i.e. not reducing the price by the amount of the eliminated injection charge), while the transmission tariff for withdrawals will increase to make up for the lost revenue.
[201] RO: In 2017, the electricity law was amended by eliminating the zonal tariffs (for both for injection and withdrawal) to ensure that all producers pay the same injection charge; before different injection charges were applied for 7 location.
[202] SK: Producers are also using transmission grid, therefore they are paying part of T-tariffs
[203] SK: Producers are also using distribution grid, therefore they are paying part of D-tariffs
[204] ES: According to Article 16.1 of Law 24/2013 tariffs must be unique throughout the national territory. Consequently, G-charges cannot be used to provide generators location signals. In addition, the G-charge was established in variable terms and eventually implemented in the price paid by consumers. As a consequence the G-charge has been removed by the Circular 3/2020 and the entire cost of networks are allocated to demand. There has never been any charges related to ancillary services, system loss charges, metering charges.
[205] SE: Removing fees for producers would significantly increase costs for local consumers and lead to a subsidy for export which would risk the acceptance for the energy transition as well as the possibility to have industry in rural Sweden.
[206] SE: The final tariff methodology designed by the Swedish TSO and formulated after a remittance process with the involved actors. The actors are included in a reference group that discusses and analyses proposed changes. All changes are approved by the board of the TSO.
[207] BE: Ancillary services reservation costs / part of the balancing reserves costs. Injection tariffs equally share ancillary services costs among all network users.
[208] FI: G-charges consist of fixed capacity fee per MW for power plants and energy-based charge for the use of grid / input into the grid. The NRA did not have information about which cost categories each tariff basis recover.

Country	Costs for building, upgrading, maintaining infrastructure	Costs for grid losses	Costs for system services	Costs for metering, administrative / management costs
France		X (E)[209]		
Ireland	No data	No data	No data	No data
Latvia[210]	X (P)	X (P)	X (P)	X (P)
The Netherlands				X (L)[211]
Norway	X (L)	X (E)	X (L)	X (L)
Romania		X (E)	X (E)[212]	
Slovak Republic	X (P)			
Sweden[213]	X (P)	X (E)	X	X (P)

Note: E=energy-based, P=power-based, L=Lump sum

Table 10: DSO costs (partially) recovered via distribution charges for injection

Country	Costs for building, upgrading and maintaining the D-infrastructure	Costs for grid losses	Costs for system services	Costs for metering, administrative / management costs[214]
Austria[215]		X (E)	X (E)	X (L)[216]
Belgium[217]	Flanders: X (from Jan. 2023)	Flanders: X (E) (until Dec. 2022)	Flanders: X (E) (until Dec. 2022) Wallonia: X (P, EUR/kVA[218])	Flanders: X (E) (until Dec. 2022) Wallonia: X (L, EUR/year)
Denmark				
Estonia[219]	X (P+ L[220])	X (P)	X (P)	X (L[221] + P)
Finland[222]	No data	No data	No data	No data
France				X (L)
Germany[223]				

[209] FR: The injection charge covers losses on the national network generated by electricity exports and the part of Inter TSO Compensation costs associated to losses on the national network.
[210] LV: In Latvia, the injection charge aims to recover part of the TSO costs (i.e. it covers multiple cost categories and not dedicated to a specific cost categories).
[211] NL: Administrative costs, costs for the costs of the administrative processing of metering data, the administration of the register of connections, and the billing costs.
[212] RO: Congestion management costs
[213] SE: The energy-based charge consist of two parts: marginal loss coefficient (which is computed individually for every user) and the energy price on the day-before market. The split between the cost recovery of the 2 tariff basis may significantly vary much from year to year because the energy charge is connected to the electricity market price.
[214] Including costs for warnings, disconnection from the grid, etc.
[215] AT: The ancillary services are covering approximately 0.6%, the metering charges covered by the producers approximately 0.4 % and the charges for system losses paid by the producers approximately 1.3 % of the D-costs.
[216] AT: The metering charge is applied based on the type of meter and is defined as price cap per meter per month.
[217] BE (FLA): Until December 2022 D-injection charges for recovery of grid losses, system services and other costs (pension schemes and local retributions) are applied and recovered via energy-based tariffs. From January 2023 D-injection charges for recovery of network costs (directly related to injection) will be applied instead.
[218] BE (WAL): This depends on the standard profile of the producer: for instance, for producer profile: TMT (MV) wind (22 GWh – 10 MW – 2200 h – 0% self-consumption): fixed term: 20% - capacity term: 80%; for producer profile: MV (MV) biomass (7820 MWh – 1.15 MW – 6800 h – 50% self-consumption): fixed term: 85% - capacity term: 15%, for producer profile: TBT/BT (LV) solar (142500 kWh – 150 kW – 950 h –78% self-consumption): fixed term: 5% - capacity term: 95%.
[219] EE: the power-based charge is based on contracted power.
[220] EE: The lump sum charge recovers part of the DSO costs without aiming a specific cost category. It includes all the costs of metering but partly also other costs (for example, the costs of administration, management and maintenance of the distribution network).
[221] EE: Idem.
[222] FI: Producers usually pay (for injection) a fixed monthly fee (EUR/month lump sum), an energy-based fee (EUR/MWh) and a generation capacity fee (based on actual maximum capacity)The NRA did not have information about which cost categories each tariff basis aim to recover and the share of cost recovery by each of them..
[223] DE: The “negative injection charge” applies for any avoided network costs of the DSOs.

Country	Costs for building, upgrading and maintaining the D-infrastructure	Costs for grid losses	Costs for system services	Costs for metering, administrative / management costs[214]
Latvia[224]	X (P)	X (P)	X (P)	X (P)
Malta				X (L, EUR/year)
The Netherlands				X (L, EUR/year)
Norway[225]	X (L)	X (E)	X (L)	X (L)
Slovak Republic	X (P)			
Sweden[226]	X (P)	X (P)		X (P)

Note: in parenthesis the respective tariff basis used for the recovery of the cost category is provided. E=energy-based, P=power-based, L=Lump sum

Table 11: Value for annual total transmission G-Charges paid by the producers [M€]

Country	Value for annual total transmission G-Charges paid by the producers [M€]								
	2013	2014	2015	2016	2017	2018	2019	2020	2021
Denmark	12.18	11.71	14.21	10.04	10.9	11.1	10.68	10.42	12.01
Finland	30.08	29.7	33.91	44.28	53.53	56.33	No data	No data	No data
Ireland	52.1	60.18	60.0	60.81	58.47	61.94	69.54	75.71	76.66
Latvia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.461
Norway[227]	57.14	71.05	No data	69.37	No data	No data	82.9	80.3	No data
Portugal	23.8	24.62	23.97	27.8	25.24	28.06	24.45	24.76	23.29
Romania	117.87	131.89	70.73	20.92	11.43	13.6	12.93	13.25	13.87
Slovak Republic	N/A	7.84	7.96	7.83	7.77	7.91	8.8	8.9	9.4
Spain	137.49	128.99	131.45	132.5	131.2	130.5	129.2	N/A	N/A
Sweden[228]	86.02	85.76	90.49	75	90.58	No data	No data	99.6	101.6

Table 12: Total measured energy injected annually by the producers to the transmission system [TWh]

Country	Total measured energy injected annually by the producers to the transmission system [TWh]								
	2013	2014	2015	2016	2017	2018	2019	2020	2021
Denmark	30.29	29.04	35.34	28.86	27.62	27.04	26.70	25.89	29.74
Finland	42.97	36.4	37.67	63.23	58.04	60.27	No data	No data	No data
Ireland	25.62	25.78	No data	28.3	29.53	29.3	29.48	30.74	30.12
Latvia									4.599
Norway	57.17	60.68	No data	63.04	No data	No data	29.5	67.2	No data
Portugal	47.3	49.51	48.08	55.82	54.43	56.2	48.7	49.3	46.6
Romania	52.4	57.29	57.79	56.97	56.15	56.94	52.37	49.63	52.79
Slovak Republic		15.68	15.92	15.74	16.14	15.94	17.5	17.8	18.8
Spain	270.53	257.98	262.91	265.01	262.4	261	258.4		
Sweden	105.3	116.6	117.8	118.05	122.34	124.4	No data	120	121

[224] LV: In Latvia, the injection charge aims to recover part of the DSO's costs (i.e. it covers multiple cost categories and not dedicated to a specific cost categories).
[225] NO: 2020: G-charge: 82%, Energy component: 18%
[226] SE: In one of the largest DSO area the injection charges differ between the two kinds of distribution networks in Sweden. For the local grid (max 10kV) it is based on yearly max power produced. Sek/kw, year without any respect to when. For the regional grid (larger than 10kV) it is based on location and subscribed power. Simplified the distance to closest TSO connection multiplied by subscribed power and price. They also pay for the injection fees from the TSO (cascading). If they are on the 130kV level they also in general are seen as increasing our losses and as such pay for produced energy to cover our costs of losses from production.
[227] NO: 9.7 NOK/EUR exchange rate was used for years 2019 and 2020.
[228] SE: 10.6 SEK/EUR exchange rate was used for years 2020 and 2021.

Table 13: Annual average transmission G-charges paid by producers [€/MWh]

Country	Annual average transmission G-charges paid by producers [€/MWh]									Legal limit [229] [€/MWh]
	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Denmark	0.4	0.4	0.4	0.38	0.4	0.4	0.4	0.4	0.4	1.2
Finland	0.7	0.85	0.9	0.7	0.92	0.93	No data	No data	No data	1.2
Ireland	2.03	2.33	0	2.15	1.98	2.11	2.4	2.5	2.5	2.5
Latvia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.535	0.5
Norway[230]	1.00	1.17	1.04	1.1	1.1	1.1	1.1	1.16	1.2	1.2
Portugal	0.5	0.5	0.5	0.5	0.46	0.5	0.5	0.5	0.5	0.5
Romania[231]	2.25	1.97	1.22	0.37	0.2	0.24	0.25	0.27	0.26	2
Slovak Republic	N/A	0.5	0.5	0.4974	0.48	0.5	0.5	0.5	0.5	0.5
Spain	0.5	0.5	0.5	0.5	0.5	0.5	0.5	N/A	N/A	0.5
Sweden	0.83	0.65	0.77	0.63	0.74	No data	No data	0.83	0.84	1.2

Table 14: Percentage of transmission costs covered via injection charges and allocation method

Country	Percentage of T-costs covered via injection charges	Allocation method of the T-costs between injection charges and withdrawal charges and methodology for the calculation of T-tariffs for injection
Austria	7%	Recovery of network losses: The charge for network losses is calculated by adding all costs for network losses and dividing by the quantities supplied and injected. The share arise by multiplying the injected volumes by the charge for network losses. Recovery of costs of system services: According to Section 48 of the Electricity Act 2010, the regulatory authority shall regularly ex officio establish the allowed cost, targets and volume situation of system operators with an annual quantity supplied to withdrawing parties of more than 50 GWh in the calendar year 2008 by official decision. The allowed cost and the volume situation of other system operators may be established ex officio by official decision.
Belgium	5%	50% of ancillary services reservation costs are allocated to injection, but with a cap, which is determined according to a benchmark with neighbouring (NWE) countries' injection charges.
Bulgaria	No data	No data
Denmark	3.6%	Injection rate for infrastructure has been fixed, and for system services set through a method. No further description of the method was provided. Remaining costs are covered through the withdrawal tariff.
Finland	Not available	This Information is not collected by the NRA. G-charges consist of fixed capacity fee per MW for power plants (without variation) and energy-based charge for the use of grid / input into the grid.
France	2.9%	The injection charge is calculated as the following: The cost associated with electricity exports (sum of losses on the national network associated to electricity exports and of the part of Inter TSO Compensation costs associated to losses on the national network) is divided by the forecasted energy injection on voltage levels 150 kV and above. The rest of the costs are covered by withdrawal charges. The current injection charge is 0.23 €/MWh.

[229] Upper value of the range set by point 3 of Annex Part B of Commission Regulation (EU) 838/2010 and by the Decision of the EEA joint Committee No 7/2011.
[230] NO: the values in the table refer only to the G-charge, they do not include the additional mark-up for system operation (i.e. 0.2 EUR/MWh in years 2017-2019, 0.05 EUR/MWh in 2020 and 0.17 EUR/MWh in 2021, calculating with 10 NOK/EUR exchange rate).
[231] RO: The value for the annual average transmission G-charges paid by producers is determined by dividing the total revenue collected from the transmission and distribution-connected producers to the total measured electricity injected into both T-grid and D-grid.

Country	Percentage of T-costs covered via injection charges	Allocation method of the T-costs between injection charges and withdrawal charges and methodology for the calculation of T-tariffs for injection
Germany	Not applicable	The negative injection charge is based on the general network tariffs for withdrawal. Injection to a certain network level leads to the payment of a negative injection charge according to the tariff of the upstream level. E.g. if a plant is connected to the LV level, the negative injection charge is calculated according to the network operator's tariff for the MV/LV level. This is due to the assumption that injection to a certain voltage level avoids withdrawal from the next upstream level.
Ireland	25% (2020)	The Generators Transmission Use of System (G-TUoS) tariffs are calculated individually for each generator based on the location of its connection to the system. This G-TUoS charge is capacity based (i.e. based on MEC of generator).The G-TUoS tariff has a locational element; which is calculated considering the usage of current generation on future network using a "reverse MW mile" methodology. There is also a Postage Stamp element which applies evenly to all generators based on their Maximum Export Capacity (MEC).G-TUoS is set to collect 25% of the approved revenue for network costs.
Latvia	3.2% (2020)	Injection charge is set according to the ceiling set by the EU law for Latvia (i.e. 0.5 EUR/MWh). The total transmission costs recovered via injection charges is calculated by multiplying the total electricity injected directly into the T-grid (MWh) by 0.5 EUR/MWh (which is the maximal charge set in Regulation for Latvia). The injection charge is calculated by dividing the above calculated sum (in EUR) by the total installed generation capacity (MW) connected to the T-grid. The rest of the transmission costs are recovered by withdrawal charges.
The Netherlands	Close to 0%	Grid users that only inject pay only a fixed lump sum tariff, which contributes to administrative costs, processing of metering data, the administration of the register of connections, and the billing costs. The rest of the costs are recovered through withdrawal charges. Due to the small size of this tariff, it is not a relevant factor for producers and could not disturb a level playing field.
Norway	10,5%	The injection charge includes: a G-charge for infrastructure costs (i.e. CAPEX and OPEX), a surcharge for system services costs as well as an energy-based charge to cover marginal losses. The G-charge and the surcharge for system services costs is a lump sum payment which is based on a 10-year moving historical average of production and have been designed in order to be neutral with respect to short-run production decisions and long-run capacity investment decisions. The charge for each generator is calculated each year from the average production in previous years[232] (i.e. the charge for 2022 is based on average production during the years 2011-2020). The generators cannot influence the annual cost by altering the operational decisions as the yearly amount is given at the start of the year.
Romania[233]	6%	Transmission charge for injection is determined by considering a revenue and an estimated injected electricity into both transmission grid and distribution grid. The revenue is corresponding to costs associated to injected electricity: the part of grid losses related to generated electricity and congestion costs. Generators pay through the network charge up to one third of the cost of grid losses as well as the cost of congestion.
Slovak Republic	No data	T-costs are set independently. NRA sets fixed power-based unit price (EUR/MW) for access and energy-based (EUR/MWh) for transmitted energy. Basic for the calculation of this tariff (for access to the transmission system) is rated power of the generation equipment and their maximum possible injection capacity (MW) (methodology is published in the TSO technical documentation) and this value is then stated in the contract. The coefficient of inclusion of power generators´ reserved capacity (so called G-charge) shall be - according to the NRA's Decree - set in such a way so that the planned payments which power generators connected to the transmission grid make to the TSO for transmission network access in year t do not exceed the revenue set as multiplication of 0.5 EUR/MWh and the planned volume of power supplied to the transmission grid in year t by power generators connected to the transmission grid.
Sweden[234]	35%	No data

[232] NO: For hydro-power, the charges paid by producers can, to a large extent, be considered as fixed, depending on the amount of precipitation and inflows to the reservoirs on average during the previous years.
[233] RO: Preliminary data
[234] SE: The split between the cost recoveries of the 2 tariff basis may vary much from year to year due to that the energy charge is connected to the electricity market price.

Table 15: Percentage of distribution costs covered via injection charges and allocation method

Country	Percentage of D-costs covered via injection charges	Allocation method of the D-costs between injection charges and withdrawal charges and methodology for the calculation of D-tariffs for injection
Austria	2.4%	Calculating the injection tariffs is done by the same procedure like calculating the withdrawal charges: This tariff will be set, which meets the allowed revenues as a multiplication of the quantities consumed by different consumer groups. The share arises by multiplying the injected volumes by the charge for network losses. The share is dependent on the injected volumes, it is not a predetermined share.
Belgium	Flanders: <1% Wallonia: 1% (2020)	Flanders: Most costs are allocated to withdrawal. Only the power-based network costs directly related to a certain voltage level are allocated between injection and withdrawal. The allocation key is based upon the share of investments directly related to injection compared to total investments. Wallonia: The injection tariffs are determined in such a way that the costs they generate for a producer correspond to the weighted average of the costs generated by the injection tariffs applicable in Flanders and Brussels and those applied by Elia (T-level), as well as by those practiced in neighbouring countries (France, Luxembourg, Germany, the Netherlands). As far as neighbouring countries are concerned, the comparison can be made on the basis of a representative sample. The weighting is based on the sum of the injection capacities installed in these countries or regions.
Estonia		The injection charge consists of a power-based charge set based on contracted power and a lump sum charge. The charges recover part of the DSO costs without aiming a specific cost category. The lump sum includes all the costs of metering but partly also other costs (for example, the costs of administration, management and maintenance of the distribution network).
Finland	N/A	Under national law, small-scale generation (max 1 MW) connected to the distribution network may only be allocated part of its costs to the network, and the ceiling for injection of small-scale generation is 0.07 EUR/kWh. In addition, the distribution injection charge must cover a relatively smaller share of the distribution network costs than the distribution withdrawal charge.
France		Yearly management charge, which aims to cover costs related to the management of producers by the DSO. It is the same between consumers and producers.
Germany	0%	
Latvia	0.2%	Injection charge is set according to the ceiling set by the EU law for Latvia (i.e. 0.5 EUR/MWh). The share of distribution costs recovered via injection charges is calculated by multiplying the total electricity injected directly into the D-grid (MWh) by 0.5 EUR/MWh. The injection charge is calculated by dividing the above calculated sum (in EUR) by the total installed generation capacity (MW) connected to the D-grid. The rest of the distribution costs are recovered by withdrawal charges
Malta	Data is not available to the NRA	No predetermined shares. Electricity producers on “Export only” mode pay as injection charge a fixed lump sum tariff, which contributes to metering, administrative and management costs. Electricity consumers pay a withdraw charge a fixed lump sum, which contributes as well to metering, administrative and management costs. These annual lump sums are different according to consumer type and single/three phase connection.
The Netherlands	Close to 0%	Grid users that only inject pay only a fixed lump sum tariff, which contributes to administrative costs, costs for facilitating switching, costs for allocation, verification and validation and the cost of maintaining the register of connections. Due to the small size of this tariff it is not a relevant factor for producers and could not disturb a level playing field.
Norway	4.3%	The injection charge includes: a G-charge for infrastructure costs; a surcharge for system services costs (energy-based, 10-year moving average – same as G-charge); an energy-based charge to cover marginal losses. The G-charge is a lump sum payment which is based on a 10-year moving historical average of production. The charge applied to each generator is each year calculated from the average production in previous years (the charge for 2022 is based on average production during the years 2011-2020).
Slovak Republic	Approximately 1%	The withdrawal charge has 3 tariff elements: an energy-based tariff element (EUR/kWh) which is paid for the volume of the withdrawn energy; an energy-based tariff element (EUR/kWh) which is paid for losses; and a power-based tariff element (EUR/kW) which is paid for the contracted (reserved) capacity and differs per voltage level. For injection there is only a power-based charge - paid for 15% of the maximal reserved capacity multiplied by power-based tariff value (different for different voltage levels). (The methodology of calculation the tariffs is set in the ÚRSO decree 18/2017.)

Country	Percentage of D-costs covered via injection charges	Allocation method of the D-costs between injection charges and withdrawal charges and methodology for the calculation of D-tariffs for injection
Sweden	About 30% (in regional grid of one of the largest DSOs)	In one of the largest DSO: Injection charges are calculated first. The withdrawal charges cover the rest of the costs which are not covered by injection charges. The producers which provide generation that reduces the losses in the grid get paid an amount that is based on the energy price (SEK/kWh), since network losses are based on the energy cost. Since they reduce the cost of the grid they get reimbursed for that cost by the grid operators. Injection charges are calculated: Cost of transmission injection charge + distance to transmission grid connection*subscribed production*locational price (kr/kW*km) + subscribed production*voltage level price (kr/kW). The prices were calibrated with previous channel price model which calculated cost in relation to how much of the grid was used.

Table 16: Tariff basis, variation and differentiation of the transmission tariffs for injection

Country	Tariff basis	Flat rate (uniform) charge without variation	Variation of tariffs based on		
			Voltage	Location[235]	Time-of-use
Austria	E	Yes			
Belgium	E	Yes[236]			
Bulgaria	E	No data			
Denmark	E	Yes			
Ireland[237]	P		No data	Yes	No data
Finland	E+P	Yes			
France	E				
Latvia	P	Yes			
The Netherlands	L		Yes[238]	No	No
Norway	L+E	G-charge is flat. Some variation applies due to marginal loss pricing for generators.		Yes	
Romania	E	Yes			
Slovak Republic	P	Yes			
Sweden	E+P		No	Yes[239]	No

Note: "E" means energy-based charge, "P" means power-based charge, "L" means lump sum charge

[235] Variation based on location, unrelated to the connection to a specific network operator (e.g. the network charges are set to be different to indicate at which locations the electricity is most or least needed)
[236] BE: Reservation costs of ancillary services cannot be differentiated by voltage level so a uniform tariff value is applied to each voltage level.
[237] IE: Based on the information provided by the NRA in 2019, Transmission Use of System tariffs are composed of two elements: (1) a postage stamp which is applied evenly to all generators and calculated based on the generators' Maximum Export Capacity; (2) locational signal.
[238] NL: The network users that only inject pay only a very limited lump sum administrative fee. This fee does vary between different voltage levels.
[239] SE: The injection charge differs between nodes in the transmission grid (same applies for the withdrawal charge).

Table 17: Tariff basis, variation and differentiation of the distribution tariffs for injection

Country	Tariff basis	Flat rate (uniform) charge without variation	Variation of tariffs based on		
			Voltage	Location[240]	Time-of-use[241]
Austria	E (+L)[242]		Yes	Yes[243]	No
Belgium	Flanders: E Wallonia: E+L	Flanders: Yes Wallonia: No	Wallonia: Yes[244]	Wallonia: No	Wallonia: No
Estonia	P+L		Yes	No	No
Finland	E (+P+L)[245]	Yes			
France	L		Yes	No	No
Germany	E (negative injection charge)		Yes	No	No
Latvia	P	Yes			
Malta	L	Yes			
The Netherlands	L		Yes[246]	No	No
Norway		Yes			
Slovak Republic[247]	P		Yes	No	No
Sweden[248]	P		Yes	Yes	Yes (some DSOs)

Note: "E" means energy-based charge, "P" means power-based charge, "L" means lump sum charge

Table 18: Exemption, discount or differentiation of unit tariff values or tariff basis between producers

	Exemption, discount or differentiation of unit tariff values or tariff basis for some of the producers	
Country	**T-connected producers**	**D-connected producers**
Austria	Producers with installed capacity up to 5 MW are exempted from tariffs for injection pursuant to national law.	Producers with installed capacity up to 5 MW are exempted from T-tariffs for injection pursuant to national law. No differentiation, exemption or discount to any producers regarding D-tariffs for injection[249].
Belgium	No differentiation, exemption or discount to any producers.	Wallonia: Producers which inject electricity on the LV level and whose power is less than 10 kVA are exempted[250].

[240] Variation based on location, unrelated to the connection to a specific network operator (e.g. the network charges are set to be different to indicate at which locations the electricity is most or least needed). D-tariff for injections are different based on the DSO area to which the user is connected to in several countries/jurisdictions including BE's Flanders and Wallonia regions, Estonia, Finland and the Netherlands.
[241] It does not take into account differences due to mandatory/voluntary use of time-differentiated tariffs by the network users.
[242] AT: The metering charge is applied based on the type of meter and is defined as price cap per meter per month.
[243] AT: different tariffs are set for different network areas. Multiple DSOs can operate within a single network area.
[244] BE (WAL): The fixed term is expressed in EUR/year and varies according to the voltage level to which is connected the network user. The capacity charge includes a tariff for flexible injection capacity (currently free of charge) and a tariff for permanent injection capacity. These tariffs are expressed in EUR/kVA and vary according to the level voltage to which the grid user is connected.
[245] FI: the injection charges are mainly energy-based (with a ceiling set by the national law), but individual DSOs may also have power-based and/or lump sum charge components in the injection tariff
[246] NL: The network users that only inject pay only a very limited lump sum administrative fee. This fee does vary between different voltage levels.
[247] SK: injection charge is fixed price value, depending on maximal reserved capacity (MRC) of generator connection to the distribution system - Injection charge = 15% *MRC * distribution tariff value (different for different voltage levels).
[248] SE: Tariff varies depending on voltage level and location (Note: the practice was provided for one of the largest DSOs). But tariff also varies amongst the DSOs.
[249] AT: The charge for network losses is the same for all the generators (and also for other consumers).
[250] BE (WAL): Article 4 of the decree of the Walloon Parliament of 19 January 2017 relating to the D-tariff methodology provides that the "tariffs for the use of a distribution network, applicable to production units, can be differentiated according to the technology of these units and their date of commissioning. These tariffs are determined taking into account any criterion considered relevant by CWaPE, such as a comparison with neighbouring countries and in consultation with all the players, so as not to jeopardize the country's security of supply by decline in the competitiveness of the production units concerned. In the tariff proposal accompanied by the budget, the distribution network operator justifies these differentiations".

	Exemption, discount or differentiation of unit tariff values or tariff basis for some of the producers	
Country	**T-connected producers**	**D-connected producers**
		Flanders: No differentiation, exemption or discount to any producers.
Bulgaria	The NRAs reported difference between RES vs. non-RES producers but the difference has not been specified.	No information has been provided by the NRA.
Denmark	Some RES producers have been exempted through legislative acts, not as part of the tariff methodology. However, these exemptions are not available anymore for new producers.	Some RES producers have been exempted through legislative acts, not as part of the tariff methodology.
Finland	No differentiation, exemption or discount to any producers.	Some DSOs do not apply injection tariff for small power producers.
France	Producers who are connected to lower than 150 kV voltage level are exempted. Reasoning: the costs covered by the injection charge (losses caused by exported electricity and losses linked to ITC) are directly imputable to producers connected at 225 and 400 kV.	
Ireland		For the capacity up to 5 MW each distribution-connected generator is exempted from transmission network charges. From 5 MW onwards there is an incremental rule; e.g. a 7 MW generator is charged for 2 MW (7-5 MW), etc.
Malta		The metering, administrative and management fee is different for RES producers compared to the two non-RES producers (large fossil fuel power plants) having a PPA with the DSO. The metering, administrative and management fee is lower for residential producers than for non-residential producers[251].
Norway	No differentiation, exemption or discount to any producers.	No differentiation, exemption or discount to any producers.
Romania		Producers whose installed capacity is lower than 5 MW are exempted from T-tariff for injection. Reason: Generated electricity from D-connected producers with installed capacity up to 5 MW is consumed in D-grid and don't use T-grid.
Slovak Republic	Power-based tariff for access to the grid is not paid by ancillary services providers.	Power-based tariff for access to the grid is not paid by ancillary services providers.
Sweden	The information is not available to the NRA.	DSOs may apply some differentiation, exemption or discount to some producers, e.g. depending on the size of the producer, but this information is not available to the NRA, since the DSOs are free to design their own tariffs. In one of the biggest DSO areas the injection charges are only applied to network users who have a capacity for production larger than the capacity to consume. Producers below 1500 kW are exempted from part of injection charges according to the national law and pay only for metering and similar.

Table 19: Transmission and distribution tariffs for storage facilities

Country	**T-connected storage**		**D-connected storage**	
	Injection charge	**Withdrawal charge**	**Injection charge**	**Withdrawal charge**
Austria	Energy-based charge paid for T-costs	Energy-based and power-based charge paid for T-costs (reductions apply)	No D-connected non-PHES storage	No D-connected non-PHES storage Energy-based and power-based charge

[251] MT: on "export only" mode different lump sum payments depending on whether the producer is residential/domestic or non-residential as well as different lump sum payments depending if the connection is single phase or three phase.

Country	T-connected storage		D-connected storage	
	Injection charge	**Withdrawal charge**	**Injection charge**	**Withdrawal charge**
			Energy-based charge paid for both T and D-costs	paid for both T and D-costs (reductions apply)
Belgium	Energy-based charge paid for T-costs (exemptions exist for some storages)	Energy-based and power-based charge paid for T-costs (exemptions exist for some storages)	Brussels: (No D-connected PHES storage) Flanders: Energy-based charge paid for D-costs only Wallonia: Power-based charge paid for D-costs only (No D-connected PHES storage)	Brussels: (No D-connected PHES storage) Flanders: Energy-based and power-based charge paid for D-costs only Wallonia: Energy-based and power-based charge paid for D-costs only (No D-connected PHES storage)
Bulgaria	Not subject to injection charges (only PHES storage connected to the T-grid)	Energy-based charge paid for T-costs (only PHES storage connected to the T-grid)	(No storage facilities are connected to the D-grid yet)	(No storage facilities are connected to the D-grid yet)
Croatia	No injection charge applies in the country until end 2022. (Only PHES storage connected to the T-grid)	Energy-based and power-based charge paid for T-costs	No injection charge applies in the country until end 2022.	Energy-based and power-based charge paid for both T and D-costs[252]
Cyprus	No injection charge	(No storage facilities are connected to the T-grid yet)	No injection charge	Not subject to withdrawal charges: (No storage facilities are connected to the D-grid yet. If connected directly to the D-grid, it would not be subject to any network charge beyond the connection charge.)[253]
Czech Republic	No injection charge (Only PHES storage connected to the grid)	Energy-based charge paid for T-costs (no power-based component unlike consumers) (some exemptions apply)	No injection charge (Only PHES storage connected to the grid)	Energy-based charge paid for T-costs (no power-based component unlike consumers) (some exemptions apply)
Denmark	Energy-based charge paid for T-costs	Energy-based charge paid for T-costs	No injection charge applies until end 2022. From 2023, energy-based charge paid for both T and D-costs	Energy-based charge paid for both T and D-costs
Estonia	No storage facilities are connected to the T-grid yet	No storage facilities are connected to the T-grid yet	No storage facilities are connected to the D-grid yet	No storage facilities are connected to the D-grid yet
Finland	No PHES storage facilities are connected yet Energy-based and power-based charge paid for T-costs by non-PHES storage facilities	No PHES storage facilities are connected yet Energy-based and power-based charge paid for T-costs by non-PHES storage facilities	No commercial storage facilities are connected to the D-grid yet Energy-based, power-based and lump sum charge paid for T-costs only	No commercial storage facilities are connected to the D-grid yet Energy-based, power-based and lump sum charge for both T and D costs
France	Energy-based charge paid for T-costs	Energy-based and power-based charge paid for T-costs	Don't pay an injection charge for T-costs and there is no injection charge for D-costs	Energy-based, power-based and lump sum charge paid for both T and D-costs

[252] HR: Power-based charge only has to be paid during peak periods.
[253] CY: Cf. CERA's Regulatory Decision No. 3/2019. This exemption aims to incentivise storage installations.

Country	T-connected storage		D-connected storage	
	Injection charge	**Withdrawal charge**	**Injection charge**	**Withdrawal charge**
Germany	No injection charge	Energy-based and power-based charge paid for T-costs	Negative injection charge also applies to storage facilities if they inject into the grid.	Energy-based and power-based charge paid for both T and D-costs
Greece	No injection charge	Energy-based and power-based charge paid for T-costs (Note: No T-connected non-PHES storage)	No injection charge (No storage facilities are connected to the D-grid yet)	No storage facilities are connected to the D-grid yet
Hungary	No injection charge	Energy-based charge paid for T-costs (No T-connected non-PHES storage)	No injection charge	Energy-based, power-based and lump sum charge paid for both T and D-costs (No T-connected non-PHES storage)
Ireland	Power-based injection charge for T-costs.	Energy-based and power-based charge paid for T-costs	D-connected network users do not pay an injection charge for D-costs. (exemptions apply) (No PHES storage is connected to the D-grid.)	Energy-based and lump sum charge is paid for both T and D-costs by storage facilities. (No PHES storage is connected to the D-grid)
Italy[254]	No injection charge	Not subject to withdrawal charges	No injection charge	Not subject to withdrawal charges
Latvia	(No storage facilities are connected to the T-grid yet)	(No storage facilities are connected to the T-grid yet)	(No storage facilities are connected to the D-grid yet)	(No storage facilities are connected to the D-grid yet)
Lithuania	No injection charge	Energy-based and power-based charge paid for T-costs (few exceptions defined by national law)	No injection charge (No storage facilities are connected to the D-grid yet)	Energy-based charge paid for both T and D costs
Luxembourg	No injection charge (No storage facilities are connected to the T-grid yet.)	No storage facilities are connected to the T-grid yet. If connected, they would be treated for withdrawal the same way as consumers (i.e. energy-based and power-based charge for T-costs)	No injection charge (No storage facilities are connected to the D-grid yet.)	No storage facilities are connected to the T-grid yet. If connected, they would be treated for withdrawal the same way as consumers (i.e. energy-based, power-based charge or energy-based and lump sum charge paid for both T and D-costs)
Malta	No transmission network	No transmission network	Not subject to injection charges (No PHES storage)	Energy-based, power-based and lump sum charge paid for D-costs (No PHES storage)
The Netherlands[255]	Not subject to injection charges	Power-based and lump sum charge for T-costs	Not subject to injection charges (No D-connected PHES storage yet)	Energy-based, power-based and lump sum charge paid for both T and D-costs
Norway	Marginal losses only (could be either positive or negative)	Charged as consumers: Marginal losses +	Marginal losses only (could be either positive or negative)	Charged as consumers: Marginal losses +

[254] IT: Regulatory decision 574/2014 extended the no-charging of pumped hydro to other storage facilities (pure storage). The consultation preparing decision 574 stated the reason of "equal treatment". The no-charging of pumped hydro plants was introduced by decision 348/2007, together with the no-charging of auxiliary generation services. In the consultation before the decision, it was stated that the duration of withdrawal of auxiliary services is very low (ranging from 50 to 350 hours/year), therefore justifying a different treatment.

[255] NL: For withdrawing, storage pays the same tariff as consumers (connected at the same voltage level). For injecting, storage does not pay the lump sum administrative fee because it pays this fee as consumer and therefore the administrative costs have already been recovered.

Country	T-connected storage		D-connected storage	
	Injection charge	**Withdrawal charge**	**Injection charge**	**Withdrawal charge**
	(Only PHES storage is connected to the T-grid)	power-based fixed charge. (Only PHES storage is connected to the T-grid)		power-based fixed charge
Poland[256]	No injection charge (Only PHES storage is connected to the T-grid)	Energy-based and power-based charge paid for T-costs (Only PHES storage is connected to the T-grid) (based on net withdrawal)[257]	No injection charge	Energy-based, power-based and lump sum charge paid for both T and D-costs
Portugal	No injection charge (only PHES storage is connected to the T-grid)	Energy-based and power-based charge paid for T-costs[258] (only PHES storage is connected to the T-grid) (exemptions apply)	No injection charge	Energy-based and power-based charge paid for both T and D-costs [259] (exemptions apply)
Romania	No storage facilities are connected to the T-grid yet	No storage facilities are connected to the T-grid yet	Energy-based charge paid for T-costs only (exemptions apply)	Energy-based charge paid for both T-costs and D-costs
Slovak Republic	Power-based charge paid for T-costs (some exemptions apply) Only PHES storage is connected to the T-grid (i.e. no batteries).	Energy-based and power-based charge paid for T-costs (some exemptions apply) Only PHES storage is connected to the T-grid (i.e. no batteries).	Power-based charge for D-costs only (some exemptions apply)	Energy-based and power-based charge for both T and D-costs (some exemptions apply)
Slovenia	No injection charge	Not subject to withdrawal charges (as energy conversion was exempted from network charges by national law)[260]	No injection charge	Not subject to withdrawal charges (as energy conversion was exempted from network charges by national law)[261]
Spain	No injection charge	Not subject to withdrawal charges (due to shift of charges to final consumers and for the purpose of increasing security of supply)	No injection charge	Not subject to withdrawal charges (due to shift of charges to final consumers and for the purpose of increasing security of supply)
Sweden	Subject to injection charges. (No storage facilities are connected to the T-grid yet)	Subject to withdrawal charges. (No storage facilities are connected to the T-grid yet)	Power-based and lump sum charge (some exemptions exist in some DSO areas)	Energy-based and lump sum charge (some exemptions exist in some DSO areas)

Note: If a D-connected network user is indirectly charged for T-costs (e.g. the transmission withdrawal tariffs are paid by the distribution system operators (DSO's) and this costs is shifted further to a D-connected network users) it is still considered as a payment for T-costs by a D-connected network user.

[256] PL: Storages are charged according to the special rules defined in the Energy Law Act amended in 2021 and settlements coming into force from 2022. Settlement with energy storage facilities is based on the balance of energy withdrawn and injected into the grid.
[257] PL: PHES facilities are charged according to the special rules defined in the Energy Law Act amended in 2021 and settlements coming into force from 2022. At the moment batteries are not connected to the transmission grid in Poland. Settlement with energy storage facilities is based on the balance of energy withdrawn and injected into the transmission grid.
[258] PT: PHES facilities are exempted from withdrawal charges. Non-PHES autonomous storage facilities (e.g. standalone batteries) are not exempted from withdrawal charges in T-tariffs.
[259] PT: PHES facilities are exempted from the payment of D-tariffs for electricity used for the pumping water (other electricity needs, such as lighting, is subject to regular payment of network charges), which is a regime that exists for many years, and reflects the particular role of pumped-hydro for the balance of the system. Autonomous storage facilities (e.g. standalone batteries) are not exempted from withdrawal charges in D-tariffs.
[260] SI: With new Electricity Supply Act (valid from October 2021) this was changed and will be implemented in new tariff system as defined by NRA.
[261] SI: Idem.

Table 20: Exemption, discount or differentiation of unit tariff values or tariff basis between storage facilities

	Exemption, discount or differentiation of unit tariff values or tariff basis for some of the storage facilities vs. other storage facilities	
Country	**T-connected storages**	**D-connected storages**
Austria	Difference between pumped-hydro and other storage facilities (e.g. batteries); Reasoning: due to the large scale options to act supportive for the transmission grid a separate network-charge (only for the load-based tariff component) for pumped-hydro storage is in place (they do not pay any of the grid utilisation charges and charge for network losses for a period of 15 years from the time they are commissioned.)	The pumped-hydro storage facilities pay reduced network charge compared to other storage facilities (e.g. batteries), (i.e. they do not pay any of the grid utilisation charges and charge for network losses for a period of 15 years from the time they are commissioned.) (Currently there is no D-connected non-PHES storage facility, but they would pay the same charge as consumers.)
Belgium	New storage facilities, commissioned after July 2018, receive a full exemption of all network tariffs (except connection charges) during the first 10 years, while former storage facilities where a substantial capacity increase was commissioned after July 2018 receive a 80% discount on all access transmission tariffs during the first 5 years[262].	No differentiation, exemption or discount to any storage facilities.
Bulgaria	No non-PHES storage connected to the T-grid. Regarding the charging of PHES storage no information has been provided	No storage facilities are connected to the D-grid yet.
Croatia	No differentiation, exemption or discount to any storage facilities.	No differentiation, exemption or discount to any storage facilities.
Cyprus	No storage facilities are connected to the T-grid yet. No differentiation between storage facilities.	No storage facilities are connected to the D-grid yet. No differentiation between storage facilities.
Czech Republic	Only PHES storage connected to the grid. If it were connected, non-PHES storage is not subject to exemption from power-based component. Reasoning: historically, PHESs offered essential balancing services.	Only PHES storage connected to the grid. If it were connected, non-PHES storage is not subject to exemption from power-based component. Reasoning: historically, PHESs offered essential balancing services.
Denmark	No differentiation, exemption or discount to any storage facilities	No differentiation, exemption or discount to any storage facilities.
Estonia	No storage facilities are connected to the T-grid yet. No differentiation between storage facilities.	No storage facilities are connected to the D-grid yet. No differentiation between storage facilities.
Finland	No PHES storage is connected to the T-grid yet. No differentiation, exemption or discount to any storage facilities.	No commercial storage facilities are connected to the D-grid yet.
France	Some PHES are partially exempted (their withdrawal tariffs are reduced The condition is: withdrawing more than 10 GWh/year and having an utilisation rate of more than 44% in low hours)	No differentiation, exemption or discount to any storage facilities.
Germany[263]	PHES whose pump capacity or turbine power increased by at least 7.5% or whose storage capacity increased by at least 5% after 04.08.2011 are fully exempted for the first 10 years. Non-PHES storage facilities built after 31.12.2008 and put into operation within 15 years from 04.08.2011 are fully exempted for the first 20 years of operation.	PHES whose pump capacity or turbine power increased by at least 7.5% or whose storage capacity increased by at least 5% after 04.08.2011 are fully exempted for the first 10 years. Non-PHES storage facilities built after 31.12.2008 and put into operation within 15 years from 04.08.2011 are fully exempted for the first 20 years of operation.
Greece	No differentiation, exemption or discount to any storage facilities.	No differentiation, exemption or discount to any storage facilities.
Hungary	No differentiation, exemption or discount to any storage facilities.	No differentiation, exemption or discount to any storage facilities.
Ireland	One PHES (i.e. Turlough Hill) is fully exempted.	For the capacity up to 5 MW each distribution-connected storage is exempted from transmission network charges.

[262] BE: The objective is to promote storage development for Flex/SoS reasons. No reassessment is foreseen yet.
[263] DE: BNetzA is at the current state not in charge of deciding upon the network tariffs. BNetzA deems the basic structure according to which storages are treated as regular network users and only charged for their energy withdrawal fair. There are also some specific rules allowing for discounts for certain storage facilities.

	Exemption, discount or differentiation of unit tariff values or tariff basis for some of the storage facilities vs. other storage facilities	
Country	**T-connected storages**	**D-connected storages**
		From 5 MW onwards there is an incremental rule; e.g. a 7MW storage is charged for 2MW (7-5MW), etc.
Italy	Not applicable, storage is not subject to network tariffs	Not applicable, storage is not subject to network tariffs
Lithuania	No differentiation, exemption or discount to any storage facilities.	Batteries smaller than 1MW exempted from all network tariffs. There is a different energy withdrawal counting for batteries >1MW - the energy for charging the battery, which later will be used for T-network stability is not charged with T-tariff nor D-tariff.
Luxembourg	No differentiation, exemption or discount to any storage facilities.	No differentiation, exemption or discount to any storage facilities.
Malta	Not applicable, no transmission network	No differentiation, exemption or discount to any storage facilities.
The Netherlands	No differentiation, exemption or discount to any storage facilities (but the practice is under revision)[264]	No differentiation, exemption or discount to any storage facilities
Norway	No differentiation, exemption or discount to any storage facilities.	No differentiation, exemption or discount to any storage facilities.
Poland	No differentiation, exemption or discount to any storage facilities, but all storage facilities pay a reduced fixed T-charge compared to the T-charge paid by consumers[265]	No differentiation, exemption or discount to any storage facilities.
Portugal	PHES is exempted from T-withdrawal charges. Autonomous storage facilities pay withdrawal charges for T-costs.	PHES is exempted from the payment of D-withdrawal tariffs[266] to reflect the particular role of PHES for the balance of the system. Autonomous storage facilities (e.g. standalone batteries) are not exempted from D-tariffs. Autonomous storage facilities are subject to the same withdrawal charges of the D-tariffs as consumers. Autonomous storage facilities as intermediary energy consumers are exempted from energy policy costs, which is levied on final energy consumption.[267]
Romania	No storage facilities are connected to the T-grid yet.	Storage facilities whose installed capacity is lower than 5 MW are exempted from T-tariff for injection
Slovak Republic	The T-connected storage, which provides solely ancillary services to TSO does not pay any access to the grid charge. The T-connected storage injecting or withdrawing electricity for commercial purposes (for the time being needs to be connected as local DSO) pay a T-charge for access to T-system for injection or withdrawal based on the connection capacity (injection or withdrawal) which is higher. The reason behind is not to discourage the activation of ancillary services.	The D-connected storage, which provides solely ancillary services does not pay any access to the grid charge. The D-connected storage injecting or withdrawing electricity for commercial purposes pay a D-charge for access to D-system for injection or withdrawal based on the connection capacity (injection or withdrawal) which is higher. The reason behind is not to discourage the activation of ancillary services. Producers operating a hydroelectric power plant with a total installed capacity up to 5 MW are fully exempted.

[264] NL: The ACM will investigate whether it is necessary and possible to adjust the tariff structure in such a way that it becomes more attractive for market parties to invest in energy storage.
[265] PL: In the formula for calculating the fixed charge, there is a reduction factor proportional to the efficiency of the energy storage, which reduces the contracted capacity.
[266] PT: for electricity used for the pumping water (other electricity needs, such as lighting, is subject to regular payment of network charges), which is a regime that exists for many years,
[267] PT: PHES is exempted from the payment of D-withdrawal tariffs to reflect the particular role of for the balance of the system. Autonomous storage facilities (e.g. standalone batteries) are not exempted from D-tariffs. In what regards network charges (transmission and distribution) to autonomous storage facilities, according to the NRA there is no discrimination compared consumers, since the same network charges shall apply. The energy withdrawal, from the perspective of the grid, is treated in the same way. There is a different treatment in what regards the allocation of energy policy costs, which is performed through the "network access tariff" (this tariff includes the T-tariff and D-tariff, as well as energy policy costs). As a storage facility corresponds to intermediate consumption, and not final consumption, and in order to avoid that these energy policy costs are paid twice by final consumption, the intermediate consumption at storage facilities is exempted from these energy policy costs (similar to the application of VAT, which only should apply to final consumption).

	Exemption, discount or differentiation of unit tariff values or tariff basis for some of the storage facilities vs. other storage facilities	
Country	**T-connected storages**	**D-connected storages**
	Producers operating a hydroelectric power plant with a total installed capacity up to 5 MW are fully exempted.	
Slovenia	Not applicable, storage is not subject to network tariffs	Not applicable, storage is not subject to network tariffs
Spain	Not applicable, storage is not subject to network tariffs	Not applicable, storage is not subject to network tariffs
Sweden	No storage facilities are connected to the T-grid yet.	In one of the DSOs area no storage is connected, for others the NRA has no exact information. However, in some DSO areas some storage facilities are exempted from some costs.

Table 21: Transmission and distribution tariffs for prosumers

Country	**T-connected prosumers**		**D-connected prosumers**	
	Injection charge	**Withdrawal charge**	**Injection charge**	**Withdrawal charge**
Austria	Energy-based and power-based charge paid for T-costs only[268]	Energy-based and power-based charge paid for T-costs only	Energy-based and power-based charge paid for D-costs only[269]	Energy-based and power-based charge paid for both T and D-costs
Belgium[270]	Energy-based charge for T-costs	Energy-based and Power-based charge for T-costs	Flanders: Energy-based charge Wallonia: Power-based charge	Brussels: Energy and lump sum or energy and power-based charging Flanders: Energy-based and power-based charge Wallonia: Energy-based and power-based charge (for D-costs)
Bulgaria	Energy-based charge for T-costs	Do not pay a withdrawal charge for T-costs	Energy-based charge for T-costs only	No data
Croatia	No injection charge	Energy-based and power-based charge paid for T-costs	No injection charge	Energy-based and power-based charge paid for both T and D-costs[271]
Cyprus	No injection charge	Energy-based charge for T-costs	No injection charge	Energy-based and power-based charge paid for both T and D-costs
Czech Republic	No injection charge	Energy-based and power-based charge paid for T-costs	No injection charge	Energy-based and power-based charge paid for D-costs only
Denmark	Energy-based charge for T-costs	Energy-based charge for T-costs	Energy-based charge for both T and D costs.	Energy-based and lump sum charge
Estonia	No injection charge	Energy-based charge for T-costs	Power-based and lump sum charges	Energy-based, power-based and lump sum charges paid for both T and D-costs
Finland	Energy-based and power-based charge paid for T-costs	Energy-based and power-based charge paid for T-costs	Energy-based, power-based and lump sum	Energy-based, power-based and lump sum

[268] AT: No G-charge in place. The charges paid for injection are the charge for network losses in kWh, metering charge and connection charge. Network losses and system service charge are paid by producers with a connected capacity of more than 5 MW.
[269] AT: Idem.
[270] BE: Charging of the D-connected network users for T-costs depends on the distribution tariff methodology applicable in each of the 3 regions of Belgium.
[271] HR: Power-based charge only has to be paid during peak periods.

Country	T-connected prosumers		D-connected prosumers	
	Injection charge	**Withdrawal charge**	**Injection charge**	**Withdrawal charge**
			charges paid for both T and D-costs (some exemptions for some prosumers in some DSO areas exist)	charges paid for both T and D-costs
France	Energy-based charge for T-costs	Energy-based and power-based charge paid for T-costs	Don't pay an injection charge for T-costs and there is no injection charge for D-costs	Energy-based, power-based and lump sum charges paid for both T and D-costs
Germany	No injection charge	Energy-based and power-based charge paid for T-costs	Negative injection charge also applies to prosumers if they inject into the grid.	Energy-based and power-based charge paid for both T and D-costs
Greece	No injection charge	Energy-based and power-based charge paid for T-costs	No injection charge	Energy-based and power-based charge paid for both T and D-costs
Hungary	No injection charge	Energy-based charge for T-costs	No injection charge	Energy-based, power-based and lump sum charge paid for both T and D-costs (net metering for some network users)
Ireland	Power-based injection charge for T-costs	Energy-based and power-based charge paid for T-costs	D-connected network users do not pay an injection charge for D-costs. D-connected prosumers pay an injection charge for T-costs, but exemptions apply.	Energy-based and lump sum charge is paid for both T and D-costs (exemptions apply)
Italy	No injection charge	Power-based charge paid for T-costs	No injection charge	Power-based charge paid for both T and D-costs
Latvia	Power-based charge paid for T-costs (no prosumers are connected to the T-grid)	Energy-based and power-based charge paid for T-costs (no prosumers are connected to the T-grid)	Power-based charge paid for D-costs only	Power-based charge paid for D-costs only
Lithuania	No prosumers connected to the T-network.	No prosumers connected to the T-network.	No injection charge	Energy-based charge paid for both T and D costs
Luxembourg	No injection charge	Energy-based and power-based charge paid for T-costs	No injection charge	Energy-based, power-based charge or energy-based and lump sum charge paid for both T and D-costs
Malta	No transmission network	No transmission network	Don't pay any injection charge	Energy-based, power-based and lump sum charge paid for D-costs
The Netherlands	Don't pay any injection charge	Power-based and lump sum charge for T-costs	Don't pay any injection charge	Energy-based, power-based and lump sum charge paid for both T and D-costs
Norway	Energy-based and lump sum charge paid for T-costs	Energy-based and power-based charge paid for T-costs	Energy-based and lump sum charge is paid for both T and D costs (exemptions apply)	Energy-based and power-based charge paid for both T and D-costs
Poland	No injection charge	Energy-based and power-based charge paid for T-costs[272]	No injection charge	Energy-based, power-based and lump sum

[272] PL: As prosumers connected to the transmission grid (T-connected non-storage network users who both inject and withdraw energy), are considered final consumers with generation units that inject surplus produced energy into the transmission grid.

Country	T-connected prosumers		D-connected prosumers	
	Injection charge	**Withdrawal charge**	**Injection charge**	**Withdrawal charge**
		(based on net withdrawal)		charge paid for both T and D-costs. (discount applies on withdrawal due to injection) [273]
Portugal	No injection charge	Energy-based and power-based charge paid for T-costs	No injection charge	Energy-based and power-based charge paid for both T and D-costs[274]
Romania	Energy-based charge paid for T-costs	Energy-based charge paid for T-costs	Energy-based charge paid for T-costs only (exemptions apply)	Energy-based charge for both T- and D costs
Slovak Republic	Power-based charge paid for T-costs	Energy-based and power-based charge paid for T-costs	Power-based charge for D-costs only	Energy-based and power-based charge for both T and D-costs
Slovenia	No injection charge	Energy-based and power-based charge paid for T-costs	No injection charge	Energy-based and power-based charge paid for both T and D-costs
Spain	No injection charge	Energy-based and power-based charge paid for T-costs	No injection charge	Energy-based and power-based charge paid for both T and D-costs
Sweden	Energy-based and power-based charge paid for T-costs	Energy-based and power-based charge paid for T-costs	No injection charge for T-costs. In one of the largest DSO area they do not pay injection charge for D-costs either.	Energy-based, power-based and lump sum charges paid for D-costs only[275]

Note: If a D-connected network user is indirectly charged for T-costs (e.g. the transmission withdrawal tariffs are paid by the distribution system operators (DSO's) and this costs is shifted further to a D-connected network users) it is still considered as a payment for T-costs by a D-connected network user.

Table 22: Exemption, discount or differentiation of unit tariff values or tariff basis between prosumers

	Exemption, discount or differentiation of unit tariff values or tariff basis for some of the prosumers vs. other prosumers	
Country	**T-connected prosumers**	**D-connected prosumers**
Austria	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Belgium	No differentiation, exemption or discount to any prosumer.	Flanders: Prosumers with a production capacity up to 10 kW are exempted[276] from withdrawal charges. Wallonia:

[273] PL: Prosumers connected to the distribution network (D-connected non-storage network users who both inject and withdraw energy) also settle their energy charges on the basis of the provisions of the Energy Law. They pay variable charges (which cover part of T-costs) and quality charge for energy withdrawn from the distribution grid. The discount is in use: the prosumer is allowed to withdraw (not paying for the distribution services) 70/80 percent of injected energy. The payment is realized by the supplier.
[274] PT: In the case of the self-consumption regime, which corresponds to energy sharing of renewable energy over the public grid, an exemption from T-tariffs may apply, depending on the relative position of the generation and consumption facilities. This happens because with the information on generation and consumption in 15 minute intervals, one considers that the corresponding network flows only use the network assets strictly necessary to transport that energy. For instance, if the energy sharing over the public grid involves generation and consumption only connected at distribution level, then that consumption will not be subject to the T-tariff. In addition, proximity criteria must be met, i.e. the generator and the consumption point cannot be located too far away to be exempted from the payment of T-tariffs. Finally, the self-consumption regime involves a further analysis on possible inverted power flows, which is still ongoing. For the example from before (generator and consumption connected at distribution), if one concludes that inverted power flows exist from distribution into the transmission grid, then it will be considered that the T-grid is at least partially being used, and a fraction of the T-tariff must be paid as well by these network users. The exact fraction to apply will result from the ongoing study, and is currently set at zero.
[275] SE: In general, households often has a fixed charge (based on fuse size) plus energy charges. Low voltage other than households often have energy, power and fixed charge. High voltage has energy, power and fixed components.
[276] BE: The DSO will carry out an assessment by 2023.

	Exemption, discount or differentiation of unit tariff values or tariff basis for some of the prosumers vs. other prosumers	
Country	**T-connected prosumers**	**D-connected prosumers**
		There is no injection tariff for prosumers which inject electricity on the LV level and whose connected power is less than 10 kVA.
Bulgaria	No data	No data
Croatia	No differentiation, exemption or discount to any prosumer.	Household consumers are in the self-supply tariff model and they pay only for net withdrawal (i.e. the injection is deducted). Non-household consumers pay for gross withdrawal.
Cyprus	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Czech Republic	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Denmark	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Estonia	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Finland	No differentiation, exemption or discount to any prosumer.	Some DSOs do not apply injection charge for some small producers.
France	No differentiation, exemption or discount to any prosumer.	There are a difference between individual (that produce for themselves) and collective (that produce for others according to a contract and a perimeter criterion) prosumers. Individual prosumers are only charged with withdrawal charges, whereas collective prosumers are also partly charged for the self-consumption part.
Germany	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Greece	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Hungary	No differentiation, exemption or discount to any prosumer.	Only for network users with micro power plants (under 50 kW) is net metering available.[277] The withdrawal charges for them are the same as for other network users.[278]
Ireland		Auto Producers (Prosumer) MEC=0 do not pay any distribution tariffs, while Auto Producers >MEC 0 do pay withdrawal charge. Charges for withdrawal for prosumers are the same as those applied to consumers with similar technical characteristics.
Italy	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Latvia	No prosumers are connected to the T-grid. However, based on current rules there were no differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Lithuania	No prosumers are connected to the T-network	No differentiation, exemption or discount to any prosumer until July 2022. Afterwards, some differentiation in the charging of household and non-household prosumers.
Luxembourg	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer
Malta	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
The Netherlands	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Norway	No differentiation, exemption or discount to any prosumer.	Prosumers with injected kW < 100 kW are exempted from G-charge and their network tariff is based on net withdrawal.

[277] HU: In case of a micro power plant (under 50 kW): yearly (under 3×80A connection capacity) or monthly (above 3×80A connection capacity) net metering.
[278] HU: Net metering for micro power plants under 50 kW was introduced to incentivise their penetration, when it was low. With the current more significant level of penetration, the measure is under reconsideration.

	Exemption, discount or differentiation of unit tariff values or tariff basis for some of the prosumers vs. other prosumers	
Country	**T-connected prosumers**	**D-connected prosumers**
Poland	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Portugal	No differentiation, exemption or discount to any prosumer.	Difference among prosumers, depending on the relative position of the generation and consumption facilities. In the case of collective self-consumption regime, corresponding to energy sharing of renewable energy over the public grid, the network tariffs paid depend on the voltage level of connection of the generating unit. The higher that voltage level is, the higher the corresponding network tariff.[279]
Romania	No differentiation, exemption or discount to any prosumer.	Producers whose installed capacity is lower than 5 MW are exempted from T-tariff for injection.
Slovak Republic	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Slovenia	No differentiation, exemption or discount to any prosumer.	Prosumers or self-consuming communities with contracted capacity up to 43 kW are subject to net-metering (regarding the energy-based component of the distribution tariff for withdrawal) with 1 year accounting interval[280], while prosumers with contracted power above 43 kW are subject to gross metering. (Reasoning: to incentivise small consumers to become active consumers and produce their own electricity.)
Spain	No differentiation, exemption or discount to any prosumer.	No differentiation, exemption or discount to any prosumer.
Sweden	No prosumers are connected to the T-network	Small prosumers are exempted from paying injection tariff (up to 63A fuse and a maximum effect of 43.5 kW) and are only subject to a withdrawal tariff.

Note: if net metering is available only for some prosumers while it is not available for others or different tariff basis apply for different prosumers these are also considered as a difference in the table.

Table 23: Application of gross or net injection/withdrawal in case of energy-based charging

Country	**T-tariffs**	**D-tariffs**
Austria	The tariff is based on gross withdrawal.	The tariff is based on gross withdrawal.
Belgium[281]	The tariff is based on net withdrawal. (T-tariffs are charges on 15 minutes basis, this netting applies within each quarter of hour).	Flanders: The tariff is based on gross withdrawal (or net withdrawal + invertor power in case of no smart meter). Brussels: The tariff is based on gross withdrawal (i.e. injection and withdrawal are metered separately). Wallonia: The grid costs are based on gross withdrawal and there is a cap computed on the grid costs based on the net withdrawal + the prosumer tariff.
Bulgaria	No data	No data
Croatia	The tariff is based on gross withdrawal.	The tariff is based on net withdrawal only for households.[282]

[279] PT: For instance, if withdrawal and injection take both place in the LV grid, and if the public grid is used, than the withdrawal charge of the network tariff does not include the cost-cascading effect from the network tariff of higher voltage levels (i.e. it only includes the D-tariff of LV). But if injection occurs at MV and withdrawal at LV, then only the network tariffs of the voltage levels above MV will not be included (i.e. it only includes the D-tariffs for MV and LV).
[280] SI: based on the Decree on the self-supply of electricity from renewable energy sources issued by the government
[281] BE: Charging of the D-connected network users for T-costs depends on the distribution tariff methodology applicable in each of the 3 regions of Belgium.
[282] HR: Household customers which have their own electricity production are in the self-supply tariff model and they pay only for net measured energy.

Country	T-tariffs	D-tariffs
Cyprus	The tariff is based on gross withdrawal.	Prosumers are charges only for the excess of withdrawn energy i.e. the injected energy is deducted.
Czech Republic	The tariff is based on gross withdrawal.	The tariff is based on gross withdrawal.
Denmark	The tariff is based on gross injection and gross withdrawal.	No data
Estonia	The tariff is based on gross withdrawal.	The tariff is based on gross withdrawal.
Finland	No data	No data
France	The tariff is based on gross withdrawal.	The tariff is based on gross withdrawal.
Germany	The tariff is based on gross withdrawal.	The tariff is based on gross withdrawal.
Greece	The tariff is based on gross withdrawal.	The tariff is based on gross withdrawal.
Hungary	The tariff is based on gross withdrawal.	The tariff is based on net withdrawal only for prosumers under 50 kW.[283]
Ireland	The tariff is based on gross withdrawal.	The tariff is based on gross withdrawal.
Italy	The relevant tariff has no energy-based component.	The relevant tariff has no energy-based component.
Latvia	No prosumers or storage facilities are connected to the T-grid. However, based on current rules the tariffs are based on gross withdrawal.[284]	No storage facilities are connected to the D-grid yet.
Lithuania	The tariff is based on gross withdrawal. (Note: No prosumers are connected to the T-grid)	The tariff is based on gross withdrawal.[285]
Luxembourg	The tariff is based on gross withdrawal.	RES prosumers pay network charges based on net withdrawal per 15 minute period.
Malta	No transmission network	The tariff is based on gross withdrawal.
The Netherlands	The relevant tariff has no energy-based component.	The relevant tariff has no energy-based component.
Norway	The tariff is based on gross withdrawal.	The tariff is based on gross withdrawal, except prosumers with injected kW < 100 kW, whose tariff is based on net withdrawal.
Poland	The tariff is based on net withdrawal	Prosumers connected to the distribution network settle their energy charges on the basis of the provisions of the Energy Law. Prosumers pay the same withdrawal charges as consumers, but discount mechanism is in use. The prosumer is allowed to withdraw (not paying for the distribution services) 70/80 percent of injected energy.
Portugal	The tariff is based on gross withdrawal.	The tariff is based on gross withdrawal.
Romania	The tariff is based on gross withdrawal.	The tariff is based on gross withdrawal.
Slovak Republic	The tariff is based on gross withdrawal.	The tariff is based on gross withdrawal.
Slovenia	The tariff is based on net withdrawal for prosumers who equal or under 43 kW connection capacity for other network users it is based on gross withdrawal.	The tariff is based on net withdrawal for prosumers who equal or under 43 kW connection capacity[286] for other network users it is based on gross withdrawal.
Spain	The tariff is based on gross withdrawal.	The tariff is based on net withdrawal.
Sweden	Not provided	Not provided

[283] HU: In case of network users with micro power plants (under 50 kW) the injected energy decreases the basis for the payment of the withdrawal charge. (Reason: to incentivise their penetration). The other network users have to pay for the actual withdrawal.
[284] LV: Electricity producers pay fixed injection tariff and for self-consumption (includes tariff variable and fixed part). Injection tariff is calculated taking into consideration the Regulation 2010/838. Other circumstances weren't taken into account. Also, important aspect is that the approved injection tariff is very small and do not cover all expenses which electricity producer creates to the system.
[285] LT: For prosumers, DSO installs a meter that records the amount of electricity consumed from the grid and the amount of energy produced and supplied to the grid. Data from electricity meters are read automatically/remotely every month and DSO calculates and provides an accurate bill to the user on the self-service website. According to the meter reading, it is automatically calculated every month: how much electricity the consumer has supplied to the grid and how much has consumed. If prosumer produced more than consumed – paying only D-Tariff. If consumed more than produced – paying for the difference as electricity consumer to electricity supplier.
[286] SI: Volumetric charge is calculated based on annual net withdrawal for network users only in so-called self-consumption scheme, which is limited to household and small commercial users up to 43 kW connection capacity.

Table 24: Cost-offsetting in case both injection and withdrawal charges are applied in the country

Country	T-tariffs	D-tariffs
Austria	PHES storage facilities pay reduced network charges compared to consumers. No cost off-setting for non-PHES storage. Prosumers do not pay injection charge, only withdrawal charge.	PHES storage facilities pay reduced network charges compared to consumers. No cost off-setting for non-PHES storage would apply, if there were any connected to the D-grid.
Belgium	Net metering applies	Brussels: No cost-offsetting Flanders: No cost-offsetting Wallonia: No cost-offsetting (under construction for next regulatory period)
Bulgaria	Only withdrawal charge is applied for storage and only injection charge is applied for prosumers	No data
Denmark	No cost off-setting	No data
Finland	No cost off-setting	No cost off-setting
France	No cost off-setting	Not applicable as no injection charge applies for D-connected network users
Germany	Not applicable as no injection charge applies for T-connected network users[287]	The negative injection charges is applied for D-connected storage facilities to reward cost saving. (it does not apply for prosumers due to their volatile generation)
Ireland	No data	Not applicable as no injection charge applies for D-connected network users
Latvia	Not applicable as neither storage nor prosumers are connected to the T-grid.	If the difference between production capacity and self-consumption load is less than or equal to zero, the electricity prosumer will not have to pay the capacity fee. Not applicable for storage as there are none connected to the grid.
Malta	No transmission network	The administrative fee is paid only once by all network users.
The Netherlands	Prosumers and storage facilities do not pay injection charge (i.e. administrative fee for producers), only withdrawal charge.	Prosumers and storage facilities do not pay injection charge (i.e. administrative fee for producers), only withdrawal charge.
Norway	No cost off-setting	No cost off-setting
Romania	No cost off-setting	No cost off-setting
Slovak Republic	No cost off-setting in current decree, but in the new one there will be cost off-setting – storage and prosumer will pay only for the one capacity (for injection or withdrawal), which is higher.	No cost off-setting in current decree, but in the new one there will be cost off-setting – storage and prosumer will pay only for the one capacity (for injection or withdrawal), which is higher.
Sweden	Neither storage facilities nor prosumers are connected to the T-grid yet.	All prosumers pay for withdrawal. If they have a higher production than consumption they also pay injection charges. If the prosumer is small (with a connection not bigger than 63A) and have higher consumption than production it is exempted of paying injection charges and pay only for the withdrawal. All other cases pay both for injection and withdrawal. Injection fees are based on power not energy. (Note: the practice was provided for one of the DSO areas)

Note: "No cost-offsetting" in the table means that the storage facilities and prosumers pay the same injection charge as producers and the same withdrawal charge as consumers

[287] DE: BNetzA is at the current state not in charge of deciding upon the network tariffs. BNetzA deems the basic structure according to which storages are treated as regular network users and only charged for their energy withdrawal fair. There are also some specific rules allowing for discounts for certain storage facilities.

Table 25: Recent changes to the injection charges or planned future changes

Country	Recent changes (i.e. compared to last ACER tariff reports in 2019 and 2021) or changes which are currently under consideration
Austria	Distribution: The plans for phasing out the metering charge for both the generators and the consumers is initiated by the Smart Metering rollout
Belgium	Flanders: Until July 2022: D-injection charges for recovery of grid losses, system services and other costs (pension schemes and local retributions) are applied. From July 2022: D-injection charges for recovery of network costs (directly related to injection) are applied. Question of the storage grid tariff will be addressed with the next tariff methodology. The DSO will carry out an assessment by 2023. Wallonia: Implementation of requirements of Article (18)(1) of Regulation (EU) 2019/943 for storage; return of experience of period 2019-2023. There is no injection tariff for LV installations and power less than 10 kVA. This element will be analysed as part of the next 2024-2028 tariff methodology.
Croatia	In 2021, new Electricity Market Act (Official Gazette, Nos 111/21) is issued. The new law obligated HERA to include network tariff for producers in tariff systems and to issue new methodology for the determination of the tariffs for electricity transmission system. The new law defines that the pump-storage hydro power plant and storage operator for the energy storage are considered as consumers regarding paying for the electricity withdrawn from the network. New TSO-Methodology (Narodne novine, br. 84/22) is issued in July 2022 and will be applied for the first time for 2023[288]. New Tariff methodology for Croatian DSO, HEP-ODS (Narodne novine, br. 84/22) issued in July 2022 and will be applied for the first time for 2023.[289]
Denmark	Transmission: It is currently being considered introducing connection fees to better cover the costs incurred by connecting production to the grid. In addition it is expected that the energy payment will be increased. For both types of charges: geographical differentiation is being considered to better reflect the difference in costs incurred depending on location of new production capacity.
Germany	On 2 Sep. 2021, the ECJ ruled (C-718/18) that the so called normative regulation that is applied in Germany does not comply with EU-Law. The NRA (BNetzA) will have to become more independent. In particular - among others - the network tariff methodology cannot be set in ordinances, but will have to be added to BNetzA's jursidiction. BNetzA will evaluate the necessity of any changes to the tariff methodology.
Greece	Until late 2020 T-network users with the ability to inject power to the grid bore the cost of T-system losses associated with injected energy (paying "in-kind" for transmission system losses). This is no longer the case, as according to the new electricity market rules that became effective late 2020, TSO costs due to T-system losses are recovered by suppliers. No other cost burden exists for network users who inject into the grid, for example due to provision of ancillary services for free.
Latvia	Injection charge has been introduced. No change currently under implementation or consideration.
The Netherlands	Transmission: The NRA (ACM) will investigate whether it is necessary and possible to adjust the tariff structure in such a way that it becomes more attractive for market parties to invest in energy storage.
Poland	Transmission: Changes for the charging of storages: storages to pay a reduced fixed T-charge while taking into account a reduction factor proportional to the efficiency of the energy storage, which reduces the contracted capacity. No change (regarding injection charge) currently under implementation or consideration.
Portugal	Transmission: Injection charge was eliminated on 1 January 2022.
Romania	Distribution: There are few D-networks where electricity generated is in excess. That electricity in surplus is carried to other geographical zones to be consumed. D-tariffs that cover also the costs for losses in D-networks in one zone are paid only by consumers in that zone. The NRA (ANRE) plans to elaborate a study at national level to identify the zones with big quantity of losses due to electricity surplus to the local consumption and the solutions to allocate these costs to the relevant network users (i.e. an injection charge for producers).
Slovenia	No change regarding injection charge (not applied) Transmission: In new tariff methodology, which is under consideration, storages are subject of network charges for withdrawal.
Spain	Transmission: injection charge was eliminated.
Sweden	Transmission: In 2020, the TSO changed the energy component to be dynamic, using the electricity market prices. Additional changes were made in 2021 regarding the energy component. These changes were made to give customers more correct price signals.

[288] https://www.hera.hr/hr/docs/SPKP/NN-2022-07-20-1284.pdf
[289] https://www.hera.hr/hr/docs/SPKP/NN-2022-07-20-1283.pdf

Table 26: Connection charges at transmission level

Country	Connection charge category applied ("depth" of the charge)	Basis for setting connection charge	Exemptions, discounts or other differentiation between network users	Difference based on connection firmness	Variation based on voltage level	Difference based on geographic location [290]
Austria	Shallow	Individual actual cost (€)	Exemption for: - RES below 20 kW; - P2G under 200 lfm/MWel [291]	N/A	N/A	N/A
Belgium	Shallow	Mainly lump sum per connection (€) based on length, voltage level, type (primary/secondary). Some costs (studies) are individually estimated.	No exemption, discount or difference	Only if the TSO cannot guaranty firmness and until necessary reinforcement are completed.	Yes	No
Bulgaria	Shallow	Individual actual cost	Difference between RES vs. non-RES producers[292]	N/A	N/A	N/A
Croatia	Deep	Individual actual cost contracted power (€/MW)	Producers vs. consumers[293]	N/A	No	No
Cyprus	Shallow	Individual actual cost[294]	No exemption, discount or difference	N/A	N/A	N/A
Czech Republic	Shallow	Individual actual cost; contracted power (€/MW)	No	N/A	Yes	Yes (Network users connected to urban vs. rural areas[295])
Denmark	Shallow	Individual actual cost	Difference between onshore RES producers vs. offshore RES producers[296]; Exemption for producers[297]	N/A	N/A	N/A
Estonia	Deep	Individual actual cost (€)	No exemption, discount or difference	No difference	N/A	N/A

[290] Variation based on location, unrelated to the connection to a specific DSO (e.g. the network charges are set to be different to indicate at which locations the electricity is most or least needed, not because for different DSOs different charges or tariff values apply)
[291] AT: According to national law exemption applies for small RES generation units <20kW and for P2G units with grid connection of <200 lfm/Mwel. Special exemption (no grid provision fee applied) for pumped-hydro units.
[292] BG: The difference was not explained by the NRA
[293] HR: Electricity producers pay actual connection costs. Consumers pay either a "unit fee per capacity (Euro/MW)" or the actual costs of the connection works in case it is 1.2 times higher than the costs per unit fee.
[294] CY: In accordance with the Transmission and Distribution Rules (TDR), the TSO is responsible for the processing of applications for connection to the T/D-network of producers with a requested connection capacity greater than 8 MW, or customers with a requested connection capacity greater than 12 MVA. In all other cases, applications are processed by the DSO. The applicant is charged based on the necessary equipment and the circuits required exclusively for the connection of his installations.
[295] CZ: In remote areas, users pay actual connection costs, while in urban areas, users pay unit charge per connected capacity.
[296] DK: The difference was not explained by the NRA
[297] DK: It has been decided by law that costs related with connection of production should be covered by consumers. These rules have been changed in December 2021, and new system in development.

Country	Connection charge category applied ("depth" of the charge)	Basis for setting connection charge	Exemptions, discounts or other differentiation between network users	Difference based on connection firmness	Variation based on voltage level	Difference based on geographic location [290]
Finland	Shallow	Standard lump sum fee per connection (€); (different in case of connection to power line vs. connection to substation); Individual actual cost (€) (in case of new substation is requested)[298]	No exemption, discount or difference	N/A	Yes	No
France	Shallow	Individual actual cost (€)	Exemption for off-shore RES producers and discount for onshore RES producers vs. other non-RES producers[299]	Discounts for interruptible connection agreement[300]	N/A	Yes
Germany[301]	Shallow	Individual actual cost (€)	No differentiation	N/A		
Greece	Shallow	Individual actual cost (€)	No exemption, discount or difference	N/A	N/A	Yes
Hungary	Deep	Individual actual cost	RES producers vs. other producers[302]	No difference	N/A	-
Ireland	Shallow	Individual actual cost (€)	Discount for consumers[303]	No data		
Italy	Shallow	Individual actual cost (€)	Caps/discounts for some EHV and connected network users[304]	N/A	N/A	-
Latvia	Deep	Individual actual cost (€)[305]	No exemption, discount or difference	N/A	N/A	-

[298] FI: https://www.fingrid.fi/en/grid/grid-connection-agreement-phases/fees/#grid-connection-fees-2022-2021 https://www.fingrid.fi/globalassets/dokumentit/fi/palvelut/kulutuksen-ja-tuotannon-liittaminen-kantaverkkoon/kantaverkon-liittymismaksuperiaatteet_2016.pdf

[299] FR: Onshore RES producers benefit from a reduction in connection charges. This reduction varies with the installed capacity. Offshore RES producers do not pay connection charges.

[300] FR: The implementation of the scheme is ongoing.

[301] DE: Connection charge methodology is not regulated; connection charges are set by TSOs and have to be non-discriminatory.

[302] HU: RES producers are entitled to a connection charge discount.

[303] IE: All network users are subject to connection charges. Demand customers pay 50%, while generators pay 100% of connection charges. The intent of these standard connection charges is to provide a reasonable degree of certainty for parties seeking to connect to the distribution and transmission systems in Ireland, particularly the large number of new renewable generators. Costs may vary based on voltage level, length.

[304] IT: No conceptual difference, but the supplementary costs for network upgrades could be larger for offshore RES. EHV and HV producers are required to pay standard costs borne for connecting them, calculated by the TSO depending on the necessary minimal equipment (which is defined on a case-by-case basis after individual connection requests). EHV and HV RES and high-efficiency cogeneration benefit from caps / discounts. EHV and HV consumers are required to pay 50% of the costs borne for connecting them (which are defined on a case-by-case basis after individual connection requests)

[305] LV: The costs are determined in an open tender.

Country	Connection charge category applied ("depth" of the charge)	Basis for setting connection charge	Exemptions, discounts or other differentiation between network users	Difference based on connection firmness	Variation based on voltage level	Difference based on geographic location [290]
Lithuania	Deep	Individual actual cost (€)	No exemption, discount or difference[306]	N/A	N/A	N/A
Luxembourg	Shallow	Individual actual cost (€)	No exemption, discount or difference	N/A	N/A	N/A
The Netherlands	Shallow	Individual actual cost (€) – two components[307]	No exemption, discount or difference	N/A	N/A	N/A
Norway	Deep	Individual actual cost (€) distributed on basis of customers connected capacity relative to total new available capacity	No exemption, discount or difference	Yes, subject to mutual agreement by TSO and network user [308]	N/A	N/A
Poland	Shallow	Individual actual cost	Discounts for - some RES and co-generation producers vs. other producers; - Storage facilities vs. other network users - EV charging facilities vs. other consumers[309]	N/A	N/A	N/A
Portugal	Deep	Individual actual cost (€)[310]; capacity (€/MW)	Difference between consumers vs. producers[311]	No difference	No	No
Romania	Shallow and Deep	Individual actual cost;	Difference between consumers vs. producers[313]	N/A	No	No

[306] LT: All users connected to the T-grid pay 100% of the actual connection costs.
[307] NL: The connection tariff comprises two components: 1. the initial connection tariff, which covers the costs of creating the grid connection. It varies as all connections to the high-voltage grid are tailor made. 2. the periodic connection tariff, which covers the costs of maintaining and, if necessary, replacing the connection. Parties with multiple connections receive a separate invoice for each one. The periodic connection tariff is a fixed amount that is updated once a year.
[308] NO: Connection charge may differ based on firmness level of the connection (firm vs flexible/interruptible connection agreements) subject to mutual agreement by TSO and network user
[309] PL: According to law connection fee is based on investment expenditures (CAPEX) for the connection. Final consumers pay connection fee amounting to 25% of CAPEX; DSOs and producers - 100% of CAPEX; RES less than 5 MW and co-generation less than 1 MW - 50% of CAPEX; EV charging infrastructure – 6.25% of CAPEX; storage facilities 50% of CAPEX.
[310] PT: Although the transmission network covers 3 voltage levels (150, 220 and 400 kV), the charges applicable to connection to this network do not depend on the voltage level. It is worth mentioning that the charge for the reinforcement of the existing network is charged regardless of whether the new connection motivates this reinforcement or not. To that extent, it constitutes a contribution to the investment necessary to replace the capacity taken by the connection and the respective charge internalizes the expected benefits of the connection (depending on whether it is a consumption or production facility).
[311] PT: The charge for network reinforcement varies depending on whether the facilities are consumption or production.
[313] RO: Producers pay network reinforcement component (deep connection charge).

Country	Connection charge category applied ("depth" of the charge)	Basis for setting connection charge	Exemptions, discounts or other differentiation between network users	Difference based on connection firmness	Variation based on voltage level	Difference based on geographic location [290]
		contracted power (€/MW)[312]				
Slovak Republic	Super-shallow Shallow	Individual actual costs (resp. TSO costs caused by the connections)	No exemption, discount or difference	No difference	No	No
Slovenia	Mix of shallow and deep	Individual actual cost (€); contracted power (€/MW)[314]	No exemption, discount or difference	N/A	Yes	No
Spain	Deep	Individual actual cost (€); contracted power (€/MW)	No exemption, discount or difference	N/A	Yes	No
Sweden	Deep	Individual actual cost	No exemption, discount or difference	N/A	N/A[315]	N/A[316]

Note: Regarding the difference based on connection firmness, "N/A" (Not applicable) means the cases where there are no flexible or interruptible connection agreements. Where the connection charge is calculated based on actual costs (i.e. individually estimated), the variation based on the voltage level and the location is implicit (i.e. different voltage level or location may result in different actual costs), thus in the table such cases are labelled as "N/A" (Not applicable).

Table 27: Connection charges at distribution level

Country	Connection charge category applied ("depth" of the charge)	Basis for setting connection charge	Exemptions, discounts or other differentiation between network users	Difference based on connection firmness	Variation based on voltage level	Difference based on geographic location[317]
Austria	Shallow	Individual actual cost (€); Capacity[318] (€/kW)	RES vs. Non-RES producers; PHES vs. Non-PHES storage ; Consumers in energy communities	N/A	Yes	Yes (network areas)[320]

[312] RO: The charge paid for connection infrastructure reflects the actual cost. Similarly, a grid reinforcement component is based on the actual cost but is limited by a cap approved by the NRA (ANRE) multiplied by installed capacity. As for testing and commissioning, users are charged based on the installed capacity.
[314] SI: The calculation of network connection charges is based on the average influence of the newly connected/increased load (kW) on the necessary extensions and reinforcements in the grid.
[315] SE: Since the connection charge is calculated individually for the network users, the connection charge varies because of different costs, including due to different voltage level (i.e. variation by voltage level is implicit).
[316] SE: Since the connection charge is based on actual costs (i.e. individually estimated), the variation based on the voltage level and the location is implicit (i.e. different voltage level or location may result in different actual costs.)
[317] Variation based on location, unrelated to the connection to a specific DSO (e.g. the network charges are set to be different to indicate at which locations the electricity is most or least needed, not because for different DSOs different charges or tariff values apply)
[318] AT: The system admission charge is based on the actual costs. Connection charge for RES producers is calculated based on a flat fee per kW. The system provision charge levied in case of a connection is calculated per capacity (EUR/kW).
[320] AT: There are no locational signals incorporated in the connection charges, but there are different connection charges for the individual network areas in AT. The costs of each network area are covered separately by the specific local connection charge of each network area.

Country	Connection charge category applied ("depth" of the charge)	Basis for setting connection charge	Exemptions, discounts or other differentiation between network users	Difference based on connection firmness	Variation based on voltage level	Difference based on geographic location[317]
			vs. other consumers[319]			
Belgium	Brussels: Deep Flanders: Deep Wallonia: Deep	Brussels: Individual actual cost (€); Lump sum (€) Contracted power (€/kVA) Flanders: Individual actual cost (€); Lump sum (€); Distance (€/m); Contracted power[321] Wallonia: Individual actual cost (€); Distance (€/m) Contracted power[322]	No exemption, discount or difference	Brussels: N/A Flanders: N/A Wallonia[323]	Brussels: Yes Flanders: Yes Wallonia: Yes	Brussels: No Flanders: No Wallonia: (Difference between network users connecting to rural and urban areas)[324]
Bulgaria	Shallow	Distance; Contracted power	No exemption, discount or difference	N/A	No	No
Croatia	Deep	Individual actual cost; Contracted power	Producers vs. Consumers[325]	N/A	No	No
Cyprus	Shallow	€/kVA[326]	Different charges for residential and industrial consumers[327]	N/A	Yes	Yes[328]
Czech republic	Shallow	Individual actual cost; Contracted power		N/A	Yes[329]	Yes (Difference between network users connecting to rural and urban areas[330])
Denmark	Shallow and deep	Lump sum (the average cost	Deep for producers,	Yes (Interruptible connections	Yes	Yes

[319] AT: Reduced connection charges for RES producers. Reduced system utilisation charge for pumped-hydro storage facilities. Reduced system utilisation charge for consumers, which are part of a renewable energy community.
[321] BE (FLA): In most cases, the connection charge consists of a standard lump sum per connection (EUR). Additional unit charges per capacity (EUR/kVA), per distance (EUR/m) or per connection are possible. In some cases, the individual estimated actual costs are charged.
[322] BE (WAL): Cost may be charged on the basis of a package or unit cost per service, unit charge per capacity, cost per km.
[323] BE (WAL): The injection tariff for flexible capacity is 0 EUR/kVA
[324] BE (WAL): D-consumers (LV) in urban areas are exempted from reinforcement and extension charges, whereas those outside pay actual costs. The reasoning behind is that urban networks should be designed to accommodate all user needs and to de-incentivize urban sprawl.
[325] HR: Producers are charged with an actual cost, while consumers' charge is based on the capacity.
[326] CY: If network extension/reinforcement is required a share of the cost is allocated to the DSO and the rest to the applicant based on several criteria (network characteristics, load, line etc.) described in the NRA's Regulatory Decision 03/2013.
[327] CY: e.g. the costs are separated based on the "Load Entitlement" (kVA), voltage level and network topology, if extension/reinforcement is required.
[328] CY: There is no locational specific variation but the further away from the distribution network, the higher is the charge.
[329] CZ: On each level, the connection charges matches the average historic costs on the voltage level
[330] CZ: In remote areas, users pay actual connection costs, while in urban areas, users pay unit charge per connected capacity.

Country	Connection charge category applied ("depth" of the charge)	Basis for setting connection charge	Exemptions, discounts or other differentiation between network users	Difference based on connection firmness	Variation based on voltage level	Difference based on geographic location[317]
		for a given voltage level)	semi-deep for consumers.	pay the same D-tariffs but get a discount on their connection charges)		(only for producers)[331]
Estonia	Shallow and deep	Individual actual cost (€); Contracted power (€/MW)	No exemption, discount or difference	N/A	Yes	No
Finland	Shallow and deep	Individual actual cost (€) or lump sum[332] Contracted power (€/MW)	Consumers vs. Producers/Storage facilities; Small producers vs. Other producers[333]	N/A	Yes	Yes[334]
France	Shallow	Individual actual cost (€) or lump sum; Distance (€/m) Contracted power (€/MW)	Onshore RES vs other producers[335]	Discounts for interruptible connection agreement[336]	Yes	Yes[337]
Germany	Shallow and deep	No particular basis defined[338]	No exemption, discount or difference	No difference	Yes[339]	

[331] DK: Geographical differentiation is currently only implemented for producers. The law is currently under revision so that the geographical differentiation will also be possible for consumers.
[332] FI: In case of low voltage connections near substations, charge is calculated based on the average shallow costs and capacity charge. For the rest of the connections, connecting users pay actual shallow costs and capacity charge.
[333] FI: Costs are charged differently between production and consumption in relation to the capacity reservation charge. Concerning production, the average benefits relating to connecting production to the network must be considered. In the case of small production, a capacity fee is not charged.
[334] FI: Connection pricing is based on three different principles: zone pricing, area pricing, and case by case pricing. Zonal pricing is used at a distance of at least 600 m (and at least 3x63 A connections) from existing substations. Area pricing is used outside of zone pricing. Case by case pricing is used if there are no conditions for area pricing (often a single higher-capacity subscription that is not covered by zonal pricing due to its high power and distance). Zonal pricing is based on the average actual construction costs of the connections in the zones. Area pricing is based on the construction cost of the planned area divided by all potential connections in the area. Case-by-case pricing is based on the construction costs required for an individual connection. All connection charges shall also include an average capacity reservation fee (€/kVA) to cover the average cost of strengthening the network. The cost of strengthening the network may not be charged on a case-by-case basis. The principles for determining the capacity reservation fee are determined by the regulator. The capacity reservation fee is voltage level specific and must be determined separately for production and consumption connections. For the production the capacity reservation fee is usually a smaller than for the consumption connections because DSO must take into account in its pricing the potential benefits to the capacity that production facilities may cause in relation to consumption connections. DSO is not allowed to use capacity reservation fee for production that connection power is at most 2 MVA. The costs of network development are not allowed to include in the connection pricing. Network reinforcement consists of rebuilding the network (=network development) and increasing power transmission capacity. The capacity reservation fee is defined to include only calculated average costs that have an effect on the increase in transmission capacity.
[335] FR: Onshore RES producers benefit from a reduction in connection charges. This reduction varies with the installed capacity.
[336] FR: The implementation of the scheme is ongoing.
[337] FR: A part of renewable energy connection fees is mutualised throughout regional schemes.
[338] DE: There is no particular regulation of connection charges. According to paragraph 17 of the Energy Act, the technical and economic conditions for connections have to be appropriate, transparent and non-discriminatory. These conditions apply to connection charges, too.
[339] DE: Every German DSO sets its own connection charges and indicates variations. However, the low voltage level, there is a specific rule regarding deep connection charges (NAV). The NAV stipulates that an appropriate deep connection charge for the partial remuneration of the building or reinforcement of the network can be charged. The charge is calculated according to the relation between the capacity of the specific connection and the capacity of the grid. Deep connection charges must, however, not be charged for capacities not exceeding 30 kW.

Country	Connection charge category applied ("depth" of the charge)	Basis for setting connection charge	Exemptions, discounts or other differentiation between network users	Difference based on connection firmness	Variation based on voltage level	Difference based on geographic location[317]
Greece	Shallow and deep	Individual actual cost (€); lump sum; distance (€/m); contracted power (€/MW)	Few differences: producers vs. consumers[340]	N/A	Yes	Yes[341]
Hungary	Shallow and deep	Individual actual cost distance contracted power	RES vs other producers; LV/MV vs HV consumers[342]	No difference	Yes	No
Ireland	Shallow	Various basis for setting the charge[343]	Difference between RES and non-RES producers; Difference based on size/type of the connection	N/A	Yes	
Italy	Shallow	Distance (€/m) contracted power (€/MW)	Consumers vs other network users[344]; small RES/CHP generators and other generators	N/A	Yes	No
Latvia	Shallow and deep	Individual actual cost (€); Nominal current	Smaller network users vs other network users[345]	N/A	Yes	No
Lithuania	Shallow and deep	Lump sum (€); distance (€/m); contracted power (€/MW)	Prosumers vs. other network users[346]	N/A	Yes	Yes[347]

[340] GR: Connection charges for both consumers and producers are essentially based on "deep connection cost" principle, with a few differences. For producers' connection charges are based on actual (realised) cost of network expansion and reinforcement required. Consumers' connection charges are calculated by means of a) unit costs related to the required network expansion and reinforcement works, as well as to the cost of existing network infrastructure and b) parameters related to the capacity of the required connection.
[341] GR: Unit charges for consumers' connection may differ between geographic locations (e.g. due to differences in network specifications, like coastal areas).
[342] HU: RES producers are entitled to a connection charge discount. Consumers connecting to high voltage network pay the 70% of the total costs of connection. Consumers connecting to low or medium voltage network have to pay capacity based (HUF/kW) and distance based (HUF/m) tariff elements for the connection.
[343] IE: Connection Charges vary by voltage size and incentivise customers to right size their connection and connect to the most appropriate voltage level. LV/MV: The network user pays a capital contribution towards 50% of the shallow connection. HV: The network user pays a capacity-based charge towards deep reinforcement. Standard Charge based on MIC including a 50% capital allowance Standard Charge based on a per metre charge for new network – cable /OHL. Non-standard based on 50% of actual costs. Charges are based on the Least Cost Technically Acceptable (LCTA) connection method and all enhancements over LCTA are charged at 100%
[344] IT: Connection charges for active users are differentiated between small RES/CHP generators and others; small RES/CHP generators are charged based on a standardized formula while for the others a specific estimate by the DSO is needed. Connection charges for passive users are always based on a standardized formula, different from the one for active users.
[345] LV: DSO shall cover 50% of the connection charge if the nominal current of the input protection appliance of the connection does not exceed 100A and a connection voltage does not exceed 400 V. In other cases, the network user pays the entire connection charge (deep).
[346] LT: Connection charges vary between prosumers who produce and consume in the same place (charged 50% connection costs) and prosumers who produce in one place and consume in another (charged 100% connection costs). Vulnerable users pay 20% of the connection costs. In the case of storage - if the storage will only be recharged from the network and not returned to the network, will be charged 50% connection costs. Energy storage facilities shall pay 100% of the costs, if the energy is subsequently returned to the electricity networks.
[347] LT: It takes into consideration geographical location impact on costs of connection.

Country	Connection charge category applied ("depth" of the charge)	Basis for setting connection charge	Exemptions, discounts or other differentiation between network users	Difference based on connection firmness	Variation based on voltage level	Difference based on geographic location[317]
Luxembourg	Shallow	Individual actual cost (€) or lump sum; (€) contracted power (€/MW)	No exemption, discount or difference	N/A	Yes	Yes
Malta	Shallow and deep	Individual actual cost (€); lump sum (€); contracted power (€/MW)	Smaller network users vs. other network users[348]	N/A	No	No
The Netherlands	Shallow	Individual actual cost (€) or lump sum (€) distance (€/m)[349] capacity (€/MW)	No exemption, discount or difference	N/A	No	No
Norway	Deep	Individual actual cost[350]	No exemption, discount or difference		Yes	Yes
Poland	Shallow	Individual actual cost	Producers vs storage vs consumers; RES vs. co-generation; EV charging infrastructure vs other consumers[351]	N/A	Yes	Yes geographical location and other: first connection[352]
Portugal	Deep	Individual actual cost (€); distance (€/m); contracted power (€/MW) [353]	Producers vs. consumers[354]	No difference	Yes	No
Romania	Shallow and deep	Individual actual cost lump sum	Producers vs. consumers[355]	N/A	Yes	No
Slovak Republic	Shallow and deep	Individual actual cost (€) contracted power (€/MW)	Some storage facilities vs.	No difference	Yes	

[348] MT: Up to 60 Amps, connections charged a lump sum. Over 60 Amps, connections extended from an existing substation based on the actual cost and capacity.
[349] NL: One-time connection combines a fixed cost and an additional cost per meter cable length when the connection is more than 25 m; a periodic connection charge covers the cost of capital of the assets involved - it combines a fixed cost and an additional cost per meter cable length when the connection is more than 25 m.
[350] NO: Individual charge. Customer pay a share of actual investment costs of the connection based on capacity demand.
[351] PL: There are five connecting groups in DSO: from II (110 kV), III (MV), IV (LV, more than 40 kW), V (LV, less than 40 kW), VI temporary. Groups II-III pay a charge equal to 25% of CAPEX (investments expenditures used for realisation of the connection); RES less than 5 MW and co-generation less than 1 MW: 50% of CAPEX; Micro-installation - 0% of CAPEX (free connection); EV charging infrastructure - 6.25% of CAPEX. Batteries 50% of CAPEX. Groups IV, V and VI pay charges from tariff multiplied by connection capacity.
[352] PL: For the first connection charge is calculated on 25% of investments expenditures. For the reserve connection, a connection charge covers all investments expenditures
[353] PT: Depending on the voltage level and on the requested power, the requester bears the entire connection cost or a portion of the total cost. The charge for network reinforcement depends on the voltage level as well as the power required. The charge for connection services is a function of the voltage level, the power required, the length of the connection elements, the type of connection (aerial or underground).
[354] PT: The charge for network reinforcement varies depending on whether the facilities are consumption or production.
[355] RO: Producers pay network reinforcement component (deep connection charge), while consumers bear a shallow connection charge.

Country	Connection charge category applied ("depth" of the charge)	Basis for setting connection charge	Exemptions, discounts or other differentiation between network users	Difference based on connection firmness	Variation based on voltage level	Difference based on geographic location[317]
			other storage facilities[356]			
Slovenia	Shallow	Contracted power (€/kW)[357]	Producers vs consumers; Different unit charges for households vs. non-households[358]	N/A	Yes	No
Spain	Deep	lump sum (€); contracted power (€/kW)	No exemption, discount or difference[359]	N/A	Yes	No
Sweden	Deep	Individual actual cost	No exemption, discount or difference	No[360]	N/A[361]	N/A[362]

Note: Regarding the difference based on connection firmness, "N/A" (Not applicable) means the cases where there are no flexible or interruptible connection agreements. Where the connection charge is calculated based on actual costs (i.e. individually estimated), the variation based on the voltage level and the location is implicit (i.e. different voltage level or location may result in different actual costs), thus in the table such cases are labelled as "N/A" (Not applicable).

Table 28: Current and planned offshore RES generation capacity by country

Countries	2021 total installed capacity (ENTSO-E transparency platform) (MW)	2021 offshore RES level (MW) (NRA input)	2021 offshore RES share within the total installed capacity (%)	2030 offshore RES planned increase compared to 2021 (MW)	2050 offshore RES planned increase compared to 2021 (MW)
Austria		-		-	-
Belgium	25708	2262	9%	2100 - 3500	2100 - 3500
Bulgaria	12986	No data		No data	No data
Croatia	4249	0		0	0
Cyprus	1900	0		0	0
Czech Republic		-		-	-
Denmark	15964	(1700)[363]	11%	No data	No data
Estonia	2337	0		1000	No data
Finland	16863	0		0	0
France	130560	0		5200 - 5800	22000 - 62000
Germany	230478	7787	3%	20000	No data
Greece	17888	No data		No data	No data
Hungary		-		-	-
Ireland	9827	No data		No data	No data

[356] SK: D-connected storage facilities injecting the electricity only for the purposes of providing the ancillary services do not pay connection costs.
[357] SI: New user is obliged to pay for average cost for connection while costs for connection from public grid to premises of the user depends on the individual case and its implementation/construction, which are covered by customers.
[358] SI: Specific connection charges in (EUR/kW) are calculated for different types of customers depending on the voltage level at which the costumer is connected: HV - consumption at 110 kV, MV - consumption at 35, 20 and 10 kV, LV - commercial above 43 kW, LV - commercial up to 43 kW, LV – household.
[359] ES: D-connected producers pay for their connection and all the necessary reinforcements. For D-connected consumers, a difference is made depending on the nature of the network expansion, which is either paid for by the DSO or the network user. In the latter case, for consumers who connect to LV up to 100 kW or to HV up to 250 kW, at urban area, the DSO is remunerated at ex ante set values, depending on the power and voltage level.
[360] SE: Flexible connections may be compensated via other network tariffs in some DSO areas.
[361] SE: Since the connection charge is calculated individually for the network users, the connection charge varies because of different costs, including due to different voltage level (i.e. variation by voltage level is implicit).
[362] SE: Since the connection charge is based on actual costs (i.e. individually estimated), the variation based on the voltage level and the location is implicit (i.e. different voltage level or location may result in different actual costs.)
[363] The data is based on ENTSO-E's Transparency Platform.

Countries	2021 total installed capacity (ENTSO-E transparency platform) (MW)	2021 offshore RES level (MW) (NRA input)	2021 offshore RES share within the total installed capacity (%)	2030 offshore RES planned increase compared to 2021 (MW)	2050 offshore RES planned increase compared to 2021 (MW)
Italy	93357	0		900	No data
Latvia	2843	78	3%	800	1100
Lithuania	3808	0		1400	No data
Luxembourg		-		-	-
The Netherlands	39132	2585	7%	18400	67400
Norway	40390	0		0 - 3000[364]	0 - 30000[365]
Poland	45029	0		5900	No data
Portugal	20022	25	0.1%	275	≤1,275
Romania	17306	0		0	0
Slovak Republic		-		-	-
Slovenia	3862	0		0	0
Spain	109409	No data		No data	No data
Sweden	41199	200	0.5%	200 - 5000	1500 - 35000

Note: "No data" means that it was not provided by (or available to) the NRA

Table 29: Cost sharing problem of grid connection

Country	Treatment of the problem of extending the network to serve one particular network user, leading to high connection costs for that user, which ultimately will reduce the connection costs to connect further users in the future
France	Specific treatment for RES production (S3RENR) where network reinforcements are shared with users in the future.
Greece	To ensure fair charges and address the "free-rider" problem, a mechanism is in place to reimburse network users that have paid for the full actual cost of network expansion and/or reinforcement (mainly producers and some specific consumer connection cases), in case that other users are connected in the future making use of the extended/reinforced network (up to 5 years later)
Hungary	Consumers connecting to the high voltage network: The costs of works needed to make the required connection capacity available for a single network user are split into two different categories. The two categories are direct connection cost and indirect connection cost. Direct cost category includes all the costs of the investments by the TSO that result network devices that will be used by one single network user (e.g. a direct wire). The direct cost is paid by 100% by the network user. Indirect cost category includes all the costs of the investments that result network devices that will be used by several network users. The direct cost is paid only partially by a single network user. That method assures that connection costs for further networks users in the future will not be reduced.
Ireland	The Connection Charging Methodology includes a mechanism to refund customers who pay for deep connections, where customers connect in the future. The size of the refund depends on the size of the new customer(s).
Latvia	If, when evaluating the installation of a new connection, the system operator establishes that it is economically justified to install an electrical installation with additional capacity exceeding the permitted load requested by the network user, new system user pays in proportion to his requested capacity and the system operator shall cover all other costs related to the installation of additional capacity.
Lithuania	In the case the customer is connected to the D-network and its connection requires T or D network reconstruction in order to strengthen the network, then it is assessed whether there are potential users who would connect the equipment to the enhanced network for a period of five years. If so, the network development / reconstruction cost divided (formula: installation cost / infrastructure capacity (kW)) and each subsequent connected user pays for the network reinforcement previously carried out, depending on the installed capacity, thus contributing proportionately to the cost recovery. The criteria for the assessment of a potential user are defined in the Methodology for the Connection of Electrical Equipment to the Electricity Networks approved by the NERC.
Norway	Costs are reduced by 50 % before connection charge is calculated.
Portugal	The charge for the reinforcement of the existing network (deep connection charge) results from the consideration of the set of expected benefits of the new connection, given the unit investment cost of the network operator. It is actually a contribution and takes into account, for example, the expected payment of tariffs for the use of networks, the improvement in the quality of service, the reduction of technical losses or the impact on price formation in the market (in the case of production facilities).
Romania	There are areas where consumption is higher than generation and other areas where generation exceeded the consumption. In the first situation, there is no need for reinforcements in the existing D-grid to connect new generators, so this measure (deep connection charge for producers) offers a locational signal to new

[364] NO: At least 3000 MW is planned award by 2030, but not necessarily commissioned by 2030.
[365] NO: Norway's ambitions is to award areas corresponding to 30 000 MW by 2040, but not necessarily commissioned by 2050.

Country	Treatment of the problem of extending the network to serve one particular network user, leading to high connection costs for that user, which ultimately will reduce the connection costs to connect further users in the future
	producers and could reduce the quantity of electricity transmitted over long distances and the associated costs (mainly losses).
Slovenia	New user is obliged to pay for average cost for connection while costs for connection from public grid to premises of the user depends on the individual case and its implementation/construction, which are covered by customers.
Spain	In generation, the producer pays for his connection and all the reinforcements that are necessary. In the case of consumers, a difference is made between the natural extension of the network (growth in demand that emerges naturally in the networks) and the new network extensions: In the former case, the infrastructures must be carried out and paid for by the DSO. In the second case, they must pay for the development of the networks that are necessary, as well as the reinforcement at the same voltage level to which it is connected. In the latter case, for consumers who connect in LV and with a power of up to 100 kW or in HV with a power of 250 kW, on urbanized land, the DSO is remunerated at values set ex ante, common for the entire territory, depending on the power and voltage level.
Sweden	If there are more connections probable in the area the customer only pays a relevant share of the connection. If there are none the connection can only serve that customer and that customer will have to pay it all. They have in rare occasions bought back unused connection capacity in order to connect more customers (Note: the practice was provided for one of the largest DSOs).

Table 30: Transfer or split of some of the connection charge revenues between DSOs

Country	Transfer or split of some of the connection charge revenues between DSOs
Austria	No
Belgium	No
Bulgaria	No
Croatia	No
Cyprus	No
Czech Republic	No
Denmark	Yes: If different DSO's own different voltage levels in a given area, there are two models in use: 1) No split, but if the lower level DSO feeds in more max-load to the overlying grid, the underlying grid has to pay extra for that right 2) A split based on which DSO owns which of the essential grid assets.
Estonia	No
Finland	No
France	Yes: the cost based connection charge is paid to the network operator whose network the network user will directly connect to. The network operator is obliged to transfer the share of the connection charge that is covering the costs of other network operator's investment.
Germany	No
Greece	No
Hungary	Yes: the cost based connection charge is paid to the network operator whose network the network user will directly connect to. The network operator is obliged to transfer the share of the connection charge that is covering the costs of other network operator's investment.
Ireland	No
Italy	No
Latvia	No
Lithuania	No
Luxembourg	Other: Since there is a national tariff equalization between DSOs, this is implicitly done. Compensations between DSOs at regular intervals during the year, ensure that every DSO reaches his maximum allowed revenue.
Malta	N/A (In Malta there is only one DSO)
The Netherlands	No
Norway	Other: Each DSO calculates connection charges for their own investments. The connection charges associated with the same connection are bundled, and charged the relevant customer. The connection charge is split between the DSOs, based on the costs they are responsible for.
Poland	No
Portugal	No
Romania	No
Slovak Republic	No
Slovenia	No
Spain	No
Sweden	No

Table 31: Application of charges for reactive energy at distribution level

Country	D-tariff (reactive withdrawals)	D-tariff (reactive injections)
Belgium	Brussels: Q above a percentage of P Flanders: Q above 48.4% of P Wallonia: Q above a percentage of P	Brussels: no charges for injections Flanders: Q above 48.4% of P Wallonia: no reactive injection, no charge
Bulgaria	No data	No data
Croatia	Power factor below 0.95	No reactive injection allowed
Czech Republic	Power factor below 0.95	No reactive injection allowed
Estonia	Q above 15% of P[366]	Q above 15% of P[367]
Finland	DSOs are free to decide tariff structures	DSOs are free to decide tariff structures
France	Q above a percentage of P - DSOs decide	Q above a percentage of P DSOs decide
Hungary	Q above 25% of P (LV) – Q above 30% of P (MV)	
Ireland	Power factor below 0.95	No reactive injection allowed, no charges
Italy	Q above 33% of P	No reactive injection allowed, no charges until March 2023
Latvia	Power factor below 0.929	No reactive injection allowed
Lithuania		No reactive injection allowed
The Netherlands	Power factor below 0.85[368]	No reactive injection (power factor 1)
Norway	DSOs decide the limit	No reactive injection allowed, no charges
Poland		
Portugal[369]	Q above 30% of P (measured outside the off-peak hours)	Measured during off-peak hours. DSO decides whether to apply the reactive charge approved by the regulator or not to apply any charge.
Romania	Power factor below 0.9	Power factor below 0.9 (capacitive)
Slovak Republic	Based on power factor cos fi = 0,95	No reactive injection allowed
Slovenia	9.02 Euro/Mvarh for low and medium voltage	9.02 Euro/Mvarh for low and medium voltage; 3.52 Euro/Mvhar for high voltage
Spain	Q above 33% of P	Power factor below 0.98 (capacitive), no charges

Note: Q=reactive power exchanged, P=active power exchanged

Table 32: Actual values of charges for reactive energy at distribution level

Country	D-tariff (reactive withdrawals)	D-tariff (reactive injections)
Belgium	Brussels: 15 Euro/Mvarh Flanders: 15.4499 Euro/Mvarh Wallonia: 15 Euro/Mvarh	Brussels: no charges for injections Flanders: 15.4499 Euro/Mvarh Wallonia: no charges for injections
Bulgaria	No data	No data
Croatia	Around 20 Euro/Mvarh	Around 20 Euro/Mvarh
Czech Republic	It is not possible to determine in Euro/Mvarh, charges for withdrawal of reactive energy is computed from maximal power withdrawn in MW and amount of withdrawn energy in MWh and from power factor	18 Euro/Mvarh
Estonia	4.1 or 5.8 Euro/Mvarh (depending on voltage)	6.5 or 7.9 Euro/Mvarh (depending on voltage)
Finland	Varies per DSO	Varies per DSO
France	Varies per DSO	Varies per DSO
Hungary	Around 10 Euro/Mvarh for low voltage Around 7 Euro/Mvarh for medium voltage	No data

[366] EE: When reactive energy is withdrawn or injected, a network charge must be paid if the ratio between the amount of reactive energy withdrawal or injection and the amount of active energy consuming is greater than 15%. If this ratio is 15% or less, no fee is charged for the reactive energy.
[367] Idem.
[368] NL: The reported limits apply to consumers. For producers connected to low voltage network: power factor 0.9, for producers connected to medium voltage network: power factor 0.98
[369] PT: These are the rules applicable to reactive withdrawals and injections from consumers. For producers, other specific rules apply.

Country	D-tariff (reactive withdrawals)	D-tariff (reactive injections)
Ireland		No charges for injections
Italy	7.92 - 10.24 euro/Mvarh for low voltage 2.71 - 3.51 euro/Mvarh for medium voltage	No charges for injections
Latvia	4 Euro/Mvarh	13 Euro/Mvarh
Lithuania	6 Euro/Mvarh	12 Euro/Mvarh
The Netherlands	Varies per DSO	Varies per DSO
Norway	No data	No charges for injections
Poland	Market-based and linked to active energy price	Market-based and linked to active energy price
Portugal[370]	3.6-10.8-32.4 euro/Mvarh for low voltage > 41.4 kVA 0.5-1.5-4.5 euro/Mvarh for medium voltage	8.3 euro/Mvarh for low voltage > 41.4 kVA 1.1 euro/Mvarh for medium voltage
Romania	18.6 Euro/Mvarh	18.6 Euro/Mvarh
Slovak Republic	Varies per DSO, additional fee	Varies per DSO, additional fee
Slovenia	9.02 Euro/Mvarh	9.02 Euro/Mvarh
Spain	41.554-62.332 Euro/Mvarh	No charges for injections

Table 33: Application of time-of-use signals in T-tariffs and the temporal granularity of time-of-use T-tariff structures

Country	Application of ToU signals in T-tariffs (and determination of the time granularity)	Seasonal	Day of week (working day / weekend or holiday)	Within-day (peak/ off-peak or day/ night)
Austria	No			
Belgium	Yes Note: A peak tariff period has been determined based on observations of synchronic peak load occurrences. Within peak period the annual peak-load tariff is non-zero, in off-peak period it is zero. Peak period is between November and March, Monday to Friday (except public holidays), from 17:00 to 20:00	Peak (1 November – 31 March)	Peak (Monday – Friday) Off-peak (Weekend, holidays)	Peak (17:00 to 20:00)
Bulgaria	No			
Croatia	Yes	Not applied	Not applied	Peak (08:00-22:00)
Cyprus	No Note: The network charge has currently no time differentiation (i.e. the same rates apply), but the framework allows for time differentiation by seasons, day of week and peak/off-peak within a day[371]			
Czech Republic	No			

[370] PT: Charges for reactive energy withdrawals, outside the off-peak hours, are applied in a three-step approach. The reactive energy exceeding 30% of active energy, but below 40%, is charged with the lowest unit price. The reactive energy representing between 40% and 50%, is charged with the intermediate unit price. The reactive energy exceeding 50% is charged with the highest unit price. Any reactive injections (received by the network) during off-peak hours is charged with the same reactive energy charge. These charges (reactive withdrawals and injections) are applicable to consumers. For producers, other specific rules apply.

[371] CY: Time periods: June - September (High Demand Season) vs. October - May; weekdays vs. weekends and holidays; daily peak (June - September: 16:00 - 23:00; October - May: 09:00 - 23:00)

Country	Application of ToU signals in T-tariffs (and determination of the time granularity)	Seasonal	Day of week (working day / weekend or holiday)	Within-day (peak/ off-peak or day/ night)
Denmark	No			
Estonia	Yes	Peak (1 October – 31 March)	Not applied	Peak (07:00-23:00)
Finland	Yes	Peak (1 December – 28 February)	Not applied	Peak (07:00-21:00)
France	Yes Note: Seasonal signal and peak/off-peak applied to withdrawal for users connected at 63-225 kV. There is no seasonal signal applied at 400 kV Seasons are defined based on historical load curves. The TSO may modify seasons.	Summer (1 April - 31 October) Winter (1 November – 31 March); Super-peak (1 December - 28 February)	Super peak and peak period (Monday – Friday, except holidays)	Super-peak (09:00-11:00 and 18:00-20:00) Peak (07:00-09:00, 11:00-18:00, 20:00-23:00) Off-peak (23:00 – 07:00)
Germany	No			
Greece	Yes[372] Note: For users equipped with hourly meters[373], T-tariff charges are based on their demand during predefined system peak periods. There is no charge for demand outside these system peak periods. For users equipped with conventional meters, load profiles are used to derive peak period demand profile per user category (e.g. industrial, commercial, etc.) and allocate T-costs proportional to that peak demand. Then, the unit charge to recover allocated costs is based on the annual energy consumption of each user category.	System peak periods are defined for every month of the year and they normally vary by season. Currently[374]: October- March and April - September	For non-working days no system peak periods defined	Pre-defined system peak periods[375] Currently: Peak: 17:00-22:00 or 19:00-23:00 depending on the season
Hungary	No			
Ireland	No			
Italy	No			
Latvia	No			
Lithuania	No			
Luxembourg	No			
The Netherlands	No			

[372] GR: at the moment, T-connected, D-connected MV and D-connected LV customers with subscribed capacity of at least 85 kVA. Current system peak periods: Working days - Standard time: EET/EEST October - March: 17:00-22:00; April - September: 19:00-23:00.
[373] GR: It is measured (average) demand during system peak periods. It is expressed on a per MW basis. The chargeable demand is calculated each month, as the average of the 80 highest 15-minute demand values of the customer, observed during system peak periods in the month.
[374] GR: Current system peak periods (defined in 2021, applicable from 2022 onwards)
[375] GR: System peak periods are proposed by the TSO and approved by the NRA. On an annual basis, the TSO assesses the need to redefine system peak periods and submits a proposal to the NRA. Assessment is based on analysis of system load in the previous 2 years. A proposal to redefine system peak periods should be based on evidence of significant shift in system peaks. The decision to redefine system peak periods is taken before 30 June of the year preceding the first year of application.

Country	Application of ToU signals in T-tariffs (and determination of the time granularity)	Seasonal	Day of week (working day / weekend or holiday)	Within-day (peak/ off-peak or day/ night)
Norway	No static ToU tariffs. Marginal loss tarification applies, which aims at providing a more correct price signal in each node reflecting the changes in overall losses in the system by a marginal input/output. Marginal percentages calculated each week differentiated day/night and weekend. The energy charge is marginal percentage multiplied with spot price for each hour.	Not applied		
Poland	No			
Portugal[376]	Yes Note: The time signal with four periods applies to active energy (EUR/kWh). In addition, the peak power variable, in EUR/kW/day, also reflects an additional time signal during the peak period.	Winter (when winter time starts) / Summer (when summer time starts) peak/half-peak/normal off-peak/super off-peak hours vary per season	Saturdays and, Sundays have different hours for half-peak/normal off-peak/super off-peak, no peak in weekend	Peak (5h in winter, 3h in summer) / Half-peak (12h in winter, 14h in summer) / normal off-peak (3 hours) / super off-peak (4h per day all days)
Romania	No			
Slovak Republic	No			
Slovenia	Yes A new tariff methodology is under consideration with 2 seasons and 5 time blocks for both transmission and distribution network charges	Not applied	Peak (Monday – Friday, except holidays)	Peak (06:00-22:00)
Spain	Yes Time differentiations are designed according to characterization of the demand, where it is observed there are daily 2 peaks (morning and afternoon) having hence 3 periods each day.	4 seasons (high, medium-high, medium and low) The definition of the seasons varies between the peninsula and the islands[377]	Peak (Monday – Friday) Off-peak (Weekend, holidays)	6 periods for power-based charges (except for households, who have 2 periods: 08:00 to 24:00/ 00:00 to 08:00 and off-peak days) 6 periods for energy-based charge (except for households who have 3 periods: two peaks: P1: 10:00-14:00, 18:00-22:00; P2: 8:00-10:00, 14:00-18:00, 22:00-24:00

[376] PT: The time structure presented corresponds to the weekly time schedule, where the time-of-use structure differs between workings days, Saturdays and Sundays. For low voltage end-users, a daily time schedule is also available, where all days of the year follow the same structure (more information is available here, in Portuguese).

[377] ES: Peninsula: (i) High: January, February, July and December. (ii) Medium-High: March and November. (iii) Medium: June, August and September. (iv) Low: April, May and October; Canary Islands: (i) High: July, August, September and October. (ii) Medium-High: November and December. (iii) Medium: January, February and March. (iv) Low: April, May and June; Illes Balears: (i) High: June, July, August and September. (ii) Medium-High: May and October. (iii) Medium: January, February and December. (iv) Low: March, April and November. Ceuta: (i) High: January, February, August and September. (ii) Medium-High: July and October. (iii) Medium: March, November and December. (iv) Low: April, May and June. Melilla: (i) High: January, July, August and September. (ii) Medium-High: February and December. (iii) Medium: June, October and November. (iv) Low: March, April and May.

Country	Application of ToU signals in T-tariffs (and determination of the time granularity)	Seasonal	Day of week (working day / weekend or holiday)	Within-day (peak/ off-peak or day/ night)
				(delayed one hour for Ceuta and Melilla); and one off-peak: 0:00 to 8:00 and off-peak days)
Sweden	No static ToU tariff applies, but there is a time-differentiated component in the tariff, it's based on actual hourly market prices per bidding zone with an additional supplement charge to cover risks.	Not applied	Not applied	Not applied

Table 34: Possibility of choice between different time-of-use signal options (in transmission) and availability of different ToU T-tariffs for different network users

Country	(Some) users are allowed to choose from different ToU signal options offered to them	The same time signals are available to all network users who are subject to ToU tariffs	Other details
Belgium	No	Yes	
Croatia	No	Yes	
Estonia	No	Yes	
Finland	No	Yes	
France	Yes	No	Network users can choose between 3 tariff versions depending on their withdrawal pattern.[378] Seasonal signal and peak/off-peak applied to withdrawal for users connected at 63-225 kV. There is no seasonal signal applied at 400 kV.
Greece	No	Yes	
Norway	No	Yes	
Portugal	Yes	No	For a given voltage level, network users can select more than one ToU schedule. For instance, at VHV, HV and MV there are two different weekly schedules available, which differ in the location of the peak periods. However, the same time signal is not available to all end-users. While there is a weekly schedule available to all end-users in mainland Portugal, there is an optional weekly schedule only available to VHV, HV and MV users. Also, there is a daily schedule only available to LV users. The levels of the ToU tariffs are the same in the country. What may differ is the exact location of each time period (peak, half-peak, normal off-peak, super off-peak) across users. D-connected users at LV, who also pay transmission tariffs, have access to a ToU profile with a daily schedule (i.e. distribution of time periods is the same each day). Other voltage levels (VHV, HV, MV) must follow a weekly schedule (i.e. distribution of time periods depends on the type of day: working day vs Saturday vs Sunday).
Slovenia	No	No	For network users up to 43 kW, the time signal is in the energy charge. For network users above to 43 kW, the time signal is also embedded in the capacity charge calculated based on monthly average of three highest peaks in peak periods.
Spain	No	No	Time differentiations are designed according to characterization of the demand, where it is

[378] FR: short-use, medium-use or long-use. Long-use version has higher capacity-based coefficients (EUR/kW) and lower energy-based coefficients (EUR/kWh). Short-use version has higher energy-based coefficients (EUR/kWh) and lower capacity-based coefficients (EUR/kW).

Country	(Some) users are allowed to choose from different ToU signal options offered to them	The same time signals are available to all network users who are subject to ToU tariffs	Other details
			observed there are daily 2 peaks (morning and afternoon) having hence 3 periods each day. The time signal is the same for all consumers except household consumers because there is no seasonal signal for them and they have a more simple tariff with less periods for capacity and energy.

Table 35: Application of Time-of-use signals in D-tariffs and temporal granularity of time-of-use D-tariff structures

Country	Application of ToU signals in D-tariffs and determination of the time granularity	Seasonal	Day of week (working day / weekend / holiday)	Within-day (peak/ off-peak or day/ night)
Austria	Yes Time of use tariffs (day/night and seasonal) are applied in all network areas, however in some of the network areas there is no difference between the tariff applied during the different season or the time of day. This is based on the needs of the particular network area or certain commercial network users.	Summer (1 April – 30 September) Winter (1 October – 31 March	Not applied	Day (06:00-22:00) Night (22:00-06:00)
Belgium	Yes <u>Brussels:</u> The power-based tariff (EUR/MW) is based on actual peak (07:00 – 22:00) <u>Flanders:</u> Both 07:00-22:00 and 06:00-21:00 are applied (depending on the municipality the network user lives in), but 07:00-22:00 is generally applied. Exclusive night tariff for 'accumulation heating: the DSO offers a total charging time of 8 to 9 hours at a lower night rate. From January 2023, only the exclusive night tariff remains, new time-differentiated D-tariffs are under consideration.	<u>Wallonia:</u> Day / Night periods defined by the DSO may vary seasonally	<u>Brussels:</u> Weekend days and holidays are considered "night" <u>Flanders:</u> Weekend days and holidays are considered "night" <u>Wallonia:</u> Day / Night	<u>Brussels:</u> Day (07:00-22:00) / Night (22:00-07:00) <u>Flanders:</u> Day (07:00-22:00) / Night (22:00-07:00) <u>Wallonia:</u> Day / Night (times defined by the DSO and may vary within the geographical area of the DSO)
Bulgaria	No[379]			
Croatia	Yes	Not applied	Not applied	Day (08:00-22:00) / Night (22:00-08:00)
Cyprus	No			

[379] BG: Based on information provided by the Bulgarian NRA for the 2021 ACER Report on Distribution Tariff Methodologies in Europe.

Country	Application of ToU signals in D-tariffs and determination of the time granularity	Seasonal	Day of week (working day / weekend / holiday)	Within-day (peak/ off-peak or day/ night)
	Note: The network charge has currently no time differentiation (i.e. the same rates apply), but the framework allows for time differentiation by seasons and peak/off-peak within a day[380]			
Czech Republic	Yes The DSO is obliged to ensure off-peak zone for given number of hours per day, differentiated by customers group. The exact hours of a day are chosen by the DSO.	Choice between monthly capacity charge or yearly capacity charge (for HV and MV users)[381]	Friday 12:00 to Sunday 18:00 off-peak (LV)	Peak / off-peak periods defined by the DSO
Denmark	Yes Different load periods are operated throughout the day. When allocating the costs over load periods, it is taken into account that part of the costs varies with the load in the electricity grid, while another part of the costs is unaffected by the load in the electricity grid. Thus, tariffs in periods with the greatest load (peak load) are high, while the tariffs are lower in periods with less load in the electricity grid. The general principle is that the electricity network's total revenue from a given network user category is unchanged - regardless of whether time differentiated tariffs or a flat tariff are used.			Peak / off-leak periods
Estonia	Yes	No seasonal tariffs	Working day tariffs – daily tariffs that are applied from 07:00 to 22:00 and night-tariffs that are applied from 22:00 to 07:00. Weekend / holiday tariffs - night-tariffs that are applied for 24 hours.	Daily tariffs – tariffs that are applied from 07:00 to 22:00 on working days. Night-tariffs – tariffs that are applied from 22:00 to 07:00 on working days and 24 hours on weekends and on holidays. Peak tariffs - tariffs that are applied in the period from November to March: 1) on working days between 9:00 and 12:00 and 16:00 and 20:00;

[380] CY: Time periods: June - September (High Demand Season) vs. October - May; daily peak (June - September: 16:00 - 23:00; October - May: 09:00 - 23:00)
[381] CZ: User can choose capacity charge (EUR/kW) on monthly basis or at yearly basis (at discount).

Country	Application of ToU signals in D-tariffs and determination of the time granularity	Seasonal	Day of week (working day / weekend / holiday)	Within-day (peak/ off-peak or day/ night)
				2) on weekends and holidays between 16:00 and 20:00. Peak time tariffs are not mandatory for users of network service. Using the peak time tariff is an option, not an obligation
Finland	Yes DSOs decide on their own about their respective tariff structures including time-of-use signals; applying different energy-based fee and monthly capacity-based fees per season and for day/night is a typical practice.	Winter (1 November – 31 March) / Summer (1 April – 30 October)	Not applied	Day (07:00-22:00) / Night (22:00-07:00)
France	Yes There are different time-of-use tariffs (two time-periods, four time-period, etc.). In medium voltage, a "mobile" peak period option is available: it is composed of a given number of "peak days" that are not set ex ante (these days are the same as the PP1 days of the capacity mechanism). Customers who have subscribed to this option only know the day before when peak period (with the highest price) will happen, depending on TSO's forecast, in order to match as best as possible with real congestions when they happen.	Winter (1 November – 31 March) / Summer (1 April – 30 October)	Not applied	DSOs can choose locally 16 peak hours and 8 off-peak hours
Germany	No			
Greece	Yes[382]	Capacity charge based on network use during predefined peak periods that vary by season/ month[383]		

[382] GR: For users equipped with time-of-use meters, the capacity charge is based on their demand during predefined peak periods on the network. Peak periods are defined for every month of the year and they normally vary by season. There is no capacity charge for demand outside these peak periods. For users equipped with conventional meters, load profiles are used to derive peak period demand profile per user category (e.g. industrial, commercial, etc.) and allocate the power/capacity related D-costs in proportion to the annual average peak demand of each user category. Then, the unit capacity charge to recover allocated costs is based on subscribed demand.

[383] GR: The capacity element of the D-tariff that applies to users equipped with time-of-use meters (currently all MV users and LV users with subscribed capacity of 85 kVA or above) is proportional to the monthly average demand recorded during distribution network peak demand periods.
The network peak demand periods are defined for each month, by statistical analysis of hourly network load over the two previous years. An hour is nominated 'peak demand' if it fulfils the following conditions: A) Network load during this hour exceeds XX% of the highest hourly load of the month, where XX% can have a value of 85% to 95%, or B) The hour is among the N hours with the highest load of the month, where N is typically higher than 50.
Results from this statistical analysis are processed further to remove inconsistencies and reduce randomness.

Country	Application of ToU signals in D-tariffs and determination of the time granularity	Seasonal	Day of week (working day / weekend / holiday)	Within-day (peak/ off-peak or day/ night)
Hungary	No			
Ireland	Yes Day/Night/Peak tariffs are applied upon the choice for smaller users (DG1, 2, 5); while Day/Night tariffs are mandatory for larger users (DG6, 7, 8, 9, 10).			Day: 08:00 – 23:00 (excl. Peak) Night 23:00 - 08:00 Peak: 17:00 – 19:00
Italy	No			
Latvia	Yes Network users can choose between two or three time zones - night/weekend zone and day zone or night/weekend zone, day zone and peak time zone.		Weekend hours considered as “night”	Day (07:00-08:00, 10:00-17:00, 20:00-23:00) / Night (23:00-07:00) / Peak (08:00-10:00, 17:00-20:00)
Lithuania	Yes DSOs decide on their own how to include ToU signals in their respective tariff structures; general principle - differentiation has to be based on peak loads (encourage users to shift consumption from peak to off-peak) Note: Data in the table is only an example of an applied time-signal by one of the DSO.		Weekend hours considered as “night”	Day (07:00-23:00) / Night (23:00-07:00) for the energy-based charge
Luxembourg	No			
Malta	Yes[384] ToU tariffs for 2 specific consumers’ categories: - for non-residential consumers with a consumption > 5000 MWh or 5500 MVAh and EV charging points. - for non-residential customers with a consumption > 5000 MWh or 5500 MVAh A day premium of €0.0015 and a night discount of €0.0262 over the applicable non-residential tariff is applied. <u>For EV charging tariff:</u> For residential and domestic EV charging points outside off-peak tariffs are the general electricity tariffs. EV off-peak tariffs and tariffs for non-residential		<u>For EV charging tariff:</u> On Sundays EV charging consumption off-peak tariff applies all day	for non-residential customers with a consumption > 5000 MWh or 5500 MVAh Day (06:00 – 22:00) Night (22:00 – 06:00) <u>For EV charging tariff:</u> Outside off-peak (06:00-12:00 and 16:00-24:00) / off-peak (24:00-06:00 and 12:00-16:00) for EV charging points

Peak demand periods are proposed by the DSO and approved by the NRA. In principle, they are defined before the beginning of each regulatory period and they do not change in the period, unless there is evidence of significant changes in network load profile.

[384] MT: time-of-use available for customers > 5GWh and time-differentiated all-inclusive retail charge for EV charging points

Country	Application of ToU signals in D-tariffs and determination of the time granularity	Seasonal	Day of week (working day / weekend / holiday)	Within-day (peak/ off-peak or day/ night)
	EV charging points are specific tariffs. EV charging tariffs cover energy component and part of distribution and supply costs			
The Netherlands	Yes (but very limited application) Network users that are connected to LV, non-households and connection is larger than 3x80A, but not large enough to get MV connection. This category of users is very limited in numbers. The tariff structure for this category is as follows: a. Fixed network charge (EUR / year) b. kW contracted (EUR/kW/year) c. kWh normal (EUR/kWh) for 07:00 to 23:00 on weekdays d. kWh low (EUR/kWh) for the remaining hours The kWh low and normal tariffs vary between DSOs due to different efficiency performance (benchmarking).	Not applied	Weekend hours are considered as low tariff period	Normal tariff period: 07:00 - 23:00), low tariff period for the remaining hours
Norway	Yes Before July 2022 it was mandatory to provide seasonal differentiation of the DSO-tariff. From July 2022 it is not mandatory with time or seasonal differentiation. Still, most of the DSO differentiate the energy component between day and night.	Usually Summer/winter, but it is up to each DSO to determine based on actual flows.	Not applied	Yes, it is up to each DSO.
Poland	Yes Typically there are 3 zones during the day (morning peak, afternoon peak and off-peak) and 2 periods (peak/off peak and day/night).The charges can be also differentiated for summer and winter. Night period additionally includes all hours of Saturdays and Sundays and statutory holidays	Summer (1 April – 30 September) / Winter (1 October – 31 March) peak hours vary per season	Weekends and statutory holidays treated as night period	Peak (07:00-13:00, 16:00-21:00 in winter, 19:00-22:00 in summer) / off-peak (remaining hours)
Portugal[385]	Yes	Winter (when winter time starts) / Summer (when summer time	Saturdays and, Sundays have different hours for half-	Peak (5h in winter, 3h in summer) / Half-peak (12h in winter, 14h in

[385] PT: The time structure presented corresponds to the weekly time schedule, where the time-of-use structure differs between workings days, Saturdays and Sundays. For low voltage end-users, a daily time schedule is also available, where all days of the year follow the same structure (more information is available here, in Portuguese).

Country	Application of ToU signals in D-tariffs and determination of the time granularity	Seasonal	Day of week (working day / weekend / holiday)	Within-day (peak/ off-peak or day/ night)
	The time signal with four periods applies to active energy (EUR/kWh). In addition, the peak power variable, in EUR/kW/day, also reflects an additional time signal during the peak period.	starts) peak/half-peak/normal off-peak/super off-peak hours vary per season	peak/normal off-peak/super off-peak, no peak in weekend	summer) / normal off-peak (3 hours) / super off-peak (4h per day all days)
Romania	No			
Slovak Republic	Yes		Weekends considered as off-peak	Peak /off-peak band; off-peak has to be offered 8 hours or 20 hours)
Slovenia	Yes New tariff methodology under consideration with 2 seasons and 5 time blocks for both transmission and distribution network charges		Weekends and holidays considered as off-peak	Peak (06:00-22:00) / off-peak (22:00-06:00)
Spain	Yes Time differentiations are designed according to characterization of the demand, where it is observed in there are daily 2 peaks (morning and afternoon) having hence 3 periods each day.	4 seasons (high, medium high, medium, low) Definition of seasons varies between peninsula and the islands[386]	Weekends are different from working days	6 periods for power-based charges (households have 2 periods) 6 periods for energy-based charge (households have 3 periods - 2 peak and 1 off-peak)
Sweden	Yes[387] DSOs decide on their own about their respective tariff structures; table values are typical time-of-use signals which are applied. ToU is applied to different elements on different tariffs as such the time signal varies between 2 energy counters and peak load during peak time.	Optional seasonal (summer and winter)		Optional peak/off-peak

[386] ES: Peninsula: (i) High: January, February, July and December. (ii) Medium-High: March and November. (iii) Medium: June, August and September. (iv) Low: April, May and October. Canary Islands: (i) High: July, August, September and October. (ii) Medium-High: November and December. (iii) Medium: January, February and March. (iv) Low: April, May and June. Illes Balears: (i) High: June, July, August and September. (ii) Medium-High: May and October. (iii) Medium: January, February and December. (iv) Low: March, April and November. Ceuta: (i) High: January, February, August and September. (ii) Medium-High: July and October. (iii) Medium: March, November and December. (iv) Low: April, May and June. Melilla: (i) High: January, July, August and September. (ii) Medium-High: February and December. (iii) Medium: June, October and November. (iv) Low: March, April and May.

[387] SE: optional seasonal and peak pricing energy for fuse, small and large customers. Practices differ across DSOs.

Table 36: Possibility of choice between different ToU signal options (in distribution) and availability of different ToU D-tariffs for different network users

Country	(Some) users are allowed to choose from different ToU signal options offered to them	The same time signals are available to all network users who are subject to ToU tariffs	Other details
Austria	No	No	Some (but not all) of the 14 network areas use variation based on season (summer/winter tariff) and/or time of day (high/low tariff). The tariff possibilities are: summer high tariff, summer low tariff, winter high tariff, winter low tariff. In case of different summer/winter tariffs, the winter tariff is higher.
Belgium	Brussels: No Flanders: No Wallonia: No	Brussels: Yes Flanders: Yes Wallonia: No	Wallonia: the ToU signals vary based on the DSO's choice and location of the network user.
Croatia	No	Yes	
Czech Republic	Yes	No	User can choose from more than one ToU tariff. The DSO is obliged to ensure off-peak period for given number of hours per day, differentiated by customers group. The exact hours of a day are chosen by the DSO. DSOs offer slightly different conditions. Location is also taken into account by the DSO while setting the peak/off-peak hours.
Denmark	No data	Yes	
Estonia	Yes	No	It is possible for network users to choose a ToU tariffs with peak-time tariffs instead of the ToU tariffs without peak-time tariffs which is differentiated day/night and weekdays/weekends.
Finland	No data	No	User can choose from typically two different tariff options with different time-of-use signals typically for time-of-day and time-of-day and year. The DSO sets the time intervals in these options
France	Yes	No	There are different time-of-use tariffs (two times period, four times period, etc.). In medium voltage, a "mobile" peak period option is also available to the customers. Time of use signals vary based on DSO's choice and based on location.
Greece	No	Yes	
Ireland	No	Yes	
Latvia	Yes	Yes	Network users can choose between two or three time zones -night/weekend zone and day zone or night/weekend zone, day zone and peak time zone.
Lithuania	No	No	ToU signals vary based on the DSO's choice.
Malta	No	No	ToU tariffs are provided for 2 specific consumers' categories: non-residential consumers with a consumption > 5000 MWh or 5500 MVAh and EV charging points. The ToU tariffs for these 2 specific consumers' categories are different.
Norway	No	No	Time signals (seasonal) depend on the DSO's choice and depend on the location
Poland	Yes	No	Different time-of-use tariff options can be selected by the network users. ToU signals vary among the network user groups and based on DSO's choice.
Portugal	Yes	No	Network users can select among different time-of-use schedules. For instance, users at HV and MV can select from two different ToU schedules with a weekly schedule. Users at LV can select between a weekly schedule and a daily schedule. The structure of the ToU periods is different between voltage levels. At HV, MV and a part of LV, a ToU structure with 4 periods is mandatory. For the remaining part of LV a ToU with 3, 2 or 1 periods applies.
Slovak Republic	No	Yes	
Slovenia	No	No	For network users up to 43 kW, the time signal is in the energy charge, while for network users above to 43 kW, the time signal is also embedded in the

Country	(Some) users are allowed to choose from different ToU signal options offered to them	The same time signals are available to all network users who are subject to ToU tariffs	Other details
			capacity charge calculated based on monthly average of three highest peaks in peak periods.
Spain	No	No	Time differentiations are designed according to characterization of the demand, where it is observed in there are daily 2 peaks (morning and afternoon) having hence 3 periods each day. ToU tariffs also vary based on network user groups.
Sweden	Yes	No	DSOs decide on their own about their respective tariff structures; Some DSOs allow network users to choose between different ToU tariffs and apply/ or offer different signals to different network users.

Table 37: Overview of which T-connected users are subject to time-of-use tariffs and whether time-of-use tariffs are mandatory for the network user or the user can opt in or opt out

Country	Transmission tariffs		
	Network users who are excluded from ToU signals	**ToU signals are mandatory for network users or network users can opt out**	**Share of T-connected network users for whom time-of-use network tariffs are actually applied**
Austria			No time-of-use
Belgium	Producers are excluded from time-of-use (the Annual Peak tariff is applied to all 15-min net withdrawal)	Mandatory for all those network users who are subject to time-of-use (no possibility to opt out)	100% of net withdrawal capacities
Bulgaria			No time-of-use
Croatia			Time-of-use T-tariffs for the withdrawal of the energy from the grid apply to all T-connected network users. Mandatory for all those network users who are subject to time-of-use (no possibility to opt out)
Cyprus			No time-of-use
Czech Republic			No time-of-use
Denmark			No time-of-use: The Danish TSO has considered introduction of time-of-use tariffs and submitted a tariff methodology for approval with the Danish regulator.
Estonia	Time-of-use T-tariffs are not available to network users connected to the 330 kV network. Such a decision was made because TSO and network users do not see the need for time-of-use tariffs at the voltage level.	Mandatory for all those network users who are subject to time-of-use (no possibility to opt out)	
Finland	DSO decides on to which network users it applies a ToU tariff	Consumers can opt out by choosing a general tariff offered by every DSO without any ToU signals.	
France	Time-of-use T-tariffs are not applied to users connected at 400 kV. Indeed, the sizing of the 400kV network is not directly linked to peak demand, but to inter-regional and international transits, which depend on local balances between generation and consumption.	Mandatory for all those network users who are subject to time-of-use (no possibility to opt out)	
Germany			No time-of-use
Greece	All T-connected network users have capable meters to record	Mandatory for all those network users who are subject to time-of-use (no possibility to opt out)	100%

Country	Transmission tariffs		
	Network users who are excluded from ToU signals	**ToU signals are mandatory for network users or network users can opt out**	**Share of T-connected network users for whom time-of-use network tariffs are actually applied**
	time-of-use and subject to time-of-use charges		
Hungary			No time-of-use
Ireland			No time-of-use
Italy			No time-of-use
Latvia			No time-of-use
Lithuania			No time-of-use
Luxembourg			No time-of-use
Malta			No transmission network
The Netherlands			No time-of-use
Norway	Time-of-use T-tariffs for the withdrawal of the energy from the grid apply to all T-connected network users.	Mandatory for all those network users who are subject to time-of-use (no possibility to opt out)	
Poland			No time-of-use
Portugal	All T-connected network users have capable meters to record time-of-use and subject to time-of-use charges	Mandatory for all those network users who are subject to time-of-use (no possibility to opt out)	100%
Romania			No time-of-use
Slovak Republic			No time-of-use
Slovenia	All T-connected network users have capable meters to record time-of-use and subject to time-of-use charges.	Mandatory for all those network users who are subject to time-of-use (no possibility to opt out)	100%
Spain	All T-connected network users have capable meters to record time-of-use and subject to time-of-use charges.	Mandatory for all those network users who are subject to time-of-use (no possibility to opt out)	100%
Sweden			No time-of-use

Table 38: Overview of which D-connected users are subject to time-of-use tariffs and whether time-of-use tariffs are mandatory for the network user or the user can opt in or opt out

Country	Distribution tariffs		
	Network users who are excluded from ToU signals	**ToU signals are mandatory for network users or optional (i.e. network users can opt out)?**	**Share of D-connected network users for whom time-of-use network tariffs are actually applied**
Austria	No user is excluded	ToU is mandatory if it is applicable in the particular network area. (The information on the share of mandatory versus optional time-of-use charges for distribution-connected network users is not available to the NRA	The information on the share of D-connected network users for whom time-of-use network tariffs are actually applied is not available to the NRA.
Belgium	Belgium (Brussels): No network user is excluded from Time-of-use Belgium (Flanders): No network user is excluded from Time-of-use Belgium (Wallonia): Users excluded from time-of-use: the information is not available to the regulator.	Belgium (Brussels): Time-of-use tariffs are optional to all network users with HI/LO meters, as they can still choose to switch to Total Hours (sum up the HI and LO registers) Belgium (Flanders): Time-of-use tariffs are optional to all network users (i.e. they can opt out) Belgium (Wallonia): Time-of-use tariffs are optional to low voltage network users (who can opt for a standard	Belgium (Brussels): Time-of-use network tariffs actually applied for at least 10% and below 25% of the D-connected network users. Belgium (Flanders): Time-of-use network tariffs are actually applied for at least 50% and below 75% of the D-connected network users. Belgium (Wallonia): The information on the share of D-connected network users for whom time-of-use network tariffs

Country	Distribution tariffs		
	Network users who are excluded from ToU signals	**ToU signals are mandatory for network users or optional (i.e. network users can opt out)?**	**Share of D-connected network users for whom time-of-use network tariffs are actually applied**
		meter and a single price or can opt for a dual meter for with a different price for day and night consumption) and mandatory to other network users. The information on the share of mandatory versus optional time-of-use charges for D-connected network users is not available to the regulator.	are actually applied is not available to the regulator.
Bulgaria			No time-of-use
Croatia	"Public lighting" is excluded from Time-of-use as a specific single-tariff model used exclusively for lighting of public places, public roads and similar purposes.	Time-of-use is mandatory for users with connections rated 20 kW and over (i.e. below 10% of distribution-connected network user) and optional for the rest.	Time-of-use network tariffs are actually applied for at least 50% and below 75% of the D-connected network users.
Cyprus			No time-of-use[388]
Czech Republic	Network users who do not match the conditions for using the time-of-use tariff are excluded.	Time-of-use is optional for all network users who match the conditions for using the time-of-use tariff.	Time-of-use network tariffs are actually applied for at least 50% and below 75% of the D-connected network users.
Denmark	No data	Time-of-use is optional for all network users	Information is not available to the NRA
Estonia	According to the Electricity Market Act, everyone must have smart meters and none of the network users are excluded from Time-of-use.	Time-of-use is optional for household users and mandatory for other users. The share of mandatory versus optional time-of-use charges for distribution-connected network users is about 3% mandatory (representing 65% of consumption) and 97% optional (representing 35% of consumption.	Time-of-use network tariffs actually applied for at least 90% of the D-connected network users
Finland	Users excluded from time-of-use: the information is not available to the NRA (as DSOs are free to choose their own tariff structure, it is DSO's decision whether they offer time-differentiated tariffs or not.)	The information on the share of mandatory versus optional time-of-use charges for distribution-connected network users is not available to the NRA.	The information on the share of D-connected network users for whom time-of-use network tariffs are actually applied is not available to the NRA.
France	No user is excluded (network users can all opt to have smart meters which allows ToU tariffs)	Optional for all those network users who have access to time-of-use	The information on the share of D-connected network users for whom time-of-use network tariffs are actually applied is not available to the NRA.
Germany			No time-of-use
Greece	Users excluded from time-of-use: low voltage customers with subscribed capacity less than 85 kVA, because these users are currently not equipped with time-of-use meters.	Mandatory for all those network users who are subject to time-of-use (no possibility to opt out)	Time-of-use network tariffs are actually applied for less than 10% of the D-connected network users.
Hungary			No time-of-use
Ireland	No user is excluded (Customers who have analog single read meters have no capability to record time-of-use. However, these customers can request a smart meter to avail of time-of-use tariffs. Note: the National Smart Metering Programme will replace all meters with smart meters by the end of 2024.)	All network users can avail of time-of-use tariffs. For small users (DG1, 2, 5) it is available as an option. For larger users (DG6 – 10), it is mandatory. The information on the share of mandatory versus optional time-of-use charges for distribution-connected network users is not available to the NRA.	Time-of-use network tariffs are actually applied for at least 10% and below 25% of the D-connected network users.
Italy			No time-of-use

[388] CY: Currently the network charge has no time differentiation (i.e. the same rates apply), but the framework is in place.

Country	**Distribution tariffs**		
	Network users who are excluded from ToU signals	**ToU signals are mandatory for network users or optional (i.e. network users can opt out)?**	**Share of D-connected network users for whom time-of-use network tariffs are actually applied**
Latvia	No user is excluded (Any user can apply for ToU capable meters and choose time-of-use D-tariffs.	Optional for all those network users who have access to time-of-use	Time-of-use network tariffs are actually applied for less than 10% of the D-connected network users.
Lithuania	No user is excluded (Any user can request from operator for the time-of-use capable meter and time-of-use D-Tariffs.)	Optional for all those network users who have access to time-of-use.	Time-of-use network tariffs are actually applied for less than 10% of the D-connected network users.
Luxembourg			No time-of-use
Malta	Network users with consumption that does not exceed 5GWh/year are excluded from time-of-use. EV charging points that do not have a time-of-use capable meter are excluded from time-of-use.	Optional for all those network users who have access to time-of-use.	The information on the share of D-connected network users for whom time-of-use network tariffs are actually applied is not available to the NRA.
The Netherlands			Network users that are connected to LV, non-households and connection is larger than 3x80A, but not large enough to get MV connection. This category of users is very limited in numbers.
Norway	A few customers has exemption from meters capable to record time-of-use. 1) due to cost of changing meter relative to consumption volume, 2) due to personal/medical conditions (e.g. related to radiation).	ToU is optional for household customers and mandatory for other users.	Time-of-use network tariffs actually applied for at least 90% of the D-connected network users
Poland	No user is excluded	Time-of-use is mandatory for HV network users when the DSO has only a tariff group with e.g. 3 time bands (group A23) and NO group with the single time band (A21) as HV end-users must choose a tariff group that is offered. Time-of-use is mandatory for below 10% of those network users who have it available. It is optional for other network users (more than 90%) who have time-of-use available.	Time-of-use network tariffs actually applied for at least 10% and below 25% of the D-connected network users.
Portugal	Users not equipped with time-of-use meters are excluded	Time-of-use is mandatory for below 10% of distribution-connected network users. It is mandatory for HV customers, MV customers and LV customers with contracted power above 41.4 kVA, with a time-of-use structure of 4 periods. It is mandatory for LV customers with contracted power up to 41.4 kVA and above 20.7 kVA, with a time-of-use structure of 3 periods. Time-of-use is optional for LV customers with contracted power up to 20.7 kVA. It is optional for these customers because these are less informed and in the past did in general not	Time-of-use network tariffs are actually applied for at least 10% and below 25% of the D-connected network users.

Country	Distribution tariffs		
	Network users who are excluded from ToU signals	**ToU signals are mandatory for network users or optional (i.e. network users can opt out)?**	**Share of D-connected network users for whom time-of-use network tariffs are actually applied**
		have access to meters capable of time-of-use structures.	
Romania			No time-of-use
Slovak Republic	Network users who do not fall under the specifications of particular time-of-use tariffs, as set in the Slovak NRA Decree 18/2017, are excluded from time-of-use.	Time-of-use is optional for all those network users who have access to time-of-use charges	Time-of-use network tariffs actually applied for at least 10% and below 25% of the D-connected network users.
Slovenia	No user is excluded Any user can request ToU tariffs. The existing model doesn't need smart meters for the introduction ToU (electromechanical meters with time devices are used in Slovenia for decades)".[389]	Time-of-use is mandatory for all users above 43 kW and optional for users up to 43 kW.	Time-of-use network tariffs are actually applied for at least 50% and below 75% of the D-connected network users.
Spain	No user is excluded (time-of-use D-tariffs are applicable for all users.)	Mandatory for all those network users who are subject to time-of-use (no possibility to opt out)	Time-of-use network tariffs actually applied for at least 90% of the D-connected network users
Sweden	Users excluded from time-of-use: the information is not available to the NRA	The information on the share of mandatory versus optional time-of-use charges for distribution-connected network users is not available to the NRA	The information on the share of D-connected network users for whom time-of-use network tariffs are actually applied is not available to the NRA.

Table 39: Other measures than ToU in tariff structures to give time related signals to network users

Country	Other measures to give time-related signals
Belgium	**Distribution:** Wallonia: In distribution, "exclusive night" regime, for loads that are only activated during the off-peak period (night only). The activation signal is controlled by the DSO.
Croatia	**Transmission:** Consumers on the transmission grid pay for the effectively metered peak load during peak hours through a power-based charge (EUR/kW).
Czech Republic	**Distribution:** The remote control. Tool of DSO to block certain devices in peak hours - these devices are then powered later in off-peak hours.
France	**Distribution:** New boilers are automatically working during off-peak hours and switched-off during peak hours (based on a signal transmitted via the smart meter), unless the customer chooses to set it differently.
Germany	**Transmission:** A discount is granted to network users who considerably shift their peak load outside the network's peak load. The discount can reach a maximum of 80% of the regular tariff the user would have paid.
Italy	**Distribution:** ARERA decision 541/2020 introduced the possibility of a free-of-charge capacity increase for small LV clients (households and very small businesses) during night hours and Sundays to favour EV recharging during light load hours; such opportunity is targeted to consumers with private EV charging points equipped with a smart wallbox. Currently, almost 90% of such clients have a 3.3 kW contractual capacity limit, with the above decision, the capacity limit during light load hours is increased to 6 kW. Note also that power withdrawal is limited by a breaker onboard the meter which trips above the contractual limit.
Poland	**Both transmission and distribution:** Capacity fee (surcharge) set by the law (not an element of calculated rates) applies.[390] Capacity fee is multiplied by coefficient which 1 or lower than 1 depending on whether the withdrawal is similar in peak and off-peak hours or not. (E.g. for end users which withdrawal is similar in peak and off peak hours coefficient is lower than in case of bigger difference between the withdrawal in peak and off-peak hours. (i.e. 0.17 vs. 0.5 / 0.83 and 1.)

[389] SI: the introduction of a new methodology in 2024 has smart meters as a pre-condition.
[390] PL: This surcharge is used for covering capacity market costs. The charge is variable (PLN/MWh) only for energy taken in peak hours for end-users that have contractual capacity bigger than 16 kW. Smaller end-users, i.e. households pay lump sum charge (PLN/Month). The lump sum fees are different for end-users with annual consumption up to 500 kWh, 500- 1200 kWh, 1200-2800 kWh and more than 2800 kWh.

Country	Other measures to give time-related signals
Slovenia	**Both transmission and distribution:** For consumers on MV and higher, the capacity charge is determined as the average of the three highest peaks (15 minutes) in critical-time period, which is defined by TSO and different for specific DSO or CDSO (closed distribution system operator). The TSO defines and publishes critical-time periods (2 hours per working day inside of peak period) before next calendar year. If the average of three registered peaks inside critical time period is lower than 15% of the highest monthly peak outside critical time period, consumer pays for 15% of highest peak anyway.
Spain	**Both transmission and distribution:** There is the possibility of contracting different power for different periods with the limitation that the power must increase from peak to off peak periods.
Sweden	**Both transmission and distribution:** For example flexible/interruptible connection agreements where the TSO can stop or limit the user from withdrawing from the network.

Table 40: Implementation status of local markets for system operation services

Country	Status of local markets for system operation services at distribution level	Remark
Austria	➡ **Implementation ongoing**	
Belgium	Brussels: ✘ **No implementation yet** Flanders: ➡ **Implementation ongoing** Wallonia: ➡ **Implementation ongoing**	Flanders: Today, flexibility can already be offered in the form of FCR by medium and low voltage consumers. Regarding aFRR and mFRR, the process of involving medium voltage consumers is currently ongoing (via a product design group organized by the DSOs). Low voltage consumers, on the other hand, are (deliberately) not yet targeted. Regarding the deployment of non-frequency ancillary services, the Flemish DSO Fluvius recently finalized a market consultation.[391] Commercial flexibility products offered by the DSO for congestion management are not yet available today. Wallonia: Legislative work ongoing
Bulgaria	No information was provided	
Croatia	✘ **No implementation yet**	Under consideration
Cyprus	✘ **No implementation yet**	The Cypriot electricity market is still under transitional arrangements
Czech Republic	➡**implementation ongoing for wider application of flexibility**	There is no separate flexibility market in CZ, but current tariff methodology allows certain measures: In LV: DSOs can block certain devices in peak hours.[392] In MV/HV: the network users might be clustered as ancillary service providers or they might offer flexibility pro their supplier to lower down imbalance of the supplier. It will be implemented in new tariff methodology later and more thoroughly.
Denmark	➡ **Implementation ongoing**	Currently, there are match-making events and pilot projects between aggregators and DSO's. Furthermore, an aggregator model that defines legal rules in the market is in the making by the authorities.
Estonia	✘ **No implementation yet**	N/A
Finland	✘ **No implementation yet**	Energy Authority is currently revising and developing regulatory methods for the upcoming regulatory periods (2024-2027 & 2031) and explore a possibility of a separate incentive for counting flexibility in the regulatory framework. No concrete proposal at this point yet.
France	✓ **Implemented**	Local flexibility have appeared very recently on the DSO network. Enedis has published a regional call for tender in 2020 with 2 awarded parties that are providing flexibility. The costs incurred are included in the tariffs.
Germany	✘ **No implementation yet**	
Greece	✘ **No implementation yet**	
Hungary	➡ **Implementation ongoing**	DSOs shall submit an annual report to the NRA about the status of flexibility market. The NRA may grant an exemption if it finds that the market procurement is not yet sufficiently developed. The flexibility products are currently being developed through intensive committee work and the last annual report was due by end of March 2022.
Ireland	➡ **Implementation ongoing**	The DSO issued a consultation on a Flexibility Market Plan and has commenced a number of Pilot programmes to develop flexibility services at a distribution level. The first Pilot programme is expected to commence

[391] https://partner.fluvius.be/sites/fluvius/files/2022-01/marktbevraging-ondersteunende-diensten.pdf
[392] CZ: The remote control. Tool of DSO to block certain devices in peak hours - these devices are then powered later in off-peak hours.

Country	Status of local markets for system operation services at distribution level	Remark
		in October 2022. The DSO has additional flexibility schemes going live every 3-6 months after the initial go-live this autumn and every year the DSO will consult on and publish an updated multiyear rollout plan, enabling us adapt our rollout as appropriate (building on learnings, leveraging opportunities that arise etc.)
Italy	✓ **Implemented (pilot)**	By regulatory order 352/2021, ARERA started the process of pilot projects for "local ancillary services", which term largely corresponds to flexibility. Costs for distribution infrastructure and communication are covered by distribution tariffs unless they are financed via grants or other contributions. Costs of the flexibility services are provisionally recovered by existing tariff components and regulatory accounts, with a view to define a stand-alone component and a stand-alone account when these costs will be material enough.
Latvia	✗ **No implementation yet**	
Lithuania	➔ **Implementation ongoing**	Based on the amendments of Law on Electricity (where Directive (EU) 2019/944 is transposed) DSO shall set the rules for procurement of flexibility until the end of 2022. Therefore, cost regarding this procurement is not yet included in the distribution tariffs.
Luxembourg	✓ **Implemented (pilot)**	DSOs are conducting several flexibility pilot projects. Costs for these projects are covered by network tariffs. With Luxembourg being part of the German/Luxembourgish market, the NRA together with the relevant authorities is evaluating on how to integrate the FFR FCR and flexibility markets.
Malta	✗ **No implementation yet**	Under consideration
The Netherlands	✓ **Implemented**	Costs associated to procurement of flexibility services are included in distribution tariffs. DSOs are allowed to procure local flexibility in cases where congestion is either expected or has already materialised. This is part of the procedure for congestion management at the DSO level as laid down in the Network Code. This type of flexibility can be procured through the existing GOPACS[393] platform or via bilateral contracts.
Poland	➔ **Implementation ongoing**	Currently in Poland, the process of building the Central Energy Market Information System (CSIRE) is underway (expected to be launched in 2024) and the process of mass implementation of AMI meters. The schedule provides for the installation of remote reading meters at energy consumption points representing at least 80 percent by the end of 2028. The costs of the above implementations and other costs of implementing intelligent metering systems are included in TSO and DSO's tariffs. At the same time, the legislative process is underway and new regulations are created for incentives to distribution system operators for the most cost-efficient operation and development of their networks including through the procurement of flexibility services. Regardless of the above, there are pilot projects on the possibility of a wide implementation of flexibility services.
Portugal	✓ **Implemented**	Although there is no specific provision for the recovery of flexibility procurement costs through distribution tariffs, the new TOTEX methodology applied since 2022 aims to implicitly incentivise the procurement of flexibility by the distribution system operators.
Romania	✗ **No implementation yet**	
Slovak Republic	➔ **Implementation ongoing**	Legislative work is ongoing: For the time being SK has not implemented the flexibility markets at distribution level as the NRA is waiting for update of the primary legislation and then discuss the way how to implement it as well as in secondary legislation.
Slovenia	➔ **Implementation ongoing**	Legislative work is ongoing: In the current methodology costs of procurement of services is not implemented yet as eligible cost of DSO. Implementation of article 18(8) of Regulation is subject of new methodology applicable from 2023.
Spain	✗ **No implementation yet**	Currently, it is in the process of analysis. The NRA has implemented in various regulations the possibility for agents to propose pilot projects to contribute to flexibility, digitization and efficiency.
Sweden	✓ **Implemented**	There are some flexibility markets in Stockholm (Sthlmflex[394]) and on other places (CoordiNet). The costs for flexibility is considered a part of the allowed revenue and are thus paid by the customers.

[393] NL: information about GOPACS platform is available here: https://en.gopacs.eu/
[394] SE: more info about the project Sthlmflex is available at https://www.svk.se/siteassets/2.utveckling-av-kraftsystemet/forskning-och-utveckling/sthlmflex/how-to-participate-in-sthlmflex_en_ok-002.pdf

Table 41: Transmission tariff methodology setting process

Country	Responsible party to set the tariff methodology	Consultations ahead of tariff methodology setting	Length of the tariff methodology period (i.e. frequency to amend it)	Frequency of updating the tariff values (i.e. period of applicability of the same tariff values)
Austria	NRA	Only specific stakeholders[395]	No defined period	1 year
Belgium	NRA	Public consultation	4 years[396]	1 year (set ex ante for each of the 4 years)[397]
Bulgaria	NRA	Public consultation	1 year	1 year
Croatia	NRA	Public consultation	No defined period	1 year[398]
Cyprus	NRA	Public consultation	5 years	1 year[399]
Czech Republic	NRA	Public consultation	5 years[400]	1 year[401]
Denmark	TSO (subject to NRA approval)	Public consultation [402]	No defined period	1 year[403]
Estonia	NRA	Public consultation	No defined period[404]	No defined period
Finland	TSO (without NRA approval)[405]	Public consultation [406]	8 years (4 year sub-periods)	1 year (with the possibility of revision within the year)[407]
France	NRA	Public consultation	4 years	1 year[408]
Germany	Ministry of economic affairs (legislative process for jurisdiction shift to the NRA is ongoing)[409]	Only specific stakeholders[410]	5 years	1 year[411]
Greece	NRA	Public consultation	4 years[412]	1 year[413]
Hungary	NRA	Only specific stakeholders[414]	4 years	1 year[415].
Ireland	NRA	Public consultation	5 years	1 year[416]

[395] AT: According to the national law, the Federal Economic Chamber, Federal Chamber of Agriculture, Federal Chamber of Labour, Austrian Trade Union Federation have to be consulted.
[396] BE: The tariff methodology can be revised during the regulatory period.
[397] BE: Tariff values are set (ex-ante) for the whole regulatory period, but the values differ each year.
[398] HR: Tariff is determinate in the second half of the year G for the year G+1. If there is no need to change the tariff then the tariff remains unchanged.
[399] CY: Tariff values are updated annually on the basis of a pre-defined methodology.
[400] CZ: 5 years length of the tariff methodology is binding only for setting of allowed revenues and it is not binding for methodology which is used for calculating tariffs based on the allowed revenues.
[401] CZ: Tariff values are updated annually on the basis of a pre-defined methodology.
[402] DK: NRA conducts the public consultation. The TSO might also conduct a consultation prior to sending the methodology to the NRA for approval.
[403] DK: Tariff values are updated annually on the basis of a pre-defined methodology.
[404] EE: The typical duration of the period is 3-4 years.
[405] FI: There is no ex-ante approval of tariffs or prices of network services by the NRA nor any other authorities. The NRA confirms ex-ante the revenue cap and connection charges. The NRA shall also approve ex-ante the terms and conditions of transmission and connection services before the network operators apply them. In addition the NRA supervises the compliance between methodology and the Finnish electricity act. In situation of discordance, the NRA could decide on injunction.
[406] FI: The public consultation is not formally (legally) required and carried out by the TSO.
[407] FI: Tariff values are updated annually by the TSO on the basis of a pre-defined methodology. Within a year, the TSO can update the tariff values when needed, but there is a 15% cap for tariff increases.
[408] FR: Tariff values are updated annually on the basis of a pre-defined methodology.
[409] DE: The implementation of the ECJ ruling (C-718/18) is currently in progress. Jurisdiction change is part of it.
[410] DE: There are no formal requirements for consultation when adopting the ordinance for the tariff methodology. However, it is set after consultation of the relevant energy industry associations.
[411] DE: Tariff values are updated annually on the basis of a pre-defined methodology.
[412] GR: The regulatory period for setting allowed revenue is 4 years. Tariff methodology is independent from this cycle and can be revised within a regulatory period.
[413] GR: Tariff values are updated annually on the basis of a pre-defined methodology.
[414] HU: The tariff methodology is set after consultation of the relevant stakeholders as required by the Hungarian Electricity Act.
[415] HU: Tariff values are updated annually on the basis of a pre-defined methodology.
[416] IE: Tariff values are updated annually on the basis of a pre-defined methodology.

Country	Responsible party to set the tariff methodology	Consultations ahead of tariff methodology setting	Length of the tariff methodology period (i.e. frequency to amend it)	Frequency of updating the tariff values (i.e. period of applicability of the same tariff values)
Italy	NRA	Public consultation	8 years[417] (with mid-term update)	1 year[418]
Latvia	NRA	Public consultation	No defined period[419]	1 year (with the possibility of extension)[420]
Lithuania	NRA	Public consultation	5 years	1 year[421]
Luxembourg	NRA	Public consultation	4 years	1 year[422]
The Netherlands	NRA	Only specific stakeholders[423]	3-5 years	1 year[424]
Norway	NRA	Public consultation	No defined period[425]	1 year[426]
Poland	NRA	Only specific stakeholders[427]	1 year[428]	1 year (with the possibility of revision within the year)
Portugal	NRA	Public consultation + targeted consultation of the tariff council	4 years	1 year[429]
Romania	NRA	Public consultation	5 years	1 year[430]
Slovak Republic	NRA	Public consultation	5 years	1 year[431]
Slovenia	NRA	Public consultation	3 years	1 year (set ex ante for each of the 3 years with the possibility of revision)[432].
Spain	NRA	Introduced for the methodology set by the NRA[433]	6 years	1 year
Sweden	TSO (without NRA approval)[434]	Public consultation	4 years	1 year[435]

[417] IT: Since 2016 it is 8 years, two sub-periods 4 years each. However, the WACC period is different (6 years with two sub-periods)
[418] IT: Tariff values are updated annually on the basis of a pre-defined methodology.
[419] LV: Methodology does not specify the regulatory period. TSO or system users can submit a request for changes in tariff calculating methodology. NRA evaluate submitted requests and make amendments if it is necessary.
[420] LV: Tariff values are set for one year. If the TSO doesn't submit new tariff proposal and the NRA doesn't oblige the TSO to do so, the same tariffs apply for next year.
[421] LT: Tariff values are updated annually on the basis of a pre-defined methodology.
[422] LU: Tariff values are updated annually on the basis of a pre-defined methodology.
[423] NL: When preparing a change to the national tariff code, the TSO has to consult with stakeholders. The decision on the tariff methodology is taken by the NRA after consultation of the relevant stakeholders in the context of the Dutch administrative law. The tariff decision is not subject to formal consultation, but there is an informal consultation of the proposal by the TSO.
[424] NL: Tariff values are updated annually on the basis of a pre-defined methodology.
[425] NO: The general rules for the allowed transmission revenues (and their recovery via tariffs) shall be periodically reviewed. Each period must last a minimum of 5 years. Smaller changes in the regulation and changes in the tariff methodology do not follow the same periodical system and may be amended at any time. Any changes in the rules and regulations will be subject to a public consultation.
[426] NO: Tariff values are updated annually on the basis of a pre-defined methodology.
[427] PL: The NRA consults the TSO before and during the tariff approval process (not necessarily every tariff year).
[428] PL: Tariff is approved for 1 year. Some assumptions (e.g. on RoC) are made for 5 years period.
[429] PT: Tariff values are updated annually on the basis of a pre-defined methodology.
[430] RO: Tariff values are updated annually on the basis of a pre-defined methodology.
[431] SK: Tariff values are updated annually on the basis of a pre-defined methodology.
[432] SI: Tariffs are (ex-ante) pre-defined for each year of the regulatory period separately. There is a possibility to revise the tariff values. In case where the volatility of the planned energy quantities (inputs) would result in a more than 10% increase of the tariffs.
[433] ES: The transmission tariff methodology of the Government was not public, but annually the Government consulted on the tariffs for the following year. The NRA proposed to introduce a public consultation of the tariff methodology to be set by the NRA.
[434] SE: The tariff methodology has been independently developed by the Swedish TSO. The methodology undergoes an evaluation each year. The NRA defines only the revenue cap. The regulation regarding transmission and distribution tariff methodology is being reviewed by the Swedish NRA, with the purpose of introducing secondary legislation on network tariffs in Sweden in 2020. Sweden has previously only had a general tariff regulation (in the Swedish Electricity act and Electricity Regulation). From 2019, the NRA has the right to introduce more detailed regulation on tariffs on both TSO and DSO level.
[435] SE: Tariff values are updated annually on the basis of a pre-defined methodology.

Table 42: Distribution tariff methodology setting process

Country	Responsible party to set the tariff methodology	Consultations ahead of tariff methodology setting	Length of the tariff methodology period (i.e. frequency to amend it)	Frequency of updating the tariff values (i.e. period of applicability of the same tariff values)
Austria	NRA	Public consultation by the NRA	No defined period	1 year
Belgium	Regional regulator	Public consultation by the regional regulators	Brussels: 5 years Flanders: 4 years Wallonia: 5 years	1 year
Bulgaria	NRA	Public consultation by the NRA	Between 2-5 years	1 year
Croatia	NRA	Public consultation by the NRA	No defined period	1 year
Cyprus	NRA	Public consultation by the NRA	No defined period	1 year
Czech Republic	NRA	Public consultation by the NRA	5 years (but smaller amendments are possible in each year) [436]	1 year
Denmark	DSO (subject to NRA approval)	Public consultation by the NRA	No defined period[437]	No defined period
Estonia	NRA	Public consultation by the NRA	No defined period: the tariff methodology is amended upon DSO's proposal if the NRA agrees with it or if it is provided by law.	No defined period[438]
Finland	DSO (without NRA approval)[439]	No consultation	No defined period (each DSO decides separately when to update its tariff methodology)	No defined period: each DSO decided separately when to update its tariff values
France	NRA	Public consultation by the NRA	4 years	1 year
Germany	Ministry[440]	Consultation of regulators, network operators and industry associations by the Ministry	No defined period	1 year
Greece	Formerly the NRA, from 2022: DSO (subject to NRA approval)[441]	Public consultation by the NRA	No defined period	1 year
Hungary	NRA	Consultation TSO and DSO	4 years	1 year
Ireland	DSO (subject to NRA approval)	Public consultation by the NRA	No defined period	1 year
Italy	NRA	Public consultation by the NRA	8 years (two 4-years sub-periods)	1 year
Latvia	NRA	Public consultation by the NRA	No defined period	1 year
Lithuania	NRA	Public consultation by the NRA	No defined period: the tariff methodology is	1 year

[436] CZ: 5 years length of the tariff methodology is binding only for setting of allowed revenues and it is not binding for methodology which is used for calculating tariffs based on the allowed revenues.
[437] DK: The method can in some cases be time-limited, but there is no general rule. (E.g. NRA is able to grant permission to the DSO to differentiate prices on the basis of geographical delimitation. In these cases, the methods will typically be time-limited to 2 years.)
[438] EE: The same tariff values are applied until a DSO submit an application for new tariff values approval and NRA approves it Each DSO submits such application individually and the NRA approves them separately.
[439] FI: There is no ex-ante approval of tariffs or prices of network services by the NRA nor any other authorities. The NRA confirms ex-ante the revenue cap and connection charges. The NRA shall also approve ex-ante the terms and conditions of distribution and connection services before the network operators apply them. In addition, the NRA supervises the compliance between methodology and the Finnish electricity act. In situation of discordance, the NRA could decide on injunction.
[440] DE: Methodology is set in an ordinance by the Ministry of Economic Affairs.
[441] GR: The tariff methodology applied in year 2020 and previous years was set by the NRA. The respective tariffs were calculated also by the NRA, based on DSO forecasts for connected consumer capacity and demand for power and energy. From year 2022, the DSO proposes the tariff methodology for approval by the NRA, based on principles included in the Distribution Network Code, and calculates the tariff annually, based on the approved tariff methodology. NRA approves both the tariff methodology and the tariffs calculated annually by the DSO.

Country	Responsible party to set the tariff methodology	Consultations ahead of tariff methodology setting	Length of the tariff methodology period (i.e. frequency to amend it)	Frequency of updating the tariff values (i.e. period of applicability of the same tariff values)
			amended as deemed necessary by the NRA	
Luxembourg	NRA	Public consultation by the NRA	4 years	1 year
Malta	DSO (subject to NRA approval)[442]	No consultation	No defined period	No defined period[443]
The Netherlands	NRA	Publicly announced consultation of eligible stakeholders, which demonstrated to be directly affected by the NRA decision, including TSO, DSO's, network users, traders	3, 4 or 5 years[444]	1 year
Norway	NRA	Public consultation by NRA. Ex ante information from DSO to customers	No defined period + annual income cap decisions by NRA	1 year (updated based on each company's allowed revenue, which is set annually.)
Poland	NRA	Consultation of DSOs and DSOs association	No defined period	1 year
Portugal	NRA	Public consultation + targeted consultation of the tariff council	4 years	1 year
Romania	NRA	Public consultation by the NRA	5 years	1 year
Slovak Republic	NRA	Public consultation by the NRA	5 years	5 years (but in practice typically 1 year)
Slovenia	NRA	Public consultation by the NRA	3 years	1 year
Spain	NRA	Public consultation by the NRA	6 years[445]	1 year
Sweden	DSO (without NRA approval)	No consultation	No defined period: each DSO decides separately when to update its tariff methodology	No defined period: each DSO decides separately when to update its tariff values

Table 43: Transmission tariff transparency

Country	Detailed tariff methodology	Cost categories recovered by tariffs	The amounts recovered by each tariff element (at least when the tariff is set)	Each year, the tariff values for each network user group
Austria	NOT publicly available	NOT publicly available	NOT publicly available	Publicly available
Belgium	Publicly available	Publicly available	Only overall T-costs[446]	Publicly available
Bulgaria	Publicly available	Publicly available	Publicly available	Publicly available
Croatia	Publicly available	Publicly available	Publicly available	Publicly available
Cyprus	Publicly available	Publicly available	Only overall T-costs	Publicly available
Czech Republic	Publicly available	Publicly available	NOT publicly available	Publicly available
Denmark	Publicly available	Publicly available	Only overall T-costs	Publicly available
Estonia	Publicly available	Publicly available	NOT publicly available	Publicly available

[442] MT: The DSO is required to submit the retail tariffs, which cover also the distribution costs, for the approval of the NRA. The DSO forms part of a vertically integrated company, which is also the sole supplier of electricity in Malta. The DSO is required to keep unbundled accounts at internal management accounts level only. As such there is no specific separate tariff for the use of the distribution network. The costs of the distribution network are in part covered by a maximum demand tariff, an annual fixed charge, kWh tariffs that covers also energy and the supply and connection charges. All tariffs are regulated.
[443] MT: The latest tariff approval was in 2014, i.e. the same tariffs are currently applied without any update.
[444] NL: The national law limits the regulatory period to be 3, 4 or 5 years. The NRA decides for each regulatory cycle which length it considers appropriate.
[445] ES: For this first regulatory period (2020-2025) if it is deemed necessary it can be amended at the middle of the regulatory period (for the fourth tariff year). WACC-period is also 2020-2025.
[446] BE: Only annual TOTEX budget is publicly available. Detailed costs figures are considered confidential.

Country	Detailed tariff methodology	Cost categories recovered by tariffs	The amounts recovered by each tariff element (at least when the tariff is set)	Each year, the tariff values for each network user group
Finland	NOT publicly available[447]	Publicly available	Publicly available	Publicly available
France	Publicly available	Publicly available	Publicly available	Publicly available
Germany	Publicly available	Publicly available	Only overall T-costs	Publicly available
Greece	Publicly available	Publicly available	Publicly available	Publicly available
Hungary	Publicly available	Publicly available	Only overall T-costs	Publicly available
Ireland	Publicly available	Publicly available	Publicly available	Publicly available
Italy	Publicly available	Publicly available	Partly publicly available[448]	Publicly available
Latvia	Publicly available	Publicly available	Only overall T-costs	Publicly available
Lithuania	Publicly available	Publicly available	Publicly available	Publicly available
Luxembourg	Publicly available	Publicly available	Only overall T-costs	Publicly available
The Netherlands	Publicly available	Publicly available	Publicly available	Publicly available
Norway	Publicly available	Publicly available	Publicly available	Publicly available
Poland	NOT publicly available	Publicly available	NOT publicly available	Publicly available
Portugal	Publicly available	Publicly available	Publicly available	Publicly available
Romania	Publicly available	Publicly available	NOT publicly available	Publicly available
Slovak Republic	Publicly available	Publicly available	NOT publicly available	Publicly available
Slovenia	Publicly available	Publicly available	Only overall T-costs	Publicly available
Spain	Publicly available	Publicly available	Only overall T-costs	Publicly available
Sweden	Publicly available	Publicly available	Publicly available	Publicly available

Note: "only overall T-costs" means that only total aggregated sum of the transmission costs covered by the tariffs (i.e. no disaggregated cost amounts by each tariff element.

Table 44: Distribution tariff transparency

Country	Detailed tariff methodology	Cost categories recovered by tariffs	The cost amounts recovered by each tariff element (at least when the tariff is set)	Each year, the tariff values for each network user group
Austria	Publicly available (+EN)	NOT publicly available	NOT publicly available	Publicly available
Belgium	Publicly available	Publicly available	Brussels: Total distribution cost covered by the distribution tariffs is publicly available (but no details for each tariff). Flanders: Publicly available Wallonia: Total distribution cost covered by the distribution tariffs is publicly available.	Publicly available
Bulgaria	Publicly available	Publicly available	NOT publicly available	Publicly available
Croatia	Publicly available	NOT publicly available	NOT publicly available	Publicly available
Cyprus	Publicly available (+EN)	Publicly available	Only overall (aggregated) D-costs.	Publicly available
Czech Republic	Publicly available	Publicly available	NOT publicly available	Publicly available
Denmark	Publicly available	Publicly available	Only overall (aggregated) D-costs.	Publicly available
Estonia	Publicly available [449]	Publicly available	NOT publicly available	Publicly available

[447] FI: The Finnish TSO is not obligated to publish tariff methodology, but TSO has published "Grid service pricing structure" - design for different network user.
[448] IT: The cost values are not systematically published every year. Still, they are usually published before the beginning of the regulatory period (in consultation documents regarding tariff setting) or occasionally in some NRA reporting.
[449] EE: Standard terms and conditions for applying distribution tariffs (only in Estonian) are also published.

Country	Detailed tariff methodology	Cost categories recovered by tariffs	The cost amounts recovered by each tariff element (at least when the tariff is set)	Each year, the tariff values for each network user group
Finland	NOT publicly available	NOT publicly available	NOT publicly available	Publicly available
France	Publicly available	Publicly available	Publicly available	Publicly available
Germany	Publicly available	Publicly available	Only overall D-costs[450]	Publicly available
Greece	Publicly available	Publicly available	Only overall D-costs	Publicly available
Hungary	Publicly available	NOT publicly available	Publicly available	Publicly available
Ireland	Publicly available	NOT publicly available	Total distribution cost covered by the distribution tariffs is publicly available.	Publicly available
Italy	Publicly available	Publicly available	Overall D-costs, disaggregated with different segmentation compared to the tariff elements[451].	Publicly available
Latvia	Publicly available	NOT publicly available	Only overall D-costs is published, but disaggregated information is made available upon individual requests.	Publicly available
Lithuania	Publicly available	Publicly available	NOT publicly available	Publicly available
Luxembourg	Publicly available	NOT publicly available	Only overall D-costs.	Publicly available
Malta	NOT publicly available	NOT publicly available	NOT publicly available	NOT publicly available
The Netherlands	Publicly available	Publicly available	NOT publicly available	Publicly available
Norway	Publicly available	Publicly available	Only overall D-costs.	Publicly available
Poland	Publicly available	Publicly available	NOT publicly available	Publicly available
Portugal	Publicly available	Publicly available	Only overall D-costs, disaggregated with different segmentation compared to the tariff elements.	Publicly available
Romania	Publicly available	NOT publicly available	Overall costs, disaggregated with different segmentation compared to the tariff elements[452].	Publicly available
Slovak Republic	Publicly available	NOT publicly available	NOT publicly available	Publicly available
Slovenia	Publicly available	NOT publicly available	NOT publicly available	Publicly available
Spain	Publicly available	Publicly available	Publicly available[453]	Publicly available
Sweden	NOT publicly available	NOT publicly available	NOT publicly available	Publicly available

Note: "only overall costs" means that only total aggregated sum of the distribution costs covered by the tariffs (i.e. no disaggregated cost amounts by each tariff element.

[450] DE: Allowed revenues consist of different cost categories. However, the charges are not aiming at remunerating specific costs. Rather both the power and energy charge follow a TOTEX approach.
[451] IT: The total sum collected by D-Tariffs is published every year. In addition, some aspects which do not correspond to specific elements (the remuneration on capital, the amortization and the operational expenditures) are published separately at least at the end/beginning of regulatory periods.
[452] RO: Distribution costs approved for the fourth regulatory period, aggregated by the type of cost and for all the 5 years is publicly available.
[453] ES: Allowed revenues for each DSO are published every year, with details of allowed revenues for Investment, O&M, and incentives (https://www.boe.es/diario_boe/txt.php?id=BOE-A-2022-13101). Details on the cost amounts recovered in the tariff elements are provided in the tariff model for year 2021 (available in Excel format).

Table 45: Cost recovery via withdrawal charges at transmission level

Country	Costs for building, upgrading and/or maintaining infrastructure	Costs for grid losses	Costs for system services	Costs for metering	Non-related policy costs (e.g. NON-VAT taxes, levies, cost of support schemes)
Austria	Yes	Yes[454]	Yes	Yes (separate tariff element)	No
Belgium	Yes	Yes (partially)[455]	Yes		Yes (separate tariff or tariff element)[456]
Bulgaria	Yes	Yes	Yes		No
Croatia	Yes	Yes	Yes[457]	Yes (separate tariff element)	No[458]
Cyprus	Yes	Yes	Yes (separate tariff or tariff element)	Yes (separate tariff)	Yes (separate tariff or tariff element)[459]
Czech Republic	Yes	Yes	Yes (separate tariff or tariff element)	Yes (NOT separate tariff or tariff element)	Yes (separate tariff or tariff element)[460]
Denmark	Yes	Yes	Yes (separate tariff or tariff element)		No
Estonia	Yes	Yes	Yes[461]	Yes (separate tariff element)	Yes (separate tariff or tariff element)[462]
Finland	Yes	Yes	Yes (separate tariff or tariff element)		Yes[463]
France	Yes	Yes[464]	Yes	Yes (separate tariff or tariff element)	Not part of the tariff structure, but included in the electricity bill [465]
Germany	Yes	Yes	Yes		Not part of the regulated tariff structure, but included in the electricity bill [466]

[454] AT: Producers with installed capacity 5 MW or lower are exempted.
[455] BE: Federal losses (HV) are compensated “in kind” by Balance Responsible Parties. Regional losses (under 70kV network) are recovered via network tariffs.
[456] BE: Costs of supporting schemes for renewables and co-generation of heat and power are recovered via separate tariff. Costs for Public Services Obligations (PSO), including RES support and adequacy are added to the transmission tariffs according to the electricity law.
[457] HR: FCR are provided by generators on a mandatory basis without compensation by the TSO.
[458] HR: There is a only levy (kn/kWh) set by the Government (not part of the tariff structure)
[459] CY: Costs of supporting schemes for renewables and cogeneration of heat and power are recovered via separate tariff. Costs of measures for ensuring adequacy recovered by the "Tariff for the provision of ancillary services”. RES & EE Charge (EUR/kWh) - No VAT, for support schemes on renewables and energy efficiency. Public Service Obligation (EUR/kWh) - EAC recovers the expenses incurred due to the additional costs that aroused by the application of special tariffs for vulnerable consumers
[460] CZ: Costs of RES and co-generation of heart and power support is partially is partially covered by a separate charge paid by network users. The costs of measures for ensuring adequacy is included in the transmission tariff.
[461] Frequency is held by Russian TSO for free of charge.
[462] EE: Costs of RES support are recovered by additional charge which is calculated by TSO using principles which are set in Electricity Market Act.
[463] FI: No separate tariff element. Costs of measures for ensuring adequacy: the power reserve system is financed by separate payments for electricity consumption based on the utilisation of the electricity system and the grid, which the grid operator designated for system liability is entitled to collect from the users of transmission services. Network users also pay electricity tax.
[464] FR: Losses generated by exportation of electricity are paid by generators connected to the 400 kV and 225 kV grid.
[465]FR: Supporting schemes for renewables are financed through levies set by the Government, which are not part of the tariff structure.
[466] DE: EEG-Umlage (renewables), KWKG-Umlage (cogeneration of heat and power). The network operators only function as point of payment. The charges are not considered as network tariff elements and they are also not included in the allowed revenues.

Country	Costs for building, upgrading and/or maintaining infrastructure	Costs for grid losses	Costs for system services	Costs for metering	Non-related policy costs (e.g. NON-VAT taxes, levies, cost of support schemes)
Greece	Yes	No[467]	Yes (separate tariff or tariff element)	Yes	Other charge[468]
Hungary	Yes	Yes[469]	Yes		Not part of the regulated tariff structure, but included in the electricity bill[470]
Ireland	Yes	No[471]	Yes		Yes (separate tariff or tariff element)[472]
Italy	Yes	No[473]	Yes[474]		Yes (separate tariff or tariff element)[475]
Latvia	Yes	Yes	Yes		Other charge[476]
Lithuania	Yes	Yes	Yes (separate tariff or tariff element)		Not part of the regulated tariff structure, but included in the electricity bill [477]
Luxembourg	Yes	Yes	Yes		No
The Netherlands	Yes	Yes	Yes	Yes[478] (separate tariff)	Not part of the regulated tariff structure, but included in the electricity bill[479]

[467] GR: Cf. Table 25 in Annex 1.
[468] GR: Through the RES levy (ETMEAR), auctioning of CO2 emission allowances and wholesale market uplift charges. Costs of supporting schemes for cogeneration of heart and power is covered by other charge. Costs of fossil fuel support scheme are recovered through wholesale market uplift charges. Adequacy related costs are covered through wholesale market uplift charges.
[469] HU: Partial recovery by setting a price of losses (based on market trends) justified by the NRA and using the factual volume of year n-2. There is an ex-post partial correction in both directions.
[470] HU: Supporting schemes for renewables are financed through levies set by the Government, which are not part of the tariff structure.
[471] IE: The Transmission Loss Adjustment Factors (TLAFs) are applied to generators to ensure that that the costs of transmission losses are borne by market participants who cause them. TLAFs are applied to generators' outputs so that their contribution to the market is adjusted. The value of TLAFs depends on the generator point of connection to the grid. A similar system is used in Northern Ireland.
[472] IE: Costs of RES support and Costs of supporting schemes for fossil fuels by separate charge: The PSO charge is designed by the Government and consists of various subsidy schemes to support its national policy objectives related to renewable energy and indigenous fuels (peat). PSO levy scheme supports peat until the end of 2019.
[473] IT: Consumers pay (in kind, i.e. as additional energy bought in the energy market) for a "standard" level of losses. The difference between the actual losses and the standard losses is paid (or retained) by network operators. The reason for introducing standard level of losses (and thus an implicit reward/penalty scheme for network operators) is to incentivise network operators to reduce losses in their networks.
[474] IT: Frequency containment reserve and reactive support is mandatory and free of charge. The costs of market-based voltage control actions by generators (to avoid voltage violations) are treated under the intra-zonal congestion charging mechanism.
[475] IT: A3-SOS is the tariff element to cover the costs for supporting renewable sources and CIP 6/92 cogeneration. Costs of measures for ensuring adequacy, stranded costs of phased-out power plants are also recovered by charges.
[476] LV: Costs of measures for ensuring adequacy: Support schemes for RES, co-generation and fossil fuels are not applicable since 2013. However, some of those power plants which were granted till 2013 with such an support (for 10-20 years) receive payments (the last one until 2037) from the obligatory mandatory component (OMC) set by the regulatory every year, separately from the transmission tariff.
[477] LT: Costs of supporting schemes for renewables are the public service obligation. The public services obligation price is part of the final price of electricity, which is paid by the consumer. Costs of measures for ensuring adequacy are system service. The system services price is part of the final price of electricity, which is paid by the consumer
[478] NL: For consumers the tariff is regulated and the meter is provided DSO, for other network users it is not a regulated market.by the DSO, for other network users it is not a regulated market.
[479] NL: energy tax, Public Service Obligations

Country	Costs for building, upgrading and/or maintaining infrastructure	Costs for grid losses	Costs for system services	Costs for metering	Non-related policy costs (e.g. NON-VAT taxes, levies, cost of support schemes)
Norway	Yes	Yes	Yes[480]	Yes (separate tariff element) [481]	Not part of the regulated tariff structure, but included in the electricity bill[482]
Poland	Yes	Yes	Yes	Yes (NOT separate tariff or tariff element)	Yes (separate tariff or tariff element)[483]
Portugal	Yes	No[484]	Yes (separate tariff)[485]	Yes	Yes (separate tariff or tariff element)[486]
Romania	Yes	Yes[487]	Yes[488]		Yes (separate tariff or tariff element)[489]
Slovak Republic	Yes	Yes (separate tariff or tariff element)[490]	Yes (separate tariff or tariff element)		Yes (separate tariff or tariff element)[491]
Slovenia	Yes	Yes	Yes[492]		Yes (separate tariff or tariff element)[493]
Spain	Yes	No[494]	No[495]		Yes (separate tariff or tariff element)[496]
Sweden	Yes	Yes	Yes		Yes (separate tariff or tariff element)[497]

[480] NO: Frequency containment reserve, frequency restoration reserve, replacement reserve, reactive support and voltage control
[481] NO: For consumers the tariff is regulated and the meter is provided by the DSO, for other network users it is not a regulated market
[482] NO: RES and non-VAT Tax
[483] PL: Costs of supporting schemes for renewables are recovered by a RES charge, which is set annually by the NRA. Costs of supporting schemes for cogeneration of heat and power are recovered by a cogeneration charge, which is set annually by the Minister of Energy. Costs of measures for ensuring adequacy are also recovered by other charge. Stranded costs of phased-out power plants are recovered by a transition charge calculated by the NRA.
[484] PT: Suppliers must buy the energy for their clients' consumption in addition to energy to compensate for losses which is calculated by using the 15-minute loss profiles approved and published annually by the NRA. The loss profiles are differentiated by network type (transmission and distribution) and voltage level (EHV, HV, MV, LV). In this sense, there are no tariffs for losses, since losses are purchased by suppliers on the market.
[485] PT: FCR, FRR and RR are provided by generators on a mandatory basis without compensation by the TSO. Costs of the system operator, which is the same entity as the TSO, are recovered by a separate regulated tariff (called "tariff for the global use of the system"), which is different from the transmission tariff.
[486] PT: Other costs (e.g. support schemes for renewables/cogeneration/fossil fuel, capacity mechanisms, cost for efficiency programs, rent of areas utilized by hydro plants, budget of the energy NRA, additional costs from the autonomous regions of Azores and Madeira) are recovered through a separate charge, called "global use of the system tariff".
[487] RO: Losses are paid by all consumers and by the producers with installed capacity greater than 5 MW
[488] RO: FCR are provided by generators on a mandatory basis without compensation by the TSO.
[489] RO: Costs of supporting schemes for renewables (green certificates) and the cogeneration of heat and power. Cogeneration costs are recovered through the fee for high-efficiency cogeneration.
[490] SK: Paid by consumers.
[491] SK: Costs of supporting schemes for renewables; Costs of supporting schemes for cogeneration of heat and power: Costs of supporting schemes for fossil fuels; Cost for such support schemes are recovered by system operation tariff.
[492] SI: FCR are provided by generators on a mandatory basis without compensation by the TSO.
[493] SI: Costs of supporting schemes for RES and cogeneration of heat and power is part of a supplement charge set by Government and levied on each network user who is subject to transmission tariff.
[494] ES: Suppliers must buy the energy for their clients including losses. The standard losses are established and published (currently by the Government and from January 1, 2020 by the NRA). The standard losses are differentiated by voltage level and period.
[495] ES: The costs of the ancillary services are included in the commodity price
[496] ES: A separate charge ("cargos") include among others costs of incentives to promote cogeneration and renewables of heat and power, off-peninsular compensation, income imbalances in the settlement procedure.
[497] SE: For costs of measures ensuring adequacy a separate power reserve charge is applied.

Table 46: Cost recovery via withdrawal charges at distribution level

Country	Costs for building, upgrading, maintaining infrastructure	Costs for grid losses	Costs for system services	Costs for metering	Non-related policy costs (e.g. NON-VAT taxes, levies, cost of support schemes)
Austria	Yes	Yes	Yes	Yes (separate tariff element)	Yes (separate charge)[498]
Belgium	Brussels: Yes Flanders: Yes Wallonia: Yes	Brussels: Yes Flanders: Yes Wallonia: Yes	Brussels: Yes Flanders: Yes Wallonia: Yes	Brussels: Yes (separate tariff element) Flanders: Yes (separate tariff element) Wallonia: Yes	Brussels: Yes (separate charge)[499] Flanders: Yes (separate tariff element)[500] Wallonia: Yes[501]
Bulgaria	Yes	Yes	Yes	Yes	No data
Croatia	Yes	Yes	Yes	Yes	Not part of the regulated tariff structure, but included in the electricity bill[502]
Cyprus	Yes	Yes	No	Yes (separate tariff element)	Yes (separate charge)[503]
Czech Republic	Yes	Yes	Yes	Yes (NOT separate tariff or tariff element)	Yes (separate charge)
Denmark	Yes	Yes	No	Yes (separate tariff element)	No
Estonia	Yes	Yes	No	Yes	No
Finland	Yes	Yes	Yes	Yes	Electricity tax
France	Yes	Yes	No	Yes (separate tariff element)	No
Germany	Yes	Yes	Yes	Partially (conventional metering, separate tariff element)[504]	Not part of the regulated tariff structure, but included in the electricity bill [505]
Greece	Yes	No[506]	No	Yes	No data
Hungary	Yes	Yes	N/A[507]	Yes	Not part of the regulated tariff structure, but included in the electricity bill
Ireland	Yes	No[508]	No	Yes	Public Service Obligation costs

[498] AT: RES support
[499] BE (BRU): Local municipality taxes (€/kWh), taxes paid by the DSO (contribution ISOC) (€/kWh), pension scheme of DSO employees, public service obligations/public lights
[500]BE (FLA) taxes (different than VAT), local retributions, public service obligations, cost of public lights are recovered as a separate tariff element of the distribution tariff. (pension scheme of DSO employees phased out from tariffs from July 2022)
[501] BE (WAL): Local municipality taxes (€/kWh), taxes paid by the DSO (contribution ISOC) (€/kWh), public service obligations/public lights
[502] HR: RES support scheme
[503] CY: Public Service Obligation (EUR/kWh) - is a separate charge in the electricity bill that is not subject to VAT and imposed so that the EAC can recover the expenses incurred due to the additional costs that aroused by the application of special tariffs for vulnerable consumers
[504] DE: In Germany, smart metering is deregulated
[505] DE: EEG-Umlage (renewables), KWKG-Umlage (cogeneration of heat and power). The network operators only function as point of payment. The charges are not considered as network tariff elements and they are also not included in the allowed revenues.
[506] GR: In Greece, the cost of distribution losses is borne by suppliers and included in the energy component of the final electricity price charged to their final customers;
[507] HU: In case the DSO were to purchase ancillary and flexibility services, the cost would be covered by distribution tariffs. However, such purchase has not taken place yet by the Hungarian DSOs.
[508] IR: In Ireland, the distribution loss adjustment factors (DLAFs) apply to the metered withdrawal of a network user connected to the distribution network. The DLAFs values apply to demand on the basis of which voltage level they are connected to (i.e. LV, MV and 30kV);

Country	Costs for building, upgrading, maintaining infrastructure	Costs for grid losses	Costs for system services	Costs for metering	Non-related policy costs (e.g. NON-VAT taxes, levies, cost of support schemes)
Italy	Yes	No[509]	No	Yes (separate tariff element)	Not part of the regulated tariff structure, but included in the electricity bill[510]
Latvia	Yes	Yes	Yes	Yes	No
Lithuania	Yes	Yes	Yes	Yes	No
Luxembourg	Yes	Yes	Yes	Yes (separate tariff element)	No[511]
Malta	Yes	Yes	Yes	Yes (separate tariff element)	Yes[512]
The Netherlands	Yes	Yes	Yes	Partially (only for household and small non-household consumers)[513]	Yes (separate charge)[514]
Norway	Yes	Yes	No	Yes	Not part of the regulated tariff structure, but included in the electricity bill.
Poland	Yes	Yes	Yes	Yes	Yes (separate charge)[515]
Portugal	Yes	No[516]	Yes	Yes[517]	Partially[518]
Romania	Yes	Yes	No	Yes	Not part of the regulated tariff structure, but included in the electricity bill.[519]
Slovak Republic	Yes	Yes	Yes	Yes	Yes (separate charge)[520]
Slovenia	Yes	Yes	No	Yes	Yes (separate charge)[521]
Spain	Yes	Yes	No	Yes	Yes (separate charge)[522]

[509] IT: In Italy, consumers pay (in kind, i.e. as additional energy bought in the energy market) for a "standard" level of losses. The difference between the actual losses and the standard losses is paid (or retained) by network operators. The reason for introducing standard level of losses (and thus an implicit reward/penalty scheme for network operators) is to incentivise network operators to reduce losses in their networks.
[510] IT: There is a number of policy costs which are paid by electricity consumers. In addition, TV tax is separately recovered via the electricity bills. However, they are not part of regulated network tariffs.
[511] LU: the costs of EV-recharging points accessible to the public operated by the DSO was recovered in the past as part of the distribution tariff, without distinguishing such tariff element. However, it has been excluded from the D-tariffs in the meantime;
[512] MT: apart from VAT, customers are charged excise duty on electricity
[513] NL: For large non-household consumers the metering is deregulated)
[514] NL: sustainable energy surcharge
[515] PL: Co-generation of heat and power. D-connected network users also pay for RES support scheme, stranded costs and costs of maintaining the capacity market.
[516] PT: In Portugal, energy suppliers have to procure more energy in the market to cover grid losses. The amount of energy to compensate for grid losses is added to the metered withdrawal of the supplier's customers and calculated using the hourly losses profiles which are approved annually by the NRA. These losses profiles are differentiated by network type (transmission and distribution) and voltage level (VHV, HV, MV, LV).
[517] PT: investment cost (CAPEX) of meters (both traditional and smart meters) is not recovered through distribution tariffs. OPEX related to metering are part of the costs recovered via the distribution tariff.
[518] PT: Past employee downsizing costs are recovered as part of the distribution tariff, without distinguishing such tariff element. In addition, the low voltage distribution tariff includes concession rents paid by the DSO to municipalities and an incentive for the integration of LV installations into smart grids. Other costs (e.g. support schemes for renewables/cogeneration/fossil fuel, capacity mechanisms, cost for efficiency programs, rent of areas utilized by hydro plants, budget of the energy NRA, additional costs from the autonomous regions of Azores and Madeira) are recovered through a separate charge, called "global use of the system tariff".
[519] RO: some RES, Co-gen support scheme and excise tax to be paid by D-connected users
[520] SK: RES support scheme paid by all consumers
[521] SI: RES support, energy efficiency support, market operator cost
[522] ES: RES support, stranded power generation costs for electricity production in Spanish non-peninsular territories

Country	Costs for building, upgrading, maintaining infrastructure	Costs for grid losses	Costs for system services	Costs for metering	Non-related policy costs (e.g. NON-VAT taxes, levies, cost of support schemes)
Sweden	Yes	Yes	Yes	Yes	Not part of the regulated tariff structure, but included in the electricity bill[523].

Table 47: Tariff basis, variation and differentiation of the transmission tariffs for withdrawal

Country	Tariff basis		Variation of tariffs based on			Exemption, discount or differentiation of tariff values or tariff basis for some network users
	Energy	Power	Voltage	Location[524]	Time-of-use[525]	
Austria	X	X	X	(X)[526]		
Belgium	X	X	X		X	X[527]
Bulgaria	X					
Croatia	X	X[528]	X		X	
Cyprus	X		X			
Czech Republic	X	X				
Denmark	X					
Estonia	X		X		X	
Finland	X	X			X	
France	X	X	X		X	
Germany	X	X[529]				X[530]
Greece	X	X				X[531]
Hungary	X		X			
Ireland	X	X[532]				X[533]

[523] SE: energy tax is paid by end consumers
[524] Variation based on location, unrelated to the connection to a specific network operator (e.g. the network charges are set to be different to indicate at which locations the electricity is most or least needed).
[525] Does not take into account differences due to mandatory/voluntary use of time-differentiated tariffs by the network users.
[526] AT: Different tariffs apply for different network areas. Multiple DSOs can operate within a single network area.
[527] BE: New or substantially increased storage facilities receive 80% tariff reduction for 10 or 5 years (from 2020). New or substantially increased storage facilities receive 80% tariff reduction for 10 or 5 years (from 2020).
[528] HR: Contracted power
[529] DE: The weight of the components depends on the user's peak load that occurs simultaneously with the annual peak load of the network. For users exceeding 2,500 hours of consumption, the capacity-based term is higher than the energy-based term. The opposite is true for consumers under the 2,500-hour threshold. (I.e. according to the latest data from year 2015, for transmission-connected grid users exceeding 2,500 hours of consumption/year: 83.4% capacity charge, 16.6% volumetric. For grid users under 2,500 hours: 25.5% capacity, 74.5% volumetric.)
[530] DE: Tariff reduction (discounts) is applied for consumers whose individual peak load predictably differs in a considerable way from the annual peak load of the grid and users who consume for 7.000 h/a at one connection point and whose annual consumption at this connection point crosses 10 GW/h. PHES whose pump capacity or turbine power increased by at least 7.5% or whose storage capacity increased by at least 5% after 04.08.2011 are fully exempted for the first 10 years. Non-PHES storage facilities built after 31.12.2008 and put into operation within 15 years from 04.08.2011 are fully exempted for the first 20 years of operation.
[531] GR: Allocation of costs based on aggregate demand of each consumer class (HV, MV, LV) during the summer and winter peak (2 hours annually). HV/MV customers pay fully capacity-based tariffs, LV customer tariffs are mostly energy- based (80-100%, depending on the type of customer)
[532] IE: Maximum export capacity
[533] IE: Based on how the demand customer is connected to the grid, i.e. transmission-connected, distribution-connected with a Minimum Import Capacity (MIC) ≥ 0.5MW or distribution-connected with MIC <0.5MW the power-based charge is different. The energy charge does not vary. Some PHES are fully exempted (i.e. Turlough Hill)

Country	Tariff basis		Variation of tariffs based on			Exemption, discount or differentiation of tariff values or tariff basis for some network users
	Energy	Power	Voltage	Location[524]	Time-of-use[525]	
Italy	X	X	X[534]			X[535]
Latvia	X	X				X[536]
Lithuania	X	X				X[537]
Luxembourg	X[538]	X				
The Netherlands		X[539]	X			X[540]
Norway	X	X		X		
Poland	X	X[541]				X[542]
Portugal[543]	X	X	X[544]		X	
Romania	X					
Slovak Republic	X	X				X[545]
Slovenia	X	X			X	X[546]
Spain	X	X			X	
Sweden	X	X		X[547]		

[534] IT: Customers on HV and EHV levels pay the same power-based component, while the energy-based component is slightly lower for EHV customers. Customers at lower voltage levels pay on the basis of energy.
[535] IT: PHES and non-PHES storage is not subject to withdrawal charges (for pumping/charging)
[536] LV: PHES and non-PHES storage is not subject to withdrawal charges (for pumping/charging)
[537] LT: PHES and non-PHES storage is not subject to withdrawal charges (for pumping/charging). Consumers whose electrical equipment has a permissible capacity less than 30 kW are partially exempted.
[538] LU: Metered yearly 15min peak.
[539] NL: Partly based on annual contracted maximum capacity (kW) and partly on a monthly peak capacity (kW). Additional fixed lump sum fee (0.01% of the total injection charge)
[540] NL: The large industrial consumers connected to the EHV or HV transmission grid receive partial tariff exemption if they meet certain criteria (consumption level and profile).
[541] PL: Contracted capacity
[542] PL: PHES and non-PHES storage is not subject to withdrawal charges (for pumping/charging. For T-connected (end) network users the charge is based on the reserved contractual capacity. For the points of delivery where the where distribution network is connected, the charge is based on the actual energy flows.
[543] PT: The tariff basis of the transmission tariff has the following structure, based on tariff values for year 2019: active energy (14.0%), reactive energy (2.5%), contracted power (10.5%) and peak power (73.0%).
[544] PT: Users connected at VHV pay a lower transmission tariff than users connected at lower voltage levels, as the former only pay for the VHV assets of transmission, while the latter pay also the remaining transmission assets (e.g. VHV/HV transformers).
[545] PHES is not subject to withdrawal charges (for pumping/charging). No non-PHES storage is connected to the transmission grid. Some of the largest industrial consumers are partially exempted (tariff reduction)
[546] PHES and non-PHES storage is not subject to withdrawal charges (for pumping/charging)
[547] SE: The withdrawal charge differs between nodes in the transmission grid (same applies for the injection charge).

Table 48: Tariff basis, variation and differentiation of the distribution tariffs for withdrawal

Country	Tariff basis			Variation of tariffs based on			Exemption, discount or differentiation of tariff values or tariff basis for some network users
	Energy	Power	Lump sum	Voltage	Location[548]	Time-of-use[549]	
Austria	X	X	X	X	(X) (network areas)[550]	X (E-based)	X[551]
Belgium	Brussels: X Flanders: X Wallonia: X	Brussels: X (actual maximum power) Flanders: X Wallonia: X (actual maximum power)	Brussels: X	Brussels: X Flanders: X Wallonia: X		Brussels: X (E-based) Flanders: X[552] (E-based) Wallonia: X (E-based)	Brussels: X[553] Flanders: X[554] Wallonia:
Bulgaria	X	X		X			X[555]
Croatia	X	X (actual power at peak period)[556]		X		X (both E- and P-based)	
Cyprus	X			X			
Czech Republic	X	X (contracted or rated power)		X		X (both E- and P-based)	X[557]
Denmark	X		X	X		X (both E- and P-based)	
Estonia	X	X	X	X		X (E-based)	X[558]
Finland	X	X	X	X		X (both E- and P-based)[559]	X[560]

[548] Variation based on location, unrelated to the connection to a specific network operator (e.g. the network charges are set to be different to indicate at which locations the electricity is most or least needed). D-tariff for withdrawals are different based on the DSO area to which the user is connected to in several countries/jurisdictions including BE's Flanders and Wallonia regions, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Latvia, Lithuania, the Netherlands, Poland, Romania, Sweden.
[549] Does not take into account differences due to mandatory/voluntary use of time-differentiated tariffs by the network users.
[550] AT: Different tariffs apply for different network areas. Multiple DSOs can operate within a single network area
[551] AT: Most users have a power-based D-tariff , some LV users have energy+lump sum
[552] BE (FLA): Until end 2022, there has been a day/night differentiation in the energy charge. From 2023, only the 'exclusive night' tariff for accumulation heating (energy-based) remains as a sort of ToU.
[553] BE (BRU): Network users (on LV) pay an energy-based charge and a yearly lump sum fee based on the capacity of their connection (i.e. less than or equal to 13 kVA vs. greater than 13 kVA). Network users (on HV) with peak measurement pay an energy-based charge and a power-based charge (€/kW) based on their actual monthly peak capacity (maximum of the last 12 months) during peak time of use: weekdays for 7 am to 10 pm.
[554] BE (FLA): Only energy-based tariffs are applied to household consumers (until 2022). Both power-based and energy-based tariffs are applied to most non-household consumers (depending on the metering regime).
[555] BG: Some network users have energy-based, some network users have mix of energy and power-based tariffs.
[556] HR: Power-based charge only has to be paid during peak periods.
[557] CZ: Some network users (MV or HV) have the option to have energy-based tariff only. However, this option is taken by a fraction of the eligible network users. The rest of the users have a mix of energy- and power-based charges.
[558] EE: network users have the option for energy-based only, for mix of energy-based and power-based or for mix of energy-based, power-based and lump sum charges. Households can choose also a mix of energy-based and lump sum tariff. MV connected consumers have to pay lower variable tariffs than LV connected consumers, but higher fixed fees. Consumers whose electricity consumption is higher have a possibility to use network services with network charges, which include lower variable fees and higher fixed fees compared to network charges, which are more suitable for lower electricity consumption consumers
[559] FI: Differences typically apply in the energy-based withdrawal charge, but there are DSOs that apply time elements in the power-based withdrawal charge.
[560] FI: In general, for households and small buildings, the tariff consists of an energy-based fee and a fixed basic fee, which, in some DSOs' tariff structures, depends on the size of the main fuse. For industrial consumers, the tariff usually consists of a basic fee, power fee, reactive power fee and distribution fee.

Country	Tariff basis			Variation of tariffs based on			Exemption, discount or differentiation of tariff values or tariff basis for some network users
	Energy	Power	Lump sum	Voltage	Location[548]	Time-of-use[549]	
France	X	X (contracted or rated power)	X[561]	X		X (both E- and P-based)	X[562]
Germany	X	X	X	X			X[563]
Greece	X	X (actual power at specified time or contracted power)		X			X[564]
Hungary	X	X	X	X			X[565]
Ireland	X	X	X	X		X (E-based)	X[566]
Italy	X	X	X	X			X[567]
Latvia	X	X (contracted or rated power)		X		X (E-based)	
Lithuania	X	X	X	X		X (E-based)	
Luxembourg	X	X	X	X			X[568]
Malta	X[569]	X (actual maximum power)	X			X (E-based)	X[570]

[561] FR: Management component is a lump sum (same for metering). Pure withdrawal charge consists of a power-based charge and an energy-based charge. Depending on the voltage level, there are different possible combinations of power-energy component values that users will subscribe to according to their utilisation of the network.
[562] FR: for MV users time-of-use tariffs embedded both in power and energy-based component; for LV users (under 36 kVA, time-of-use tariffs embedded only in the energy-based component.
[563] DE: Mix of energy and lump sum in exceptional cases for LV users, a mix of energy-based and power-based tariff in case of power metering and for non-LV users. Tariffs generally consist of a power-charge and an energy-based charge depending on the annual consumption (kW peak for power-based charge and kWh for energy-based charge). The weight of components depends on the user's peak load occurring simultaneously with the network's annual peak load. For users exceeding 2500 hours of consumption, the power-based term is than the energy-based term. The opposite is true for consumers under the 2500-hour threshold. At the low voltage level for consumers without power-metering, there is only an energy-based tariff unless DSOs make use of the option to additionally introduce a so-called “base charge” (lump sum). The combined tariff consisting of an energy-based component and the base charge must be proportionate to the tariff (consisting of a volumetric and a capacity component) that would be applicable on the low voltage level in case of power metering. The vast majority of DSOs make use of this option.
[564] GR: For MV network users the power-based charge is based on the actual power at specified time (e.g. system peak periods). For LV network users the power-based charge is based on contracted or rated power.
[565] HU: Larger users at low voltage level above 3×80A connection capacity and users connected to higher voltage levels have a mix of energy-based, power-based and lump sum charge, while other users have a mix of energy-based and lump sum charge.
[566] IE: some network users have only energy-based charge, some network users have a mix of energy-based and lump sum charge and some network users have a mix of energy-based, power-based and lump sum charge.
[567] IT: For most users, the network tariff has three components: fixed, energy-based and power-based. The energy-based component is only addressing transmission; therefore, the distribution tariff can be deemed as a combination of fixed and power-based. Only energy-based charge is applied for public lightning and public charging points for electric vehicles.
[568] LU: For low voltage users the energy component is paid on the consumption and an access fee is due monthly. The access fee contains the metering costs and some of the distribution costs. For non-low voltage users in distribution, the tariff has an energy and a power component, while metering is a separate monthly fee.
[569] MT: Network users with a service rating not exceeding 60A per phase pay an energy-based tariff and an annual fixed service charge. The energy-based tariff is paid on consumption only and covers part of the distribution costs as well as the energy and supply costs. Prosumers do not pay any extra charges for injection. Producers that only inject but not withdraw pay only the annual fixed service charge. Users with a service rating exceeding 60A per phase pay an energy-based tariff, an annual fixed service charge and a maximum demand tariff based on the highest demand (kW or kVA) sustained for any thirty consecutive minutes during the year multiplied by two. The energy-based tariff is paid on the electricity consumed only. Prosumers do not pay any extra charges for injection. Producers that inject pay only an annual fixed service charge. This service charge covers the metering and cost-related administration of feed-in tariff account. In Malta, all producers sell to the DSO/supplier, there is no third-party access and the retail market is not open to competition.
[570] MT: A time-differentiated kWh or KVAh tariff structure is available for consumers with a consumption exceeding 5GWh. The registered consumer on a “Non-Residential Premises Service” with a connection capacity rated above a 100 Amps per phase may apply to be metered and billed in kVAh tariffs instead of kWh tariffs.

Country	Tariff basis			Variation of tariffs based on			Exemption, discount or differentiation of tariff values or tariff basis for some network users
	Energy	Power	Lump sum	Voltage	Location[548]	Time-of-use[549]	
The Netherlands	X	X[571] (both contracted and actual power)	X	X			
Norway	X	X	X	X		X	
Poland	X	X (contracted or rated power)	X	X		X (E-based)	
Portugal	X[572]	X (both contracted and actual peak power) [573]		X		X (both E- and P-based)	
Romania	X[574]			X			
Slovak Republic	X	X (contracted or rated power)		X			
Slovenia	X	X[575]		X		X (E-based)	
Spain	X	X (both contracted and actual power) [576]		X		X (both E- and P-based)	X[577]
Sweden	X	X (actual maximum power)	X	X		X (both E- and P-based)	X[578]

[571] NL: network users pay withdrawal tariffs on the basis of: the contracted amount of power; the actual maximum amount of power required within a week or month; kWh: the amount of energy used; and a lump sum per year. Both the contracted amount of power and the actual maximum amount of power required within a week or month are applied as power-based components.
[572] PT: Each separate distribution tariff (HV, MV and LV) has the following billing variables: contracted power, peak power, active energy and reactive energy. Notwithstanding the general structure of the distribution tariffs, when applying them to small consumers connected to the LV grid (≤ 41.4 kVA), the following simplified structure applies: contracted power and active energy.
[573] PT: The criteria for the power-based charge is contracted power and peak-power, except for small consumers connected to the LV grid (denominated as Normal Low Voltage, with power levels ≤ 41.4 kVA), where peak-power is not applied.
[574] RO: The tariffs are energy-based, calculated based on the distribution costs and distributed energy related to each voltage level. These are voltage-specific tariffs (for low, medium and high voltage). The tariff paid by a user is calculated by summing the specific tariffs for its own connection voltage level and for higher voltage levels.
[575] SI: different bases depending on the voltage level and capacity. For customers connected to low voltage with capacity up to 43 kW, the withdrawal charges are applied based on the rated power according to the size of fuse. For those on low voltage with capacity above 43 kW, the charges are based on the actual monthly peak power at a specified time (e.g. system peak periods between 6h and 22h only on working days). On medium and high voltage, the withdrawal charges are based on the actual monthly peak power at a specified time – a period of two continuous hours (between 6h and 22h on working days) defined as system peak periods by the DSO. The DSO is obliged to define system peak periods (hours) for each month a year in advance.
[576] ES: Tariffs are based on time of use. Six periods are considered and there is a power-based charge for each of the periods. Additionally, there is a penalty for excess of actual power over contracted power.
[577] ES: Regarding time-of-use tariffs 6 periods are considered for power-based withdrawal charge except for households were there are 2 periods, 6 periods are considered for energy-based withdrawal charge except for households were there are 3 periods.
[578] SE: In general, households often has a fixed charge (based on fuse size) plus energy charges. Low voltage other than households often have energy, power and fixed charge. High voltage has energy, power and fixed components.

Annex 2: Links to national tariff methodologies and tariff values

Table 49: Links to transmission tariff methodologies and transmission tariff values

Country	On-going T-tariff methodology period	Link to the latest T-tariff methodology	Link(s) to the current T-tariff values / online calculator
Austria	No certain time period is defined for the methodology; latest revision in 2012 (change of law)	N/A[579]	https://www.e-control.at/documents/1785851/0/BGBLA_2021_II_558.pdf/76b5da84-7bed-5d55-ac4a-529636f186541?t=1640079374191
Belgium	Jan 2020- Dec 2023	https://www.creg.be/sites/default/files/assets/Publications/Others/Z1109-9bFR.pdf	https://www.creg.be/sites/default/files/assets/Tarifs/Elia/TarifsTransmission_2020-2023.pdf
Bulgaria		https://www.dker.bg/uploads/normative_docs/naredbi/naredba_1_06082021.pdf	https://www.dker.bg/uploads/reshenia/2021/res-c27-2021.pdf
Croatia	No certain time period is defined for the methodology; current tariff methodology was set in 2015. Revised methodology applies from 01.01.2023.	https://narodne-novine.nn.hr/clanci/sluzbeni/2015_09_104_2035.html https://narodne-novine.nn.hr/clanci/sluzbeni/2016_09_84_1860.html	https://narodne-novine.nn.hr/clanci/sluzbeni/2018_12_112_2186.html https://www.hera.hr/hr/tarifni-kalkulator-eek/
Cyprus	Regulatory period for reviewing the tariff methodology is every 5 years. Latest revision was in 2021	https://www.cera.org.cy/Templates/00001/data/nomothesia/ethniki/rythmistikes_apofaseis/2021_01_en.pdf	https://tsoc.org.cy/electrical-system/use-of-system-charges/
Czech Republic	2021-2025	https://www.eru.cz/en/-/zasady-cenove-regulace-pro-regulacni-obdobi-2021-2025-pro-odvetvielektroenergetiky-plynarenstvi-pro-cinnosti-operatora-trhu-v-elektroenergetice-a-ply	https://www.eru.cz/cs/-/cenove-rozhodnuti-c-8-2021
Denmark	No certain time period is defined for the methodology; the T-tariff methodology has been set in 2005, with only minor adjustments since[580].	The latest DUR decision approving a T-tariff methodology: https://afg.forsyningstilsynet.dk/h/42c520c9-70bc-4643-93f3-3f63bb755d28/693aa5ff46b047bc8dc0e8b97516be02?showExact=true	https://energinet.dk/El/Elmarkedet/Tariffer/Aktuelle-tariffer
Estonia	No certain time period is defined for the methodology; latest revision in 2018	https://www.konkurentsiamet.ee/sites/default/files/3_2_elektrienergia_vorgutasude_arvutamise_uhtne_metoodika.pdf (in Estonian)	https://www.konkurentsiamet.ee/et/elektri-vorgutasud
Finland	2016-2023 (2 sub-periods: 2016-2019 and 2020-2023)	Not publicly available: the Finnish TSO is not obligated to publish tariff methodology TSO has published "Grid service pricing structure" - design for different network users: https://www.fingrid.fi/globalassets/dokumentit/fi/palvelut/kayttovarma-	https://www.fingrid.fi/globalassets/dokumentit/en/customers/grid-connection/grid-service-fees-2022.pdf

[579] AT: The tariff setting methodology is only provided in the explanatory notes concerning the actual system ordinance. The changes between the years are explained under the following link: https://www.e-control.at/bereich-recht/verordnungen-zu-strom/-/asset_publisher/tiRyh5zzUOU7/content/systemnutzungsentgelte-verordnung-sne-v-1?_com_liferay_asset_publisher_web_portlet_AssetPublisherPortlet_INSTANCE_tiRyh5zzUOU7_assetEntryId=10262340&_com. The cost setting methodology is available here: https://www.e-control.at/documents/1785851/0/Regulierungssystematik_Strom-TSO_FINAL+%281%29.pdf/9a0b09ba-aaf8-8760-b156-6bd33854aa75?t=1563368399034#:~:text=Die%20Regulierungssystematik%20stellt%20fest%2C%20dass,%C2%A7%2050%20ElWOG%202010%20ber%C3%BCcksi

[580] DK: The Danish TSO, Energinet, is undertaking a reform in the tariff design. Consequently, Energinet has submitted a number of tariff methodologies for approval at DUR, while other tariff methodologies are in process.

Country	On-going T-tariff methodology period	Link to the latest T-tariff methodology	Link(s) to the current T-tariff values / online calculator
		sahkonsiirto/fingrid_kantaverkkopalvelun_hinnoittelurakenne_en_f.jpg	
France	Jul 2021- Jul 2025 (TURPE 6 period)	https://www.cre.fr/Documents/Deliberations/Decision/tarif-d-utilisation-des-reseaux-publics-de-transport-d-electricite-turpe-6-htb (in French) https://www.cre.fr/en/Documents/Deliberations/Decision/tariffs-for-the-use-of-public-transmission-electricity-grids-turpe-6-htb (in English)	https://www.cre.fr/en/Documents/Deliberations/Decision/tariffs-for-the-use-of-public-transmission-electricity-grids-turpe-6-htb (Section 5.2.2, from p.93)
Germany	No certain time period is defined for the methodology; The ordinance setting the methodology has come into force in 2005 and has since been amended several time, latest amendment was in 2021 resulted in minor changes	https://www.gesetze-im-internet.de/stromnev/	TenneT TSO: https://www.tennet.eu/fileadmin/user_upload/The_Electricity_Market/German_Market/Grid_charges/21-12-14_TTG_Netzentgelte_fuer_2022.pdf TransnetBW: https://www.transnetbw.de/files/pdf/transparenz/netzzugang-und-entgelt/preisblaetter/Preise_Netznutzung_2022.pdf?v2 50Hertz: https://www.50hertz.com/Portals/1/Dokumente/Vertragspartner/Netzkunden/Netzzugang/211210_PB%202022_final.pdf?ver=J9cz8KA9H7TawudZgq8HCw%3d%3d Amprion: https://www.amprion.net/Dokumente/Strommarkt/Netzkunden/Netzentgelte/2021/Entgelte-Amprion-g%C3%BCltig-ab-01-01-2022-deutsche-Version.pdf
Greece	No certain time period is defined for the methodology; latest revision in 2021 (RAE decision 1001/16.12.2021). Tariffs determined according to the new methodology will be effective from 1.7.2022[581]	https://www.rae.gr/wp-content/uploads/2022/01/%CE%A6%CE%95%CE%9A-%CE%92-6256-%CE%91%CE%A0%CE%9F%CE%A6%CE%91%CE%A3%CE%97-1001-2021.pdf	https://www.rae.gr/wp-content/uploads/2021/06/%CE%A8%CE%9D%CE%9E%CE%99%CE%94%CE%9E-%CE%966%CE%A7.pdf
Hungary	Apr 2021- Dec 2024	http://www.mekh.hu/download/0/a7/e0000/villamos_energia_rendszerhasznalati_dijak_modszertani_utmutato_20210401_20241231.pdf	http://www.mekh.hu/download/2/ae/e0000/rendszerhasznalati_dijak_2021_aprilistol.xlsx
Ireland			
Italy	Jan 2016- Dec 2023; (semi-period Jan 2020 – Dec 2023)	https://www.arera.it/allegati/docs/19/568-19TIT.pdf (especially articles 7, 25 and 26 and Annex tables) https://www.arera.it/it/docs/19/568-19.htm	https://www.arera.it/it/elettricita/trasmissione.htm; https://www.arera.it/allegati/docs/19/568-19tabTIT_ti.xlsx (tables 1 and 5)
Latvia	No certain time period is defined for the methodology; Tariff methodology has been adopted	https://likumi.lv/ta/id/315676-elektroenergijas-parvades-sistemas-pakalpojumu-tarifu-	https://ast.lv/en/content/transmission-tariff

[581] GR: The NRA indicated that the determination of TSO required revenue for 2022 was delayed. For this reason, T-tariffs that were determined according to the previous methodology and were based on recovery of 2021 TSO required revenue, continue to apply also in 2022. It is expected that T-tariffs for recovery of TSO 2022 required revenue will be determined on the basis of the new methodology by 30.5.2022 and they will be effective from 1.7.2022.

Country	On-going T-tariff methodology period	Link to the latest T-tariff methodology	Link(s) to the current T-tariff values / online calculator
	on 16 June 2020, and no amendment has been made yet.	aprekinasanas-metodika (in Latvian)	
Lithuania	Jan 2022 – Jan 2026 (reviewed biennially)	https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/049c46b09dcb11e48d7bacdf30d64d66/ueYGduhurK?jfwid=-1ac9ufnnuk	https://www.vert.lt/en/Pages/price-ceilings-of-electricity-transportation-services-and-public-energy-price-ceilings.aspx
Luxembourg	Jan 2021- Dec 2024	https://legilux.public.lu/eli/etat/leg/rilr/2020/05/26/a561/jo (only in French)	https://assets.ilr.lu/energie/Documents/ILRLU-1685561960-948.pdf
Malta	N/A	N/A	N/A
The Netherlands[582]	No certain time period is defined for the methodology; The latest revision was in February 2022 (only minor changes were made in the national tariff code)	https://wetten.overheid.nl/BWBR0037951/2022-02-09 (only in Dutch)	Tariff values: https://www.acm.nl/sites/default/files/documents/tarievenbesluit-tennet-2022_0.pdf (p. 22 of the tariff decision) https://www.acm.nl/sites/default/files/documents/rekenmodule-tarievenbesluit-tennet-2022.xlsx (only in Dutch)
Norway	No certain time period is defined for the methodology, latest revision was on 01.01.2019	https://www.nve.no/media/13319/vedtak-om-inntektsramme-2021-statnett-og-nordlink-norge.xlsx ; https://www.statnett.no/globalassets/for-aktorer-i-kraftsystemet/tariff/tariff-booklet-2022.pdf	https://www.statnett.no/globalassets/for-aktorer-i-kraftsystemet/tariff/tariff-booklet-2022.pdf
Poland	No certain time period is defined for the methodology (Current tariff values apply between Jan– Dec 2022)	DSOs connected to TSO grid: https://www.ure.gov.pl/pl/biznes/taryfy-zalozenia/zalozenia-dla-kalkulacj/9961,Informacja-w-sprawie-kalkulacji-taryf-OSD-na-2022-r.html Smaller DSOs: https://www.ure.gov.pl/pl/biznes/taryfy-zalozenia/zalozenia-dlkalkulac/7833,Informacja-dla-przedsiebiorstw-energetycznych-posiadajacych-koncesje-na-dystrybu.html	Stoen Operator: https://bip.ure.gov.pl/bip/taryfy-i-inne-decyzje-b/energia-elektryczna/4004,Taryfy-opublikowane-w-2021-r.html
Portugal	Jan 2022- Dec 2025 (4 years)	https://www.erse.pt/media/s3mdkbcx/estrutura-tarif%C3%A1ria-se-2022.pdf (p. 30ff)	Tariff values for year 2022: https://www.erse.pt/en/activities/market-regulation/tariffs-and-prices-electricity/#current-year https://www.erse.pt/media/aepp1v4g/diretiva-3_2022.pdf https://www.erse.pt/media/xzclkvpz/tarifas-eletricidade-2022_1_jan2022.xlsx (only in Portuguese) Tariff values for year 2023 Excel (only in Portuguese)
Romania	Jan 2020- Dec 2024	https://www.anre.ro/ro/energie-electrica/legislatie/metodologii-tarife/transport-si-servicii-de-sistem	https://portal.anre.ro/PublicLists/Ordin (ANRE Order no. 33/2022)

[582] NL: There is no defined period for the T-tariff methodology. There is a national tariff code that describes the tariff structure. This tariff code is a regulation that can be amended. Generally, an amendment will be proposed by the TSO after which the NRA decides. The latest revision of the national tariff code was in February 2022 (only minor changes were made). There is an annual tariff decision through which tariffs are set for the next calendar year. In the tariff decision allowed revenues are calculated (on the basis of a methodology which remains the same throughout the regulatory period). Then tariffs are determined by applying tariff structure described in the national tariff code. For the tariff decision, the TSO proposes the tariffs and the NRA then decides on the tariffs.

Country	On-going T-tariff methodology period	Link to the latest T-tariff methodology	Link(s) to the current T-tariff values / online calculator
		(ANRE Order no. 171/2019, with latter amendments and additions (Order no. 75/2020, Order no. 153/2020, Order no. 4/2021 and Order no. 109/2021, only in Romanian)	
Slovak Republic	Current tariff methodology was set in 2017 by the NRA New regulation period will start from 01.01.2023. ,.	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2017/18/20211215.html (Decree No. 18/2017, only in Slovakian)	Values of tariff for the system services (TSS) in Slovak NRA Decision 0097/2022/E Values of tariff for the access to the transmission system and for the transmitted energy values in Slovak NRA Decision 0078/2022/E Values of tariff for losses during energy transmission in transmission system in Slovak NRA Decision 0078/2022/E Maximal prices for the balancing services (capacity and energy) per particular types of balancing service that can be paid by Slovak TSO to balancing services providers in Slovak NRA Decision 0092/2022/E.
Slovenia	There is no defined period, last revision on 02.09.2021. The latest regulatory period is set for year 2022, previous regulatory period was set for years 2019-2021.	http://www.pisrs.si/Pis.web/pregledPredpisa?id=AKT_1050	T-tariff values: (in Slovenian language): "Tarifne postavke za omrežnino za prenosni sistem" https://www.uradni-list.si/glasilo-uradni-list-rs/vsebina/2021-01-4132?sop=2021-01-4132 On line calculator - for end price comparison: http://primerjalnik.agen-rs.si/index.php?/kalkulatorelektrika/kalkulator/action/IzbiraOdjemalca/Podstran/PrimerjavaPonudb - for network charges: http://primerjalnik.agen-rs.si/index.php?/kalkulatorelektrika/kalkulator/action/VnosPodatkovAnalizaCuo/Podstran/AnalizaCenZaUporaboOmrezja
Spain	Six years from Jan 2020 to Dec 2025	Legal text https://www.boe.es/buscar/act.php?id=BOE-A-2020-1066 Impact assessment https://www.cnmc.es/sites/default/files/2808025_42.pdf Tariff model https://www.cnmc.es/sites/default/files/2808026_42.xlsx	https://www.cnmc.es/sites/default/files/3853710.xlsx
Sweden	No certain time period is defined for the methodology; latest revision was in 2021	www.svk.se/tariff	https://www.svk.se/siteassets/4.aktorsportalen/systemdrift-o-elmarknad/transmissionsnatstarif f/aktuella-prislistor/prislista-2022_transmissionsnatet.pdf

Table 50: Links to distribution tariff methodologies and distribution tariff values

Country	On-going D-tariff methodology period	Link to the latest D-tariff methodology	Link(s) to the current D-tariff values / online calculator
Austria	No certain time period is defined for the methodology (Current tariff values apply from Jan 2022- Dec 2022)	https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20010107	https://www.e-control.at/documents/1785851/1811582/Entgelte-Strom-2022.xlsx/362ecd43-aeb5-c2f1-6f7f-6dc11be6b69f?t=1640013322118
Belgium	Brussels: Jan 2020- Dec 2024 Flanders: Jan 2021-Dec 2024 Wallonia: Jan 2019 - Dec 2023	Brussels: https://www.brugel.brussels/themes/tarifs-de-distribution-12/methodologie-tarifaire-2020-2024-320 Flanders: https://www.vreg.be/nl/tariefmethodologie-2021-2024 Wallonia: https://www.cwape.be/sites/default/files/cwape-documents/2021.09.02-M%C3%A9thodologie%20tarifaire%202019-2023%20-%20modifications%20-%20consolidation%20officieuse.pdf https://www.cwape.be/node/177#mthodologie-tarifaire	Brussels: https://www.brugel.brussels/themes/tarifs-de-distribution-12/tarifs-de-distribution-2020-2024-46 https://www.sibelga.be/fr/raccordements-compteurs/tarifs/tarifs-utilisation-du-reseau/simulateur-couts-de-distribution-electricite Flanders: https://www.vreg.be/nl/periodieke-nettarieven-elektriciteit-en-aardgas-2022 https://simulatornieuwenettarieven.vreg.be/ https://vtest.vreg.be/ Wallonia: https://www.cwape.be/node/176#grilles-tarifaires
Bulgaria			
Croatia	No certain time period is defined for the methodology; the current methodology, which applies until end 2022 was defined in 2015 July 2022.	https://narodne-novine.nn.hr/clanci/sluzbeni/2015_09_104_2034.html	https://www.hera.hr/hr/tarifni-kalkulator-eek/
Cyprus	Regulatory period for reviewing the tariff methodology is every 5 years. Latest revision was in 2021.	https://www.cera.org.cy/Templates/00001/data/nomothesia/ethniki/rythmistikes_apofaseis/2021_01_en.pdf	https://www.cera.org.cy/Templates/00001/data/hlektrismos/cost_of_use.pdf
Czech Republic	2021-2025	https://www.eru.cz/en/-/zasady-cenove-regulace-pro-regulacni-obdobi-2021-2025-pro-odvetvi-elektroenergetiky-plynarenstvi-pro-cinnosti-operatora-trhu-v-elektroenergetice-a-ply	low voltage: https://www.eru.cz/cs/-/cenove-rozhodnuti-c-9-2021 medium and high voltage: https://www.eru.cz/cs/-/cenove-rozhodnuti-c-8-2021
Denmark	No certain time period is defined for the methodology	No data	Link to 2021 tariffs (in Danish): https://www.danskenergi.dk/udgivelser/elforsyningens-nettariffer-priser-pr-1-januar-2021 (Danish) Explanation of tariff model 3.0: https://forsyningstilsynet.dk/media/10813/bilag-1.pdf
Estonia	No certain time period is defined for the methodology; latest revision was in 2018 (applied since 2019)	https://www.konkurentsiamet.ee/sites/default/files/3_2_elektrienergia_vorgutasude_arvutamise_uhtne_metoodika.pdf (in Estonian)	https://www.konkurentsiamet.ee/et/elektri-vorgutasud
Finland	No certain time period is defined for the methodology (each DSO decides separately when to update its tariff methodology). Current regulatory period is set for 2020-2023.	DSOs are not required to publish their tariff methodologies, but they can do on a voluntary basis. None of the D-tariff methodologies is currently published.	DSOs are obliged by law to publish tariff values. They provide this information on their websites

Country	On-going D-tariff methodology period	Link to the latest D-tariff methodology	Link(s) to the current D-tariff values / online calculator
France	Jul 2021- Jul 2025 (TURPE 6 period)	https://www.cre.fr/content/download/23338/file/210121_2021-13_TURPE_6_HTA-BT.pdf	https://www.cre.fr/calculatrice/detail
Germany	No certain time period is defined for the methodology (The ordinance setting the methodology has come into force in 2005 and has since been amended several time, latest amendment was in 2021, resulted in minor changes.	https://www.gesetze-im-internet.de/stromnev/	There are over 800 DSOs in Germany who publish their respective tariffs sheets. There is no online calculator. The links to the tariff sheet of some of the biggest DSOs: Westnetz: https://www.westnetz.de/content/dam/revu-global/westnetz/documents/ueber-westnetz/unser-netz/netzentgelte-strom/preisblaetter-westnetz-strom-2022-01-01.pdf Stromnetz Berlin: https://www.stromnetz.berlin/netz-nutzen/entgelte NetzeBW: https://assets.ctfassets.net/xytfb1vrn7of/24qUcbmZS2zHu7BqzWtHAI/9a09f0e883371f777ab079d722bf653c/20211215_NetzeBW_2022_Preise_NN_Strom.pdf
Greece	No certain time period is defined for the methodology; latest revision was in 2021 (RAE decision 707/16.9.2021). The tariffs determined according to the new methodology will be effective from 01.01.2023[583]	https://www.rae.gr/wp-content/uploads/2021/12/A707A_2021-%CE%95%CE%93%CE%A7.%CE%A7%CE%A7%CE%94-%CE%A6%CE%95%CE%9A-B5427_-22.11.21.pdf	https://www.rae.gr/wp-content/uploads/2020/12/%CE%91%CF%80%CF%8C%CF%86%CE%B1%CF%83%CE%B7-%CE%A1%CE%91%CE%95-2-020.pdf
Hungary	Apr 2021- Dec 2024	http://www.mekh.hu/download/0/a7/e0000/villamos_energia_rendszerhasznalati_dijak_modszertani_utmutato_20210401_20241231.pdf	http://www.mekh.hu/download/2/ae/e0000/rendszerhasznalati_dijak_2021_aprilistol.xlsx
Ireland			
Italy	2016-2023, divided into two 4-years sub-periods (2016-2019, 2020-2023)	https://www.arera.it/allegati/docs/19/568-19TIT.pdf#page=27 (Annex A to Decision 568/2019/R/eel, articles 8-13, 16, 21-26)	https://www.arera.it/it/elettricita//distr.htm
Latvia	No certain time period is defined for the methodology; the methodology was approved in Dec 2011, the last amendments in Oct 2019 Existing D-tariff rates are set for five years (Jan 2020–Dec 2024)	https://likumi.lv/doc.php?id=241677&from=off (only in Latvian)	https://www.sprk.gov.lv/sites/default/files/editor/ED/Elektroenergija/Tarifi/AS_Sadales_tikls_tarifi_01012020.pdf (tariff values from p.12) https://sadalestikls.lv/lv/tarifu-kalkulators (in Latvian)
Lithuania	Jan 2022– Jan 2026, reviewed biennially	https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/049c46b09dcb11e48d7bacdf30d64d66/ueYGduhurK?jfwid=-1ac9ufnnuk	https://www.vert.lt/en/Pages/price-ceilings-of-electricity-transportation-services-and-public-energy-price-ceilings.aspx
Luxembourg	Jan 2021- Dec 2024	https://legilux.public.lu/eli/etat/leg/rilr/2020/05/26/a561/jo (only in French)	https://assets.ilr.lu/energie/Documents/ILRLU-1685561960-948.pdf

[583]GR: The NRA indicated that the determination of DSO required revenue for 2021 and 2022 was delayed. For this reason, D-tariffs that were determined according to the previous methodology and were based on recovery of 2020 DSO required revenue, continue to apply also in 2021 and 2022. It is expected that the new methodology will be applied to determine D-tariffs for recovery of DSO 2023 required revenue.

Country	On-going D-tariff methodology period	Link to the latest D-tariff methodology	Link(s) to the current D-tariff values / online calculator
Malta	No certain time period is defined for the methodology, the methodology applies since 2008	The tariff methodology is not published. Some tariff related information is available here: https://www.rews.org.mt/#/en/rewsfa/27	The DSO forms part of a vertically integrated company which is also the sole supplier of electricity in Malta. Articles 6, 35, 43 and 4 of Directive (EU) 2019/944 do not apply to Malta (Article 4 has a time-limited derogation until 5 July 2027). The DSO is required to keep unbundled accounts at internal management accounts level only. As such there is no specific separate tariff for the use of the distribution network. The costs of the distribution network are in part covered by a maximum demand tariff, an annual fixed charge, kWh tariffs that covers also energy and the supply and connection charges. All tariffs are regulated. Link to tariffs: https://www.rews.org.mt/#/en/a/13-regulated-electricity-tariffs
The Netherlands	Jan 2022- Dec 2026	https://www.acm.nl/nl/publicaties/methodebesluit-regionaal-netbeheer-elektriciteit-2022-2026	Calculation of the allowed revenues for 2022: https://www.acm.nl/nl/publicaties/berekening-totale-inkomsten-2022-regionaal-netbeheer-elektriciteit Tariff values for 2022 for each DSO: https://www.acm.nl/nl/publicaties/tarievenbesluit-coteq-elektriciteit-2022 https://www.acm.nl/nl/publicaties/tarievenbesluit-enexis-elektriciteit-2022 https://www.acm.nl/nl/publicaties/tarievenbesluit-liander-elektriciteit-2022 https://www.acm.nl/nl/publicaties/tarievenbesluit-rendo-elektriciteit-2022 https://www.acm.nl/nl/publicaties/tarievenbesluit-stedin-elektriciteit-2022 https://www.acm.nl/nl/publicaties/tarievenbesluit-westland-elektriciteit-2022
Norway	No certain time period is defined for the methodology, the latest revision was in Jun 2021, effective from Jul 2022	https://lovdata.no/dokument/SF/forskrift/1999-03-11-302	https://www.nve.no/reguleringsmyndigheten/publikasjoner-og-data/statistikk/nettleiestatistikk/

Country	On-going D-tariff methodology period	Link to the latest D-tariff methodology	Link(s) to the current D-tariff values / online calculator
Poland	No certain time period is defined for the methodology Current tariff values apply between Jan– Dec 2022	DSOs connected to TSO grid: https://www.ure.gov.pl/pl/biznes/taryfy-zalozenia/zalozenia-dla-kalkulacj/9961,Informacja-w-sprawie-kalkulacji-taryf-OSD-na-2022-r.html Smaller DSOs: https://www.ure.gov.pl/pl/biznes/taryfy-zalozenia/zalozenia-dlkalkulac/7833,Informacja-dla-przedsiebiorstw-energetycznych-posiadajacych-koncesje-na-dystrybu.html	Stoen Operator: https://bip.ure.gov.pl/bip/taryfy-i-inne-decyzje-b/energia-elektryczna/4004,Taryfy-opublikowane-w-2021-r.html
Portugal	Jan 2022- Dec 2025	https://www.erse.pt/media/s3mdkbcx/estrutura-tarif%C3%A1ria-se-2022.pdf (p.46ff) (only in Portuguese)	Tariff values for year 2022: https://www.erse.pt/en/activities/market-regulation/tariffs-and-prices-electricity/#current-year https://www.erse.pt/media/aepp1v4q/diretiva-3_2022.pdf https://www.erse.pt/media/xzclkvpz/tarifas-eletricidade-2022_1_jan2022.xlsx (only in Portuguese) Tariff values for year 2023 Excel
Romania	Jan 2019- Dec 2023 The tariff methodology was set by ANRE Order no. 169/2018. Later amendments and additions by Order no. 193/2018, Order no. 60/2019, Order no. 203/2019, Order no. 207/2020, Order no. 3/2021, Order no. 101/2021.	https://www.anre.ro/ro/energie-electrica/legislatie/metodologii-tarife/distributie-energie-electrica (only in Romanian)	ANRE Order no. 27-32/2022: https://portal.anre.ro/PublicLists/Ordin
Slovak Republic	2017- 2022 The tariff methodology is set by Decree No. 18/2017	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2017/18/20211215.html (in Slovakian)	DSOs are obliged to publish their applied tariff values.
Slovenia	No certain time period is defined for the methodology, last revision was in Sep 2021. (The latest regulatory period is set for year 2022, previous regulatory period was set for years 2019-2021)	http://www.pisrs.si/Pis.web/pregledPredpisa?id=AKT_1050	T-tariff values: https://www.uradni-list.si/glasilo-uradni-list-rs/vsebina/2021-01-4132?sop=2021-01-4132 On line calculator: http://primerjalnik.agen-rs.si/index.php?/kalkulatorelektrika/kalkulator/action/VnosPodatkovAnalizaCuo/Podstran/AnalizaCenZaUporaboOmrezja
Spain	Jan 2020- Dec 2025	Decision setting the tariff methodology: https://www.boe.es/buscar/act.php?id=BOE-A-2020-1066 Impact assessment: https://www.cnmc.es/sites/default/files/2808025_42.pdf Tariff model: https://www.cnmc.es/sites/default/files/2808026_42.xlsx	https://www.cnmc.es/sites/default/files/3853710.xlsx
Sweden	No certain time period is defined for the methodology	Each DSO sets its own tariff methodology. DSOs are not obliged to publish their tariff methodology.	DSOs are obliged to publish their tariff values. They provide this information on their websites.

Annex 3: Tariff-related measures to protect vulnerable customers and cope with high energy prices

To cope with the rising energy prices, most countries implemented various measures, in particular to protect (vulnerable) consumers. In more than third of the countries (BE, EE, HU, LV, PL, PT, RO, ES, SE) the network tariffs have been reduced or other network tariff related measures have been introduced (e.g. postponement of the yearly indexation of the network tariffs, adjustments of losses costs or the lowering VAT tax on distribution services). (For some reported measures in each country, please refer to Table 51 below.)

Beyond actions considering the network tariffs, in several instances the countries (for example AT, HR, EE, LU, NO) introduced some compensation schemes, either in the form of voucher or allowances, while in other countries (for example BE, CY, PL, ES) there was a reduction of the taxes paid by some electricity customers[584] or other measures, such as mitigation of price growth in wholesale markets (PT) to reduce the final electricity bill.

ACER notes that some countries have already had general network tariff reduction scheme or other preferential network tariff related measure for vulnerable customers in place:

- In Belgium's Brussels region: A share of the residential customers who are deemed "vulnerable" benefit a cheaper all-in tariff
- In Belgium's Wallonia region: Financed by the State budget a social rate is granted to beneficiaries of the regional protected client status and conjunctual protected client status.
- In Italy: 30% discount on consumer's estimated annual electricity bill (including all components, taxes and network tariffs as well), as far as the customer is officially recognised as vulnerable.
- In Portugal: Social discount on the energy bill, reflected through a discount in the network access tariff for domestic customers who are considered vulnerable (about 15%).

ACER also observes that in several countries there are some non-tariff related general measures to protect vulnerable customer (for example in Austria vulnerable customers have reduction of some of the levies and the cost of support schemes for RES, but there is no reduction of network charge, in Luxembourg vulnerable customers have some cost coverage by local social offices, in Portugal there is a supporting mechanism in case of high wholesale prices).

To conclude ACER notes that in order to cope with the rising energy prices, most countries implemented various measures, in particular to protect (vulnerable) consumers. Sometimes, these measures came in addition to general protective measures, which were already in place. Many of these measures are not explicitly related to the network-tariff design, but they are often financial supports from the state budget concerning the overall electricity bill of the network user.

[584] LU, HU: measures are considered currently.

Table 51: Tariff-related measures to protect vulnerable customers and/or cope with high energy prices

Country	General or temporary measures
Austria	Some of the levies and the cost of support schemes for RES are reduced for vulnerable customers, but there is no reduction of network charges. The government provides a one-time bonus to consumers under a particular monthly income level regarding the energy cost component of the bill, but the network tariffs are not reduced.
Belgium	No T-tariff reduction or T-tariff related measures for vulnerable customers Tariffs for public service obligations (federal legislation) are set to zero (end of 21') and introduced an excise duty. From March 2022 until September 2022, the VAT rate is lowered (from 21% to 6%) on the whole electricity bill for all customers. The measure has been extended until 31 March 2023. Brussels: A relevant share of the residential customers in Brussels deemed "vulnerable" and benefit a cheaper all-in tariff, which covers the cheapest distribution costs of the country. Flanders: Social tariff applies to the regional protected clients. Wallonia: Social tariff applies to the regional protected clients. A relevant share of the residential customers in Wallonia deemed "vulnerable" and benefit a cheaper all-in tariff, which covers the cheapest distribution costs of the country.
Croatia	One time compensation to vulnerable consumers: Voucher measures for particular household groups (vulnerable energy consumers) – (9 March) and single payment which enters into force on 1 April.
Cyprus	Household consumers shall benefit from the temporary reduction of VAT on electricity from 19% to 9%.
Estonia	Temporary reduction of D-tariffs for consumers: By the government's decision, the DSOs had to reduce the network charges for consumers by 50% in the period from 01.10.2021 to 31.03.2022. The lost revenue was compensated to the DSOs by the government.
France	Regarding T-tariffs, large industrial consumers, to whom the consumption profile is stable, are eligible for a tax reduction. This percentage is determined taking into account the positive impact of these consumption profiles on the electricity system.
Greece	HV users with annual energy consumption and load factor above a lower limit, are entitled to rebates on the calculated transmission network charges.
Hungary	The yearly indexation of the network tariffs (taking place in January) was postponed by the government for up to a half year.
Italy	EHV and HV connected RES and high-efficiency cogeneration benefit from caps / discounts regarding T-tariffs. Since 2008, 30% discount on consumer's estimated annual electricity bill (including all components, taxes and network tariffs as well), as far as the customer is officially recognized as vulnerable. Automatisation of the process since 2020.
Latvia	From 1 January to 30 April 2022, fees for mandatory procurement components (OIK) and electricity distribution system services, are compensated by the State
Luxembourg	No preferential tariff for vulnerable consumers. The government announced an increase for cost of living allowances.
Malta	Vulnerable electricity customers are catered for within the social policy framework.
The Netherlands	Special tariff for small consumers. Partial tariff exemption for some large industrial consumer: i.e. there is a special tariff for users with maximum 600 hours. Furthermore the large industrial consumers qualify for a partial tariff exemption (a volume discount) if they meet certain criteria (consumption level and profile).
Norway	Financial aid from state budget to households distributed through DSO
Poland	Reduction of VAT in case of complex contracts when supplier of energy offer both energy and distribution services.
Portugal	Costs included in the T-tariff for the global use of the system depend on the wholesale price. In case of high wholesale prices, the cost paid by network users decreases. Social discount on the energy bill (currently 33.8% of the pre-tax end-user prices). The discount is reflected in the bill through a discount in the network access tariff. Approximately 15% of domestic customers are considered vulnerable. The overall network access tariff reduced substantially on 1.1.2022. On 15.12.2021 mitigation of price growth in wholesale markets Very High Voltage, High Voltage and Medium Voltage: -94.0%, Special Low Voltage (> 41.4 kVA): -66.0%
Romania	In order to cope with the rising prices, D-tariffs where adjusted by considering a higher price for acquisition of grid losses than the price approved for ongoing regulatory period and accordingly to the methodology raising limits. Even though, the adjusted price is still lower than the market price. No temporary D-tariff reduction nor other extraordinary tariff related measure is considered for the moment.
Spain	Tax reductions in order to promote cogeneration and renewables, off-peninsular compensation, income imbalances in the settlement procedure.
Sweden	The TSO is analysing the possibilities to reduce the capacity charge during 2022 due to the high amount of congestion income. The government has decided on a compensation to Swedish households for the high energy prices. This is however not a part of the tariff but will be transferred to the households via a temporary decrease of the network tariff.