

ENTSO-E

**Overview of Transmission Tariffs
in Europe: Synthesis 2021**



ENTSO-E Mission Statement

Who we are

ENTSO-E, the European Network of Transmission System Operators for Electricity, is the **association for the cooperation of the European transmission system operators (TSOs)**. The 39 member TSOs, representing 35 countries, are responsible for the **secure and coordinated operation** of Europe's electricity system, the largest interconnected electrical grid in the world. In addition to its core, historical role in technical cooperation, ENTSO-E is also the common voice of TSOs.

ENTSO-E **brings together the unique expertise of TSOs for the benefit of European citizens** by keeping the lights on, enabling the energy transition, and promoting the completion and optimal functioning of the internal electricity market, including via the fulfilment of the mandates given to ENTSO-E based on EU legislation.

Our mission

ENTSO-E and its members, as the European TSO community, fulfil a common mission: Ensuring the **security of the interconnected power system in all time frames at pan-European level** and the **optimal functioning and development of the European interconnected electricity markets**, while enabling the integration of electricity generated from renewable energy sources and of emerging technologies.

Our vision

ENTSO-E plays a central role in enabling Europe to become the **first climate-neutral continent by 2050** by creating a system that is secure, sustainable and affordable, and that integrates the expected amount of renewable energy, thereby offering an essential contribution to the European Green Deal. This endeavour requires **sector integration** and close cooperation among all actors.

Europe is moving towards a sustainable, digitalised, integrated and electrified energy system with a combination of centralised and distributed resources.

ENTSO-E acts to ensure that this energy system **keeps consumers at its centre** and is operated and developed with **climate objectives** and **social welfare** in mind.

ENTSO-E is committed to use its unique expertise and system-wide view – supported by a responsibility to maintain the system's security – to deliver a comprehensive roadmap of how a climate-neutral Europe looks.

Our values

ENTSO-E acts in **solidarity** as a community of TSOs united by a shared **responsibility**.

As the professional association of independent and neutral regulated entities acting under a clear legal mandate, ENTSO-E serves the interests of society by **optimising social welfare** in its dimensions of safety, economy, environment, and performance.

ENTSO-E is committed to working with the highest technical rigour as well as developing sustainable and **innovative responses to prepare for the future** and overcoming the challenges of keeping the power system secure in a climate-neutral Europe. In all its activities, ENTSO-E acts with **transparency** and in a trustworthy dialogue with legislative and regulatory decision makers and stakeholders.

Our contributions

ENTSO-E supports the cooperation among its members at European and regional levels. Over the past decades, TSOs have undertaken initiatives to increase their cooperation in network planning, operation and market integration, thereby successfully contributing to meeting EU climate and energy targets.

To carry out its **legally mandated tasks**, ENTSO-E's key responsibilities include the following:

- › Development and implementation of standards, network codes, platforms and tools to ensure secure system and market operation as well as integration of renewable energy;
- › Assessment of the adequacy of the system in different timeframes;
- › Coordination of the planning and development of infrastructures at the European level (Ten-Year Network Development Plans, TYNDPs);
- › Coordination of research, development and innovation activities of TSOs;
- › Development of platforms to enable the transparent sharing of data with market participants.

ENTSO-E supports its members in the **implementation and monitoring** of the agreed common rules.

ENTSO-E is the common voice of European TSOs and provides expert contributions and a constructive view to energy debates to support policymakers in making informed decisions.

Contents

1	Executive Summary	6
2	Introduction	7
3	Methodology	8
4	Main characteristics of TSO tariffs in Europe	10
5	Costs included in the calculation of the Unit Transmission Tariffs	12
6	Unit Transmission Tariffs in 2020	14
7	Analysis of TSO components of Unit Transmission Tariffs	16
7.1	Energy-related and power-related components	16
7.2	Generation component	17
7.3	Load (demand) Component	18
7.4	Impact of utilisation time	20
7.5	Impact of location	22
7.6	TSO Cost components of the Unit Transmission Tariffs	24
7.7	Evolution of TSO components of Unit Transmission Tariffs	26
8	Analysis of non-TSO components of Unit Transmission Tariffs	28
8.1	Non-TSO Costs	29
8.2	Evolution of non-TSO costs	30
9	Appendices	32
	Appendix 1: Country specific details	33
	Appendix 2: Voltage levels operated by TSOs	43
	Appendix 3: Comparison of network tariff elements losses prices	44
	Appendix 4: Comparison of system services prices	45
	Appendix 5: Tariff areas in countries with generation/consumption tariffs with locational differentiation	46
	Appendix 6: Other regulatory charges not directly related to TSO activities	49
	Appendix 7: First connection charges	53
	Appendix 8: Special tariffs	57
	Appendix 9: Treatment of Final Customers vs Distribution System Operators	61
	Appendix 10: Reactive Energy	63
	Appendix 11: Netting of flows for the application of transmission tariffs	67
	Appendix 12: Exchange rates	69
	Glossary of terms	70

1 Executive Summary

Transmission tariffs are one of the key elements of the Internal Electricity Market (IEM). Different tariff schemes have evolved and co-exist across Europe.

Transmission tariffs are one of the key elements of the Internal Electricity Market (IEM). Different tariff schemes have evolved and co-exist across Europe.

In order to compare TSO tariffs, the ENTSO-E Economic Framework Working Group calculates an annual “Unit Transmission Tariff” (UTT) for each participating country on a pre-defined “base case”. It is this virtually created UTT expressed in €/MWh that is discussed throughout this document. Thus, this overview does not compare individual transmission tariffs directly. Moreover, this overview does not take into account differences between countries in areas such as quality of service, market arrangements, technical characteristics, environmental aspects, or the location and density of generation/load, despite these factors having an influence on the absolute level of tariffs.

The “base case” used for the calculation of the UTTs is characterized by a pre-defined voltage level to which load and generation are connected, and pre-defined power demand and utilization time. The calculation of the UTT covers charges invoiced to base case grid users (generation and load) for the purpose of covering both TSO costs (infrastructure, system services and losses) and, where applicable, non-TSO costs (renewable energy support, regulatory levies, stranded costs, etc).

As in past years, two clarifications to the data submitted by TSOs for the 2021 ENTSO-E Overview of Transmission Tariffs are worth to be reminded. Firstly that, in general, the total UTT includes non-TSO costs charged to “base case” users, even if they do not form part of the TSO tariffs in the participating countries and even if they are not charged directly to base case users. This is because in some countries, non-TSO costs do form part of or are invoiced along with the TSO tariff and therefore, for consistency, it is necessary to include them. However non-TSO costs can still be disaggregated and are shown separately in this document in order to be transparent about the different elements charged to base case users. The non-TSO costs mostly relate to renewable energy support (RES) schemes. It must be clear that the focus of this report is on the charges that relate to the services provided by the TSOs.

In terms of the main findings, the table below summarises the annual, real change in the average UTT components and their values for 2021:

	2021	real change 2021/2020
Average European UTT	12.30 €/MWh	-1.41 %
• Due to TSO Costs	9.79 €/MWh	-1.32 %
• Due to Non-TSO Costs	2.51 €/MWh	-1.76 %

See Country remarks for details of the UTT changes. When annual changes exceed 10 % or 0.5 €/MWh compared to last year, reasons are provided.

The graph below illustrates how the UTT has evolved over recent years:

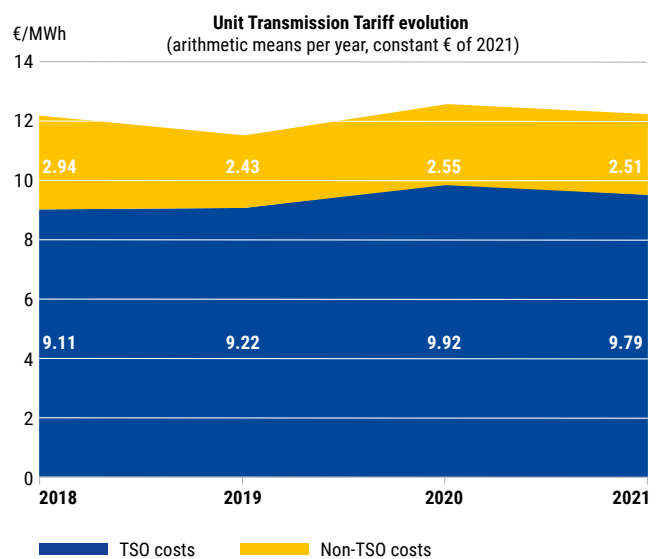


Figure 1.1: Evolution of UTT from 2018 – 2021

On average, in 2021 the TSO cost component of the UTT is divided 54.3 % for the infrastructure, 33.9 % for the system services and 11.8 % for the losses. On average, 61,3 % of the TSO cost component is invoiced based on energy (i. e. on a volume, or MWh basis), while 38,3 % is invoiced based on power (i. e. a capacity, or MW basis). The TSO part of the UTT is applied both to generation and load in 18 countries whereas in 18 countries only load is charged. The average of the TSO part of the UTT is 9.22 €/MWh for load and 0.57 €/MWh for generators. In five countries the TSO part of the UTT is charged by using locational signals.

2 Introduction

Transmission tariffs are one of the key elements of the Internal Electricity Market. It should be noted that this Overview is not a direct comparison of transmission tariffs and if used in this way, any conclusions drawn are likely to be misleading. Based on different national contexts and national policies, which transmission tariffs have to meet, there are numerous approaches which implies a considerable complexity throughout Europe.

It is outside the scope of this report to analyse all influences that shape the tariffs in each system. As there is no single “correct solution” for the allocation of costs to transmission users, different tariff schemes exist in Europe. Differences might include whether market mechanisms are used as part of the regulatory regime, the treatment of transmission losses and of ancillary services, and the level of first connection costs to which transmission grid users are exposed. This Overview does not take into account the differences among countries in areas such as quality of service, market arrangements, technical characteristics, environmental aspects, consumption density, and generation location – all factors that influence the level of such tariffs.

With the above in mind, in order to make the tariffs more comparable across the ENTSO-E countries participating in this report, a “Unit Transmission Tariff” (UTT) is calculated for a pre-defined “base case”, discussed further in Section 3. Thus, this overview does not compare individual transmission tariffs, but calculated Unit Transmission Tariffs expressed in €/MWh which may significantly differ from country specific TSO tariffs. **It is this “Unit Transmission Tariff” that is discussed throughout this document.**

Figure 2.1 summarises how this document is structured. Section 3 describes the methodology for the calculation of Unit Transmission Tariffs and the definition of the base case. Section 4 outlines the main characteristics of the TSO tariffs considered in the calculation of the Unit Transmission Tariffs. Section 5 provides detail on the costs that have been considered in the calculation of Unit Transmission Tariffs for each country, including where estimations have been made. Section 6 outlines the resulting Unit Transmission Tariffs for 2021. Section 7 analyses the TSO components of the Unit Transmission Tariffs. Section 8 examines the non-TSO components of the Unit Transmission Tariff, i. e. those costs included in the Unit Transmission Tariff, but not directly attributable to the activities of TSOs. Finally the appendices contain further detail, including country-specific remarks providing additional clarity on the reasons for any significant differences.

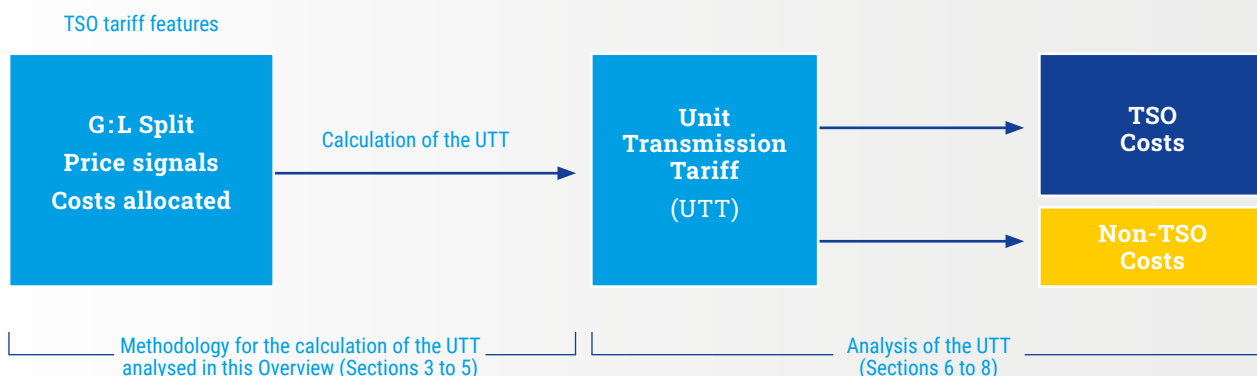


Figure 2.1: Summary of document structure

3 Methodology

The main purpose of this ENTSO-E overview is to present a comparison of calculated 2021 Unit Transmission Tariffs expressed in €/MWh for a pre-defined “base case”.

The “base case” is characterised by (i) a pre-defined voltage level to which load and generation are connected; and (ii) a power demand and utilisation time, as follows:

- › **Voltage level:** Since voltage levels of transmission networks vary across Europe, (see Appendix 2), in order to facilitate comparison an assumption has been made that both producers and consumers are connected to the EHV (Extra High Voltage) network (400 kV – 330 kV). For countries with no EHV network, load or representative load connected to the EHV network, tariffs for lower voltages have been considered.
- › **Power demand and utilisation time:** The typical load considered has a maximum demand of 40 MW when it is connected to the EHV network, and a maximum demand of 10 MW when it is connected to lower voltages. In both cases 5,000 h of utilisation time has been assumed.

“Base case users” are users with the characteristics of connection, power demand and utilisation time specified above.

The Unit Transmission Tariff is calculated under the hypothesis of the “base case” by adding the charges applied to load (L) and generation (G) (in cases where G is charged). For countries with different tariff rates per location, an average value has been taken.

In order to make the overview as comparable as possible, the calculation of the Unit Transmission Tariff covers tariffs and charges invoiced to the base case users (even if those charges are not recovered through TSO tariffs) in order to allocate the following costs:

- › **“TSO costs”**, i. e. costs related to TSO activities: Infrastructure costs (OPEX, depreciation and return on capital), costs of purchasing system services and losses compensation costs;
- › **“Non-TSO costs”**, i. e. costs not directly related to TSOs’ activities. For example: stranded costs, costs of renewable or cogeneration support schemes, regulatory levies, costs of diversification and security of supply, etc. Taxes for funding non-TSO Costs are not included in the calculation of the UTT.

The above is particularly relevant when considering the graphs in this document.

In addition, some examples are calculated by varying the “base case” assumptions:

- › The voltage level (See Section 6);
- › The load’s utilisation time (see Section 7.4);
- › The location of generation and load (same area / different area) (see Section 7.5);

For countries outside the Euro zone, local currency exchange rates as of 31 December 2021 have been used to calculate the Unit Transmission Tariff expressed in € (see Appendix 12: Exchange rates).

Figure 3.1 summarises the methodology of this Overview:

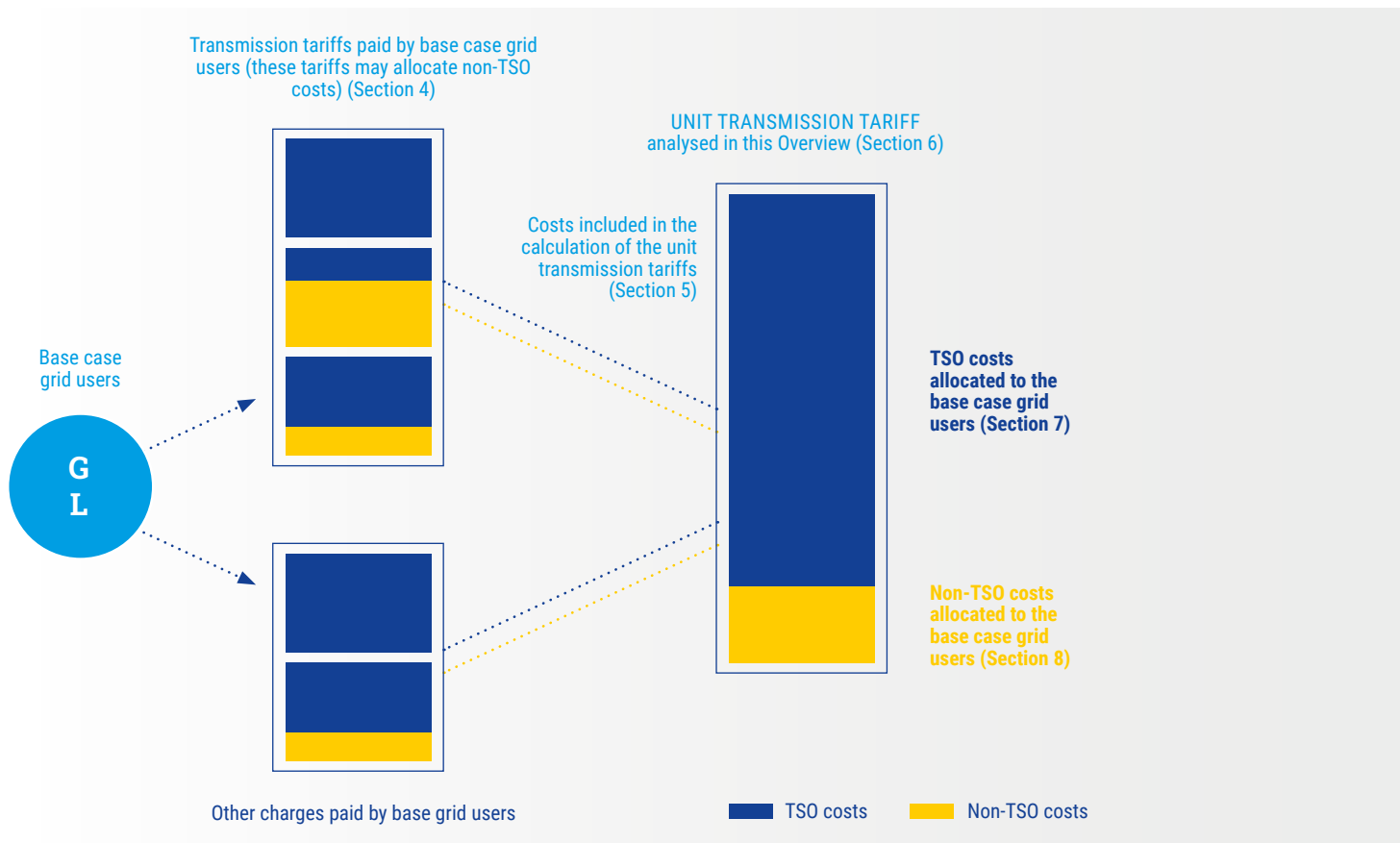


Figure 3.1: Methodology

4 Main characteristics of TSO tariffs in Europe

Table 4.1 summarises the main characteristics of TSO tariffs considered in the calculation of the Unit Transmission Tariffs shown in this overview: share of G and L network charges in %, seasonal and locational differentiation, whether the costs

of losses and system services are included in TSO tariffs and whether they are charged by TSOs. As shown in section 3, TSO tariffs applied as a charge to the users of transmission networks may allocate both TSO costs and non-TSO costs.

Country	Sharing of network operator charges		Price signal		Are losses included in the tariffs charged by TSO?	Are system services included in tariffs charged by TSO?
	Generation	Load	Seasonal	Location		
Albania	0.0 %	100.0 %	No	No	Yes	Yes
Austria	8.0 %	92.0 %	No	No	Yes	Yes
Belgium	14.0 %	86.0 %	X	No	Yes	Yes
Bosnia and Herzegovina	0.2 %	99.8 %	No	No	Yes	Yes
Bulgaria	25.3 %	74.7 %	No	No	Yes	No
Croatia	0.0 %	100.0 %	X	No	Yes	Yes
Cyprus	0.0 %	100.0 %	No	No	Yes	Yes
Czech Republic	0.0 %	100.0 %	No	No	Yes	Yes
Denmark	4.3 %	95.7 %	No	No	Yes	Yes
Estonia	0.0 %	100.0 %	X	No	Yes	Yes
Finland	18.6 %	81.4 %	X	No	Yes	Yes
France	2.0 %	98.0 %	XXX	No	Yes	Yes
Germany	0.0 %	100.0 %	No	No	Yes	Yes
Great Britain	28.6 %	71.4 %	XX	Yes	No	Yes
Greece	0.0 %	100.0 %	X	No	No	Yes
Hungary	0.0 %	100.0 %	No	No	Yes	Yes
Iceland	0.0 %	100.0 %	No	No	Yes	Yes
Ireland	25.0 %	75.0 %	No	Yes	No	Yes
Italy	0.0 %	100.0 %	No	No	Yes	Yes
Latvia	2.0 %	98.0 %	No	No	Yes	Yes
Lithuania	0.0 %	100.0 %	No	No	Yes	Yes
Luxembourg	0.0 %	100.0 %	No	No	Yes	Yes

Country	Sharing of network operator charges		Price signal		Are losses included in the tariffs charged by TSO?	Are system services included in tariffs charged by TSO?
	Generation	Load	Seasonal	Location		
Montenegro	36.3 %	63.7 %	X	No	Yes	Yes
Netherlands	0.0 %	100.0 %	No	No	Yes	Yes
FYROM	0.0 %	100.0 %	No	No	Yes	Yes
Northern Ireland	25.0 %	75.0 %	XXX	Yes	No	No
Norway	30.0 %	70.0 %	X	Yes	Yes	Yes
Poland	0.0 %	100.0 %	No	No	Yes	Yes
Portugal	8.8 %	91.2 %	XX	No	No	No
Romania	2.6 %	97.4 %	No	No	Yes	Yes
Serbia	0.0 %	100.0 %	X	No	Yes	Yes
Slovakia	3.1 %	96.9 %	No	No	Yes	Yes
Slovenia	0.0 %	100.0 %	X	No	Yes	Yes
Spain	2.2 %	97.8 %	XXX	No	No	No
Sweden	40.0 %	60.0 %	No	Yes	Yes	Yes
Switzerland	0.0 %	100.0 %	No	No	No	No

Remarks:

- The % shares of network charges between G and L are provided for the base case charge.
- The “X” indicates time differentiation. With one “X”, there is only one time differentiation (for example, “day-night”, “summer-winter”). With two “X” (or more), there are two (or more) time differentiations.
- A country remark regarding Austria, France, Great Britain, Greece, Italy, Northern Ireland, Portugal, Spain and Switzerland can be found in Appendix 1.

Table 4.1: Main characteristics of TSO tariffs in Europe

5 Costs included in the calculation of the Unit Transmission Tariffs

Country	Infrastructure				System services	
	OPEX (Except System Services Losses and ITC)	Depreciation	Return on capital invested	ITC	Primary reserve	Secondary reserve
Albania	C	C	C	C	N	C
Austria	C	C	C	B/C	N	C
Belgium	C	C	C	B/C	C	C/B
Bosnia and Herzegovina	C	C	C	B/C	C	C
Bulgaria	C	C	C	C/B	C	C
Croatia	C	C	C	B/C (estimated)	N	C
Cyprus	C	C	C	N	C	C
Czech Republic	C/B	C	C	C/B	C	C
Denmark	C (estimated)	C (estimated)	C (estimated)	B/C (estimated)	C (estimated)	C (estimated)
Estonia	C	C	C	B/C	N	N
Finland	C	C	C	C/B	C	C
France	C	C	C	C	C	C
Germany	C/B	C	C	C/B	C	C
Great Britain	C	C	C	C/B	C	C
Greece	C	C	C	C/B	C	C
Hungary	C	C	C	C/B	C	C
Iceland	C	C	C	N	C	C
Ireland	C	C	C	C	C	C
Italy	C	C	C	C	C	C
Latvia	C	C	C	C/B	C	C
Lithuania	C/B	C	C	B/C	N	C
Luxembourg	C	C	C	C	C	C
Montenegro	C	C	C	B/C	N	C
Netherlands	C	C	C	B/C	C	C
North Macedonia	C	C	C	C/B (estimated)	N	C
Northern Ireland	C	C	C	C	C	C
Norway	C	C	C	C	C	C
Poland	C	C	C	N	C	C
Portugal	C	C	C	C/B	N	C/B (estimated)
Romania	C	C	C	C/B	N	C
Serbia	C	C	C	B/C	C	C
Slovakia	C	C	C	B/C	C	C
Slovenia	C/B	C/B	C/B	C/B	C	C
Spain	C	C	C	N	N	C (estimated)
Sweden	C	C	C	B/C	C	N
Switzerland	C (estimated)	C (estimated)	C (estimated)	B/C (estimated)	C (estimated)	C (estimated)

Legend:

- C if a given cost item is included in the calculation of the Unit Transmission Tariff.
- C/B if for a given activity there are both costs and benefits/revenues, the costs are higher than benefits, and the difference is included in the calculation of the Unit Transmission Tariff (surplus of costs).
- B/C if for a given activity there are both costs and benefits/revenues, the benefits are higher than costs, and the difference reduces the Unit Transmission Tariff.
- N if a given cost is not considered in the calculation of the Unit Transmission Tariff.
- C or C/B or B/C marked as “estimated” indicate that the cost item is not invoiced by the TSO and estimated values are provided for comparability purposes.

Table 5.1: Costs included in the calculation of the Unit Transmission Tariffs

Table 5.1 provides information on different cost items related to energy transmission that have been included in the calculation of the Unit Transmission Tariff for the base case comparison which is presented in this overview. Some of these costs may not be included in the TSO transmission tariff

or be included only partially, but are added for comparability purposes (they are indicated with red colour; see the legend under the table). First connection costs are not included in the Unit Transmission Tariffs. For further details, see country remarks.

Tertiary reserve	System services					Losses	Other
	Congestion Management (internal)	Congestion Management (cross border)	Black-Start	Voltage Control Reactive Power	System Balancing		
C	N	B/C (estimated)	N	N	N	C	N
N	C	C	C	C	N	C	C
C/B	C	C/B	C	C	N	C	C
C	N	C	C	N	C	C	N
N	N	B/C	C	C	N	C	C
C	N	C	C	C	C/B	C	C
C	N	N	C	C	N	C	C
C	C	C	C	C	C/B	C/B	N
C (estimated)	C/B (estimated)	B/C (estimated)	C (estimated)	C (estimated)	B/C (estimated)	C (estimated)	C (estimated)
C	N	C	C	C	N	C	C
C	C	C	C	C	N	C	C (estimated)
C	C	C	C	C	N	C	C
C	C	C	C	C	C	N	C
N	N	B/C	C	N	N	C (estimated)	C
C	N	B/C	C	C	B/C	C	B/C
C	N	N	C	C	C	C	N
C	C	C	C	C	C	C	C
C	B/C	B/C	C	C	C	C (estimated)	C (estimated)
C	N	N	C	C	C/B	C	N
C	N	N	C	C/B	N	C	N
C	C	C	C	C	C	C	C
C	N	B/C	N	N	C	C	C
C	C	B/C	C	C	B/C	C	N
C	N	B/C (estimated)	C	C	C/B	C	N
C	C	C	C	C	C	C	N
C	B/C	N	C	C	C	C	N
C	C	B/C (estimated)	C	C	C	C	C
N	N	B/C	N	N	N	C (estimated)	C
C	C	N	N	C	N	C	N
C	C	C/B	C	C	C	C	C
C	C	N	C	C	N	C	N
C	C	C/B	C	C	N	C	C
C (estimated)	C (estimated)	N	C (estimated)	N	C (estimated)	C (estimated)	C
N	N	N	C	C	N	C	N
C (estimated)	C (estimated)	B/C (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)

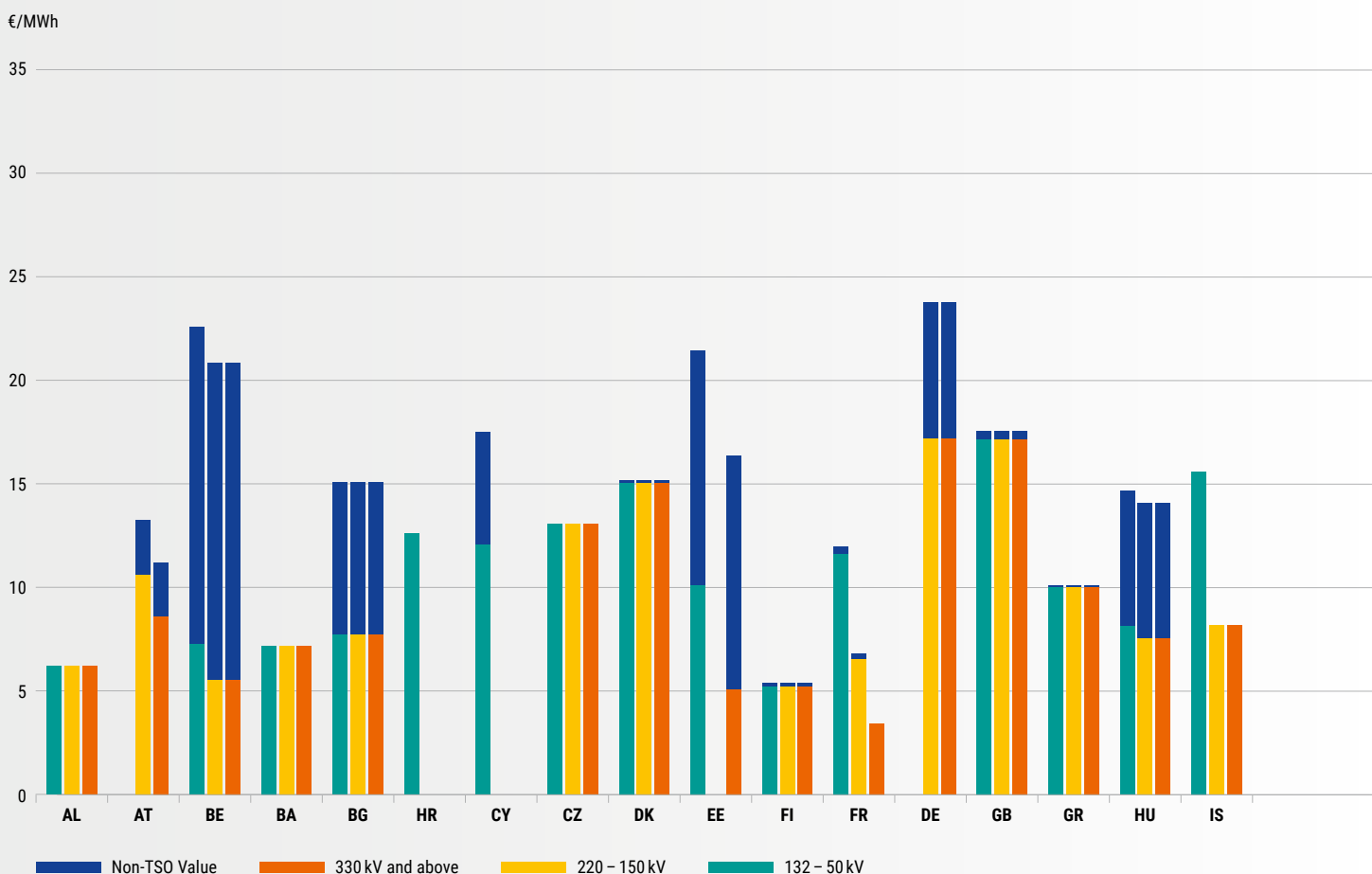
Remarks:

- This chapter is referring to total costs (TSO costs and non-TSO costs) included in the calculation of the Unit Transmission Tariff.
- Country remarks regarding France, Hungary, Italy, Northern Ireland, Portugal and Spain to be found in Appendix 1.

6 Unit Transmission Tariffs in 2020

Chart 6.1 illustrates total Unit Transmission Tariffs when the base case is modified by varying the voltage level (three different voltage level in kV). Charges related to TSO activities

are coloured in green (132 – 50 kV), yellow (220 – 150 kV) and orange (330 kV and above), whereas other regulatory charges not directly related to TSOs' activities are marked in blue.

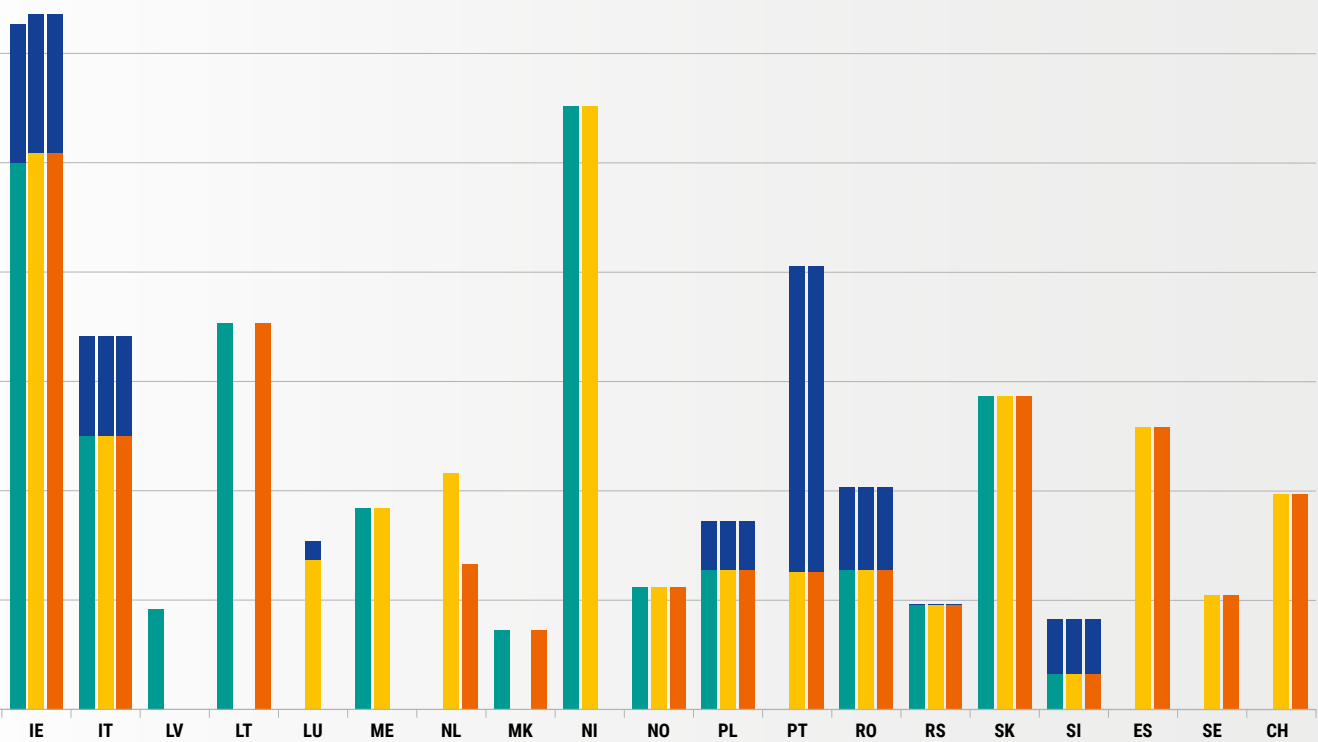


		AL	AT	BE	BA	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS
Total	330 kV and above	6.21	11.19	20.85	7.17	15.90			13.08	15.19	16.39	5.40	3.45	23.80	17.56	10.09	14.08	8.17
	220 – 150 kV	6.21	13.24	20.85	7.17	15.90			13.08	15.19		5.40	6.82	23.80	17.56	10.09	14.08	8.17
	132 – 50 kV	6.21		22.59	7.17	15.90	12.62	17.64	13.08	15.19	21.43	5.40	11.97		17.56	10.09	14.69	15.60
TSO Value	330 kV and above	6.21	8.59	5.56	7.17	7.77			13.08	15.08	5.09	5.26	3.45	17.23	17.14	10.02	7.55	8.17
	220 – 150 kV	6.21	10.64	5.56	7.17	7.77			13.08	15.08		5.26	6.57	17.23	17.14	10.02	7.55	8.17
	132 – 50 kV	6.21		7.30	7.17	7.77	12.61	12.10	13.08	15.08	10.13	5.26	11.61		17.14	10.02	8.16	15.60

Remarks:

- The example taken for this comparison is the base case (see Section 3) modified by considering different voltage levels.
- Other charges not directly related to TSO activities **are included** in the calculation of the Unit Transmission Tariff.
- When a voltage level is not relevant, as it is not operated by the relevant TSOs the value is reported as 0.

Chart 6.1: Split of the Unit Transmission Tariffs between components related to TSO activities and non-TSO activities



IE	IT	LV	LT	LU	ME	NL	MK	NI	NO	PL	PT	RO	RS	SK	SI	ES	SE	CH
31.79	17.05		17.65			6.62	3.60		5.58	8.61	20.25	10.12	4.82	14.32	4.13	12.89	5.20	9.83
31.79	17.06			7.67	9.19	10.82		27.58	5.58	8.61	20.25	10.12	4.82	14.32	4.13	12.89	5.20	9.83
31.33	17.06	4.59	19.33		9.19		3.60	27.58	5.58	8.61		10.12	4.82	14.32	4.13			
25.45	12.48		19.33			6.62	3.60		5.58	6.40	6.26	6.38	4.78	14.32	1.64	12.89	5.20	9.83
25.45	12.49			6.82	9.19	10.82		27.58	5.58	6.40	6.26	6.38	4.78	14.32	1.64	12.89	5.20	9.83
24.99	12.49	4.59	17.65		9.19		3.60	27.58	5.58	6.40		6.38	4.78	14.32	1.64			

– Values have been rounded.

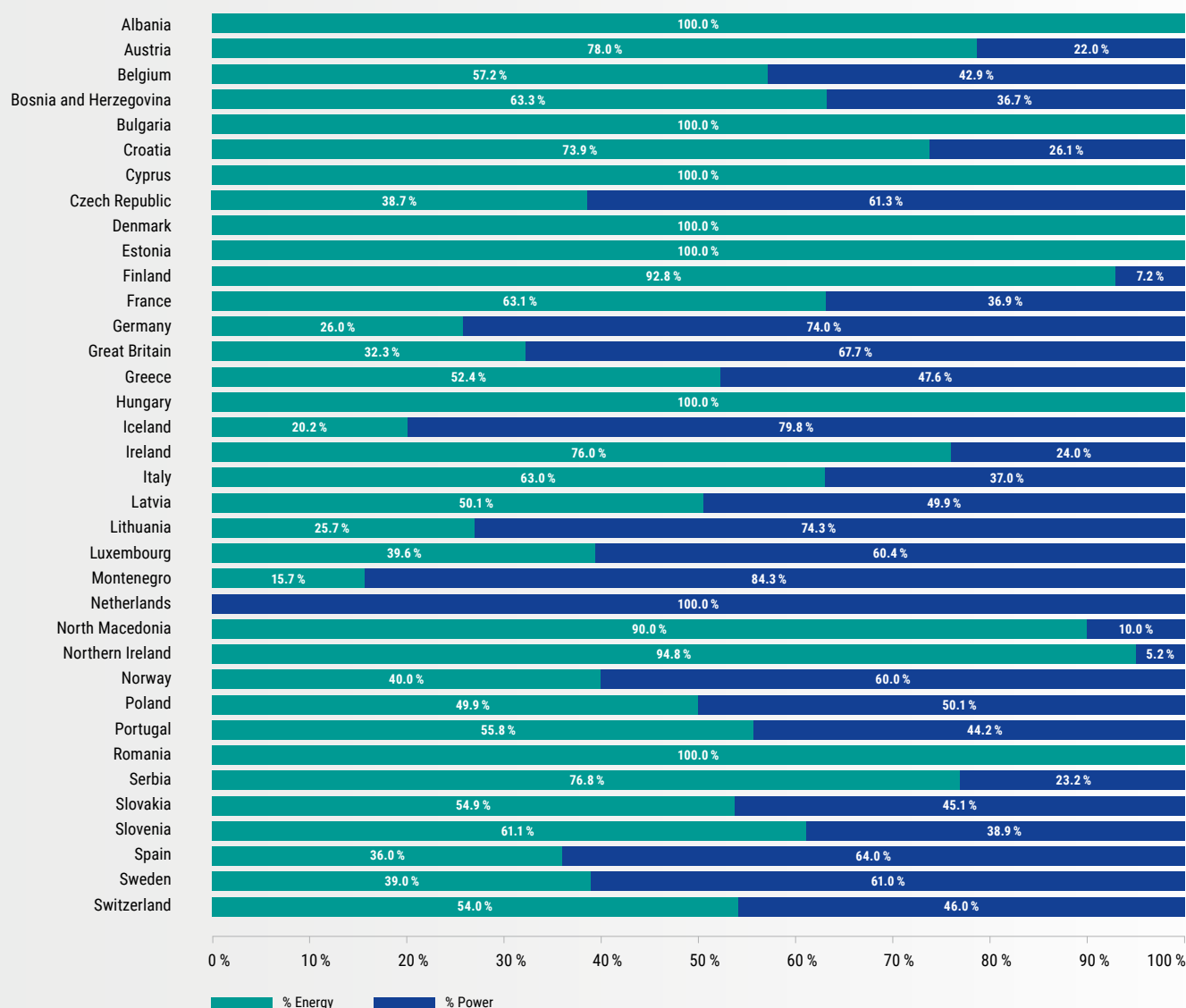
– Country remarks regarding Austria, Belgium, Bulgaria, Finland, Great Britain, Greece, Hungary, Iceland, Ireland, Lithuania, Portugal, Spain and Sweden are to be found in Appendix 1.

7 Analysis of TSO components of Unit Transmission Tariffs

7.1 Energy-related and power-related components

The main revenue drivers for Unit Transmission Tariffs are power (capacity), energy (volume) or both. Chart 7.1 presents the shares of power and energy components of the

TSO components of the Unit Transmission Tariffs for the base case.



Remarks:

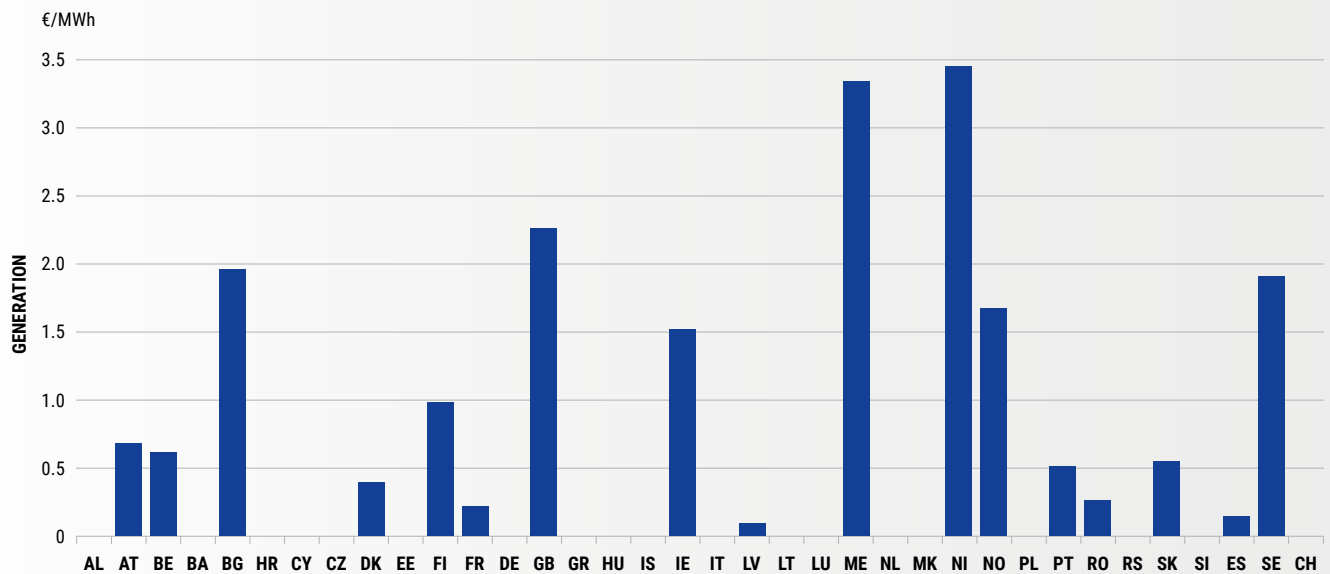
- The example taken for this comparison is the base case (see Section 3).
- Other charges not directly related to TSO activities (i. e. non TSO costs) **are not included** in the above graph.
- Values have been rounded.
- Country remarks regarding France, Italy, Spain and Sweden are to be found in Appendix 1.

Chart 7.1: Energy-related and power-related components of the TSO components of the Unit Transmission Tariff

7.2 Generation component

The Unit Transmission Tariff is calculated by adding the charges applied to the generation (G) and load (L). Chart 7.2

provides the part of the TSO components of the Unit Transmission Tariff that corresponds to generation.



Remarks:

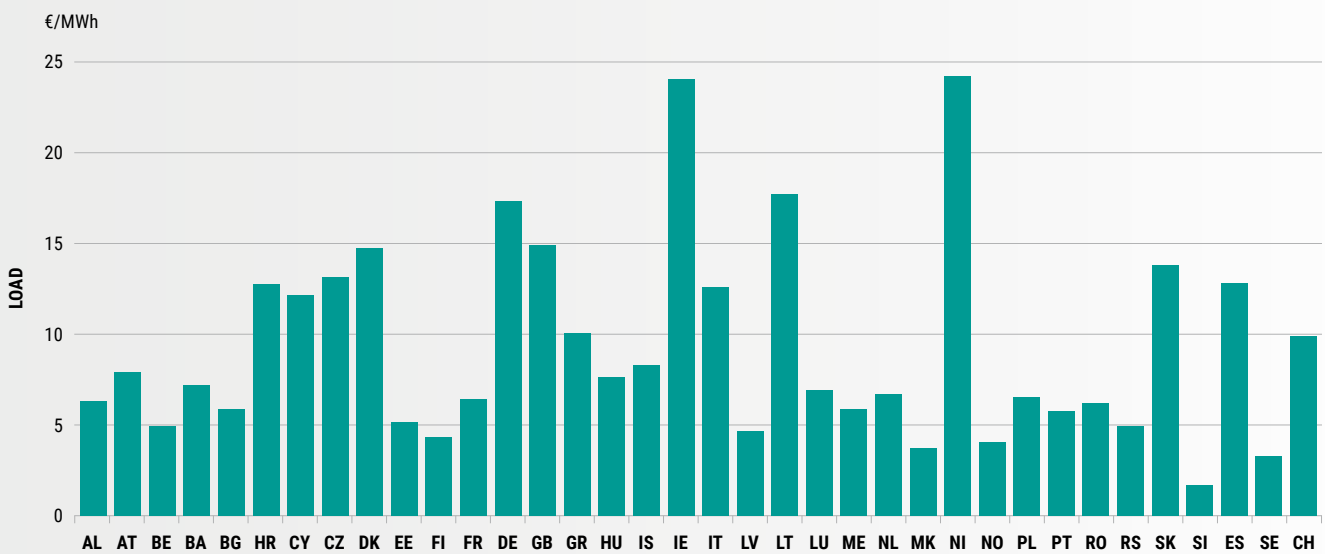
- The example taken for this comparison is the base case (see Section 3).
- Other charges not directly related to TSO activities (i. e. Non-TSO costs) **are not included** in the above graph.
- Values have been rounded.
- Commission Regulation (EU) no 838/2010 places limits on annual average transmission charges paid by producers in each Member State. It is not possible to draw the conclusion from the above graph that some countries are breaching this Regulation because the graph is comparing G charges based on Unit Transmission Charges, and not actual tariff levels charged by TSOs. Separate monitoring procedures are in place to ensure TSOs remain compliant with EC Regulations.
- Country remarks regarding Austria, France, Hungary, Northern Ireland, Spain and Sweden are to be found in Appendix 1.

Chart 7.2: G components of the TSO components of the Unit Transmission Tariffs in 2021

7.3 Load (demand) Component

The Unit Transmission Tariff is calculated by adding the charges applied to the generation (G) and load (L), which includes infrastructure costs, the costs of purchasing system

services and losses. Chart 7.3 provides the part of the TSO components of the Unit Transmission Tariff that corresponds to load only.



Remarks:

- The example taken for this comparison is the base case (see Section 3).
- Other charges not directly related to TSO activities (Non-TSO costs) **are not included** in the above graph.
- Country remarks regarding Austria, Cyprus, France, Portugal and Spain to be found in Appendix 1.

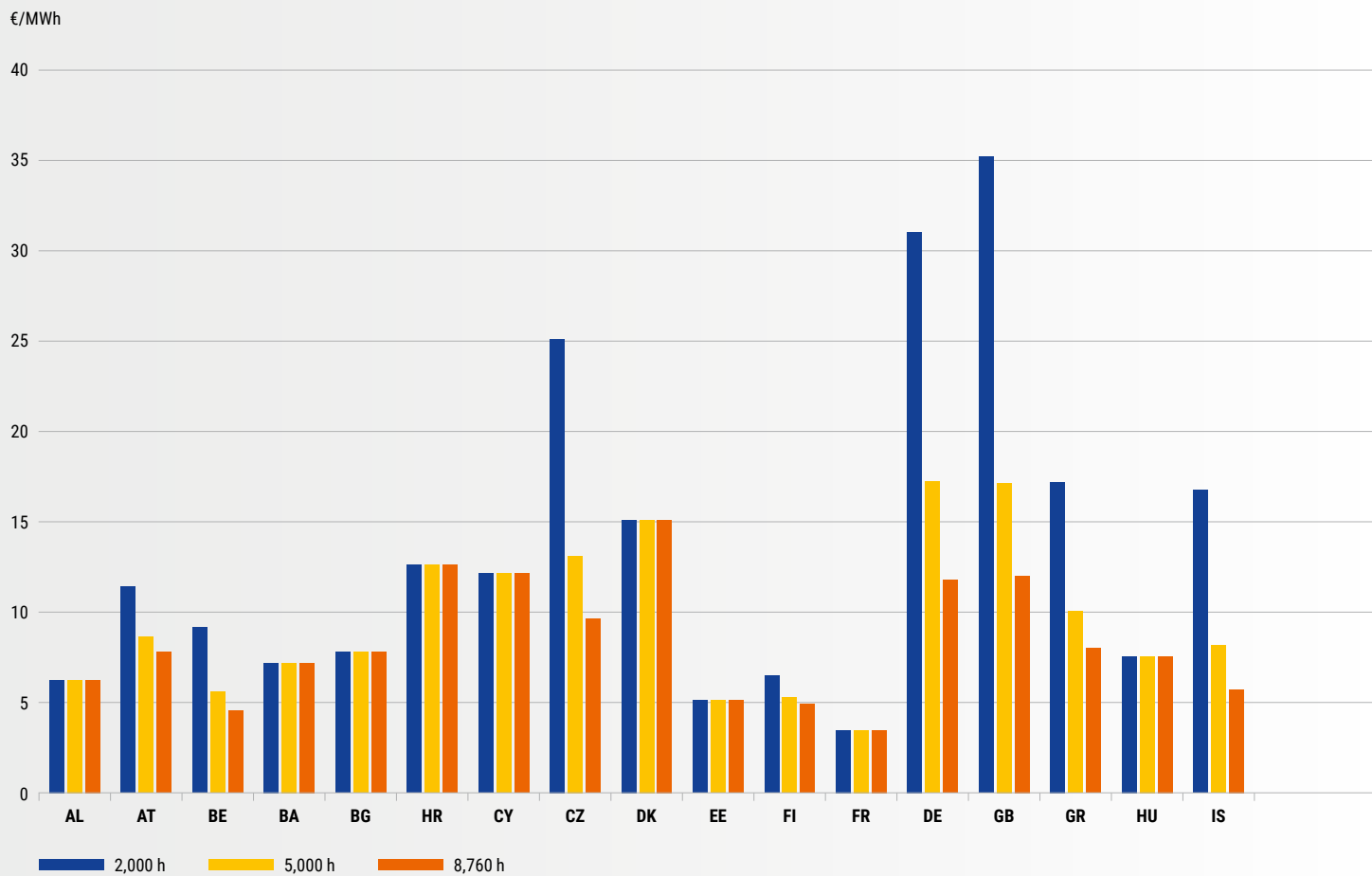
Chart 7.3: L components of the TSO components of the Unit Transmission Tariffs in 2021



7.4 Impact of utilisation time

Transmission charges paid by network users, and subsequently Unit Transmission Tariffs, change due to the utilisation time if the applied tariffs have power (capacity) as a

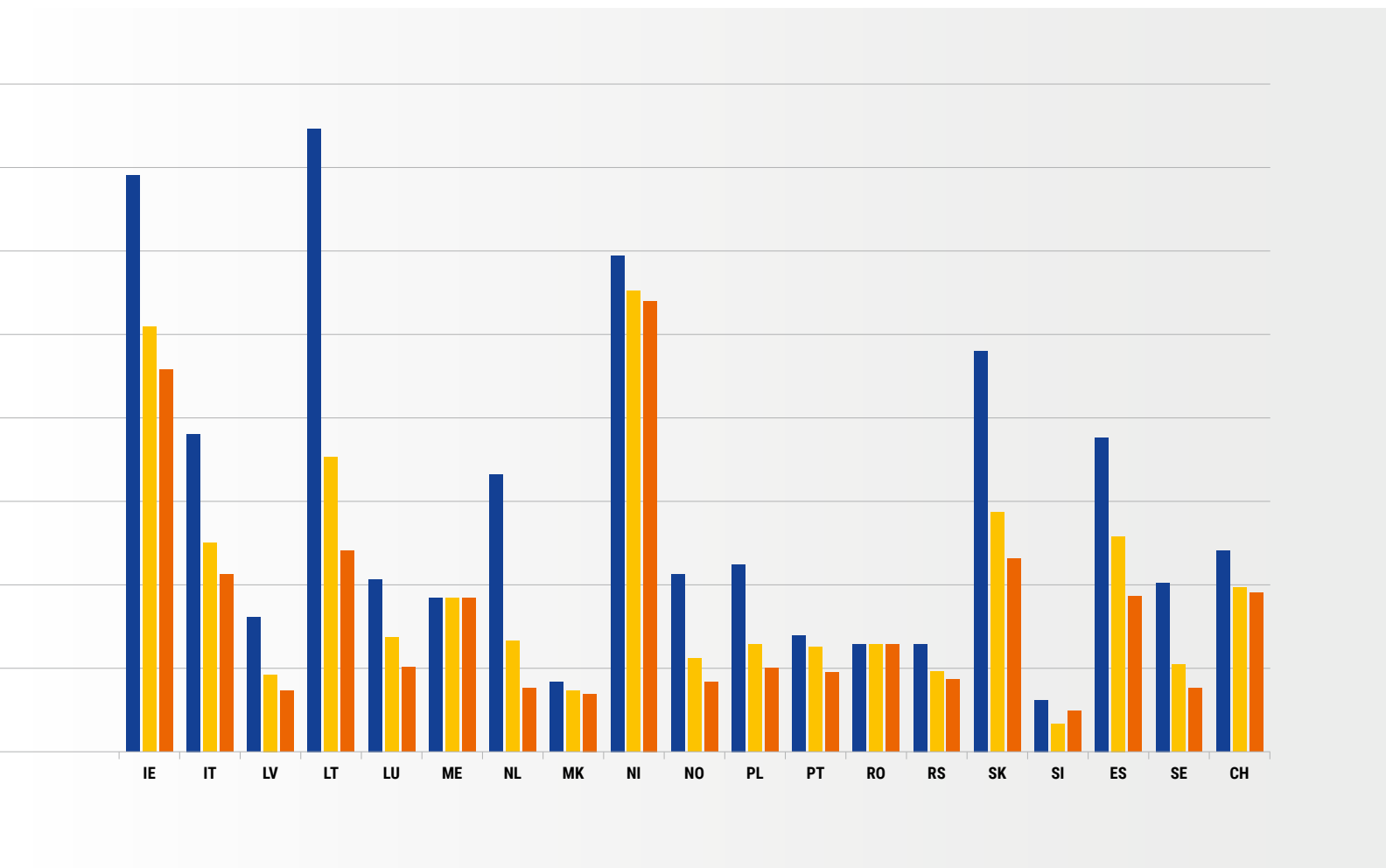
revenue driver. Chart 7.4 shows the impact of the utilisation time on the TSO components of the Unit Transmission Tariff.



Remarks:

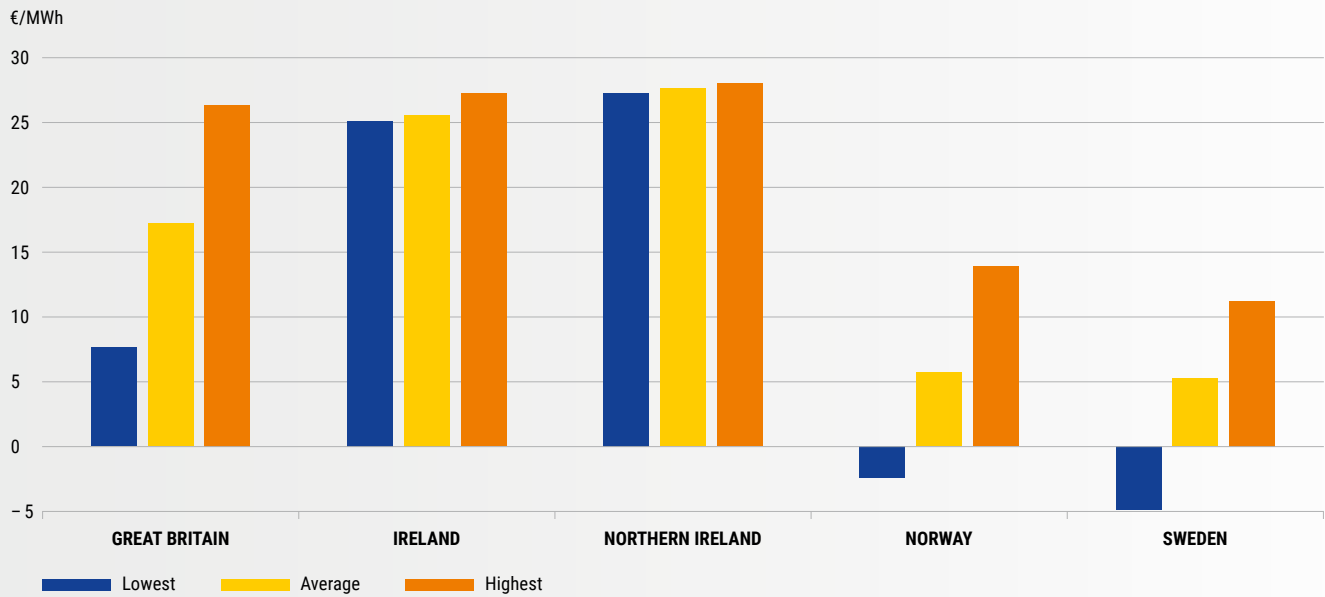
- The example taken for this comparison is the base case (see Section 3) modified by considering different utilisation times.
- Other charges not directly related to TSO activities (i. e. Non-TSO costs) **are not included** in the above graph.
- For most TSOs, a typical customer is a DSO with a seasonal load profile.
Neither a full annual utilisation time of 8,760 h nor a low utilization time of 2,000 h are realistic examples that occur on the grid.
The results for these hypothetical utilisation times are presented for comparison purposes only, in order to illustrate how fixed components of the tariffs impact on the average transmission charges.
- Country remarks regarding France are to be found in Appendix 1.

Chart 7.4: Impact of utilisation time on the TSO components of the Unit Transmission Tariffs in 2021



7.5 Impact of location

Some transmission tariffs are differentiated by location. Chart 7.5 illustrates the impact of location on the TSO components of the Unit Transmission Tariff.



Remarks:

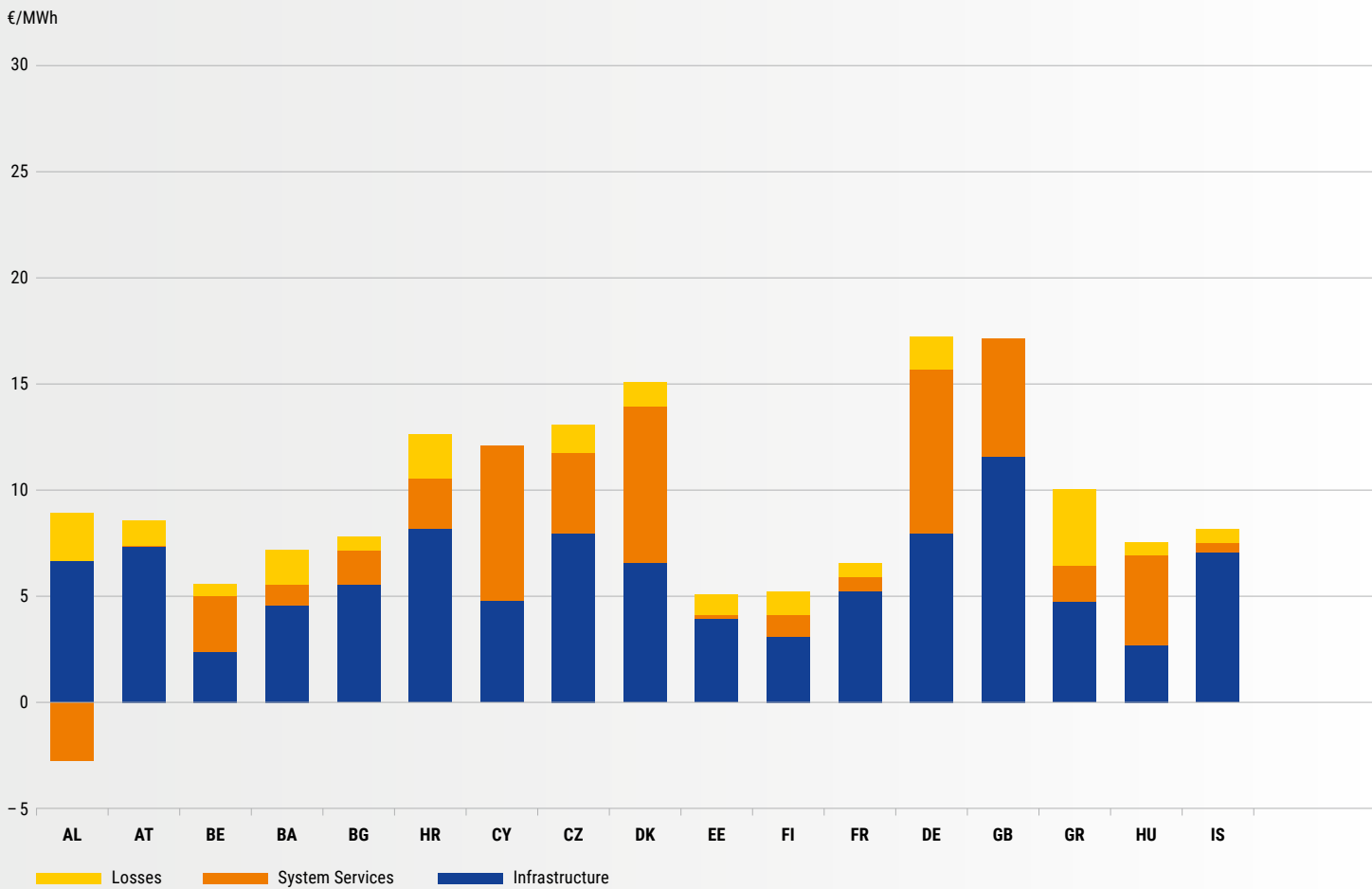
- The example taken for this comparison is the base case (see Section 3) modified by considering different locations.
- Other charges not directly related to TSO activities (i. e. Non-TSO costs) **are not included** in the above graph.
- For more details about locational differentiation of transmission tariffs see Appendix 5.
Tariff areas in countries with generation/consumption tariffs with locational differentiation.
- Further details regarding Great Britain, Ireland, Northern Ireland, Norway and Sweden are to be found in Appendix 5.

Chart 7.5: Further details regarding Great Britain, Ireland, Northern Ireland, Norway and Sweden are to be found in Appendix 5.



7.6 TSO Cost components of the Unit Transmission Tariffs

Chart 7.6 provides the split of the different TSO components of the Unit Transmission Tariff that is calculated in this report.

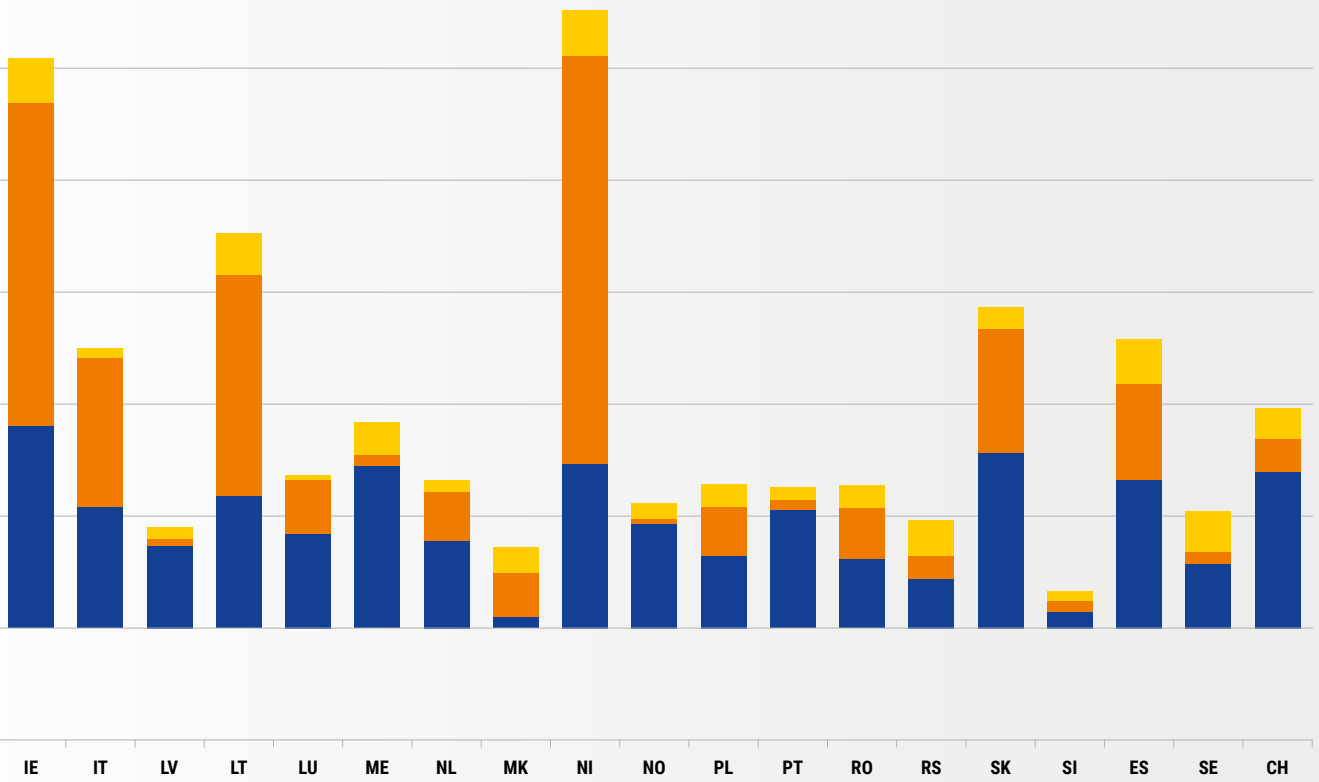


	AL	AT	BE	BA	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS
Losses	0.97	1.40	0.47	2.04	0.67	1.60		1.83	1.46	0.94	1.00	0.68	1.85		1.12	0.51	0.69
System Services	-1.42	0.09	2.58	0.77	1.34	2.52	7.40	2.90	5.06	0.18	0.94	0.67	8.07	3.83	1.33	3.82	0.46
Infrastructure	6.51	7.26	2.57	4.55	4.47	6.86	5.00	7.72	6.79	3.97	3.32	5.19	7.84	11.11	4.81	2.24	6.28

Remarks:

- The example taken for this comparison is the base case (see Section 3).
- Other charges not directly related to TSO activities (i. e. Non-TSO costs) **are not included** in the above graph.
- The figures in the chart are estimations of the value of each final price component.
- For countries where it is not possible to split the tariff as it is done in this chart, some assumptions and estimations have been made. System services include system balancing if applicable.
- A country remark regarding Austria, Bulgaria, Denmark, France, Germany, Great Britain, Hungary, Italy, Luxembourg, Netherlands, Northern Ireland, Poland, Portugal, Sweden and Spain can be found in Appendix 1..

Chart 7.6: Components of TSO costs of the Unit Transmission Tariffs in 2021

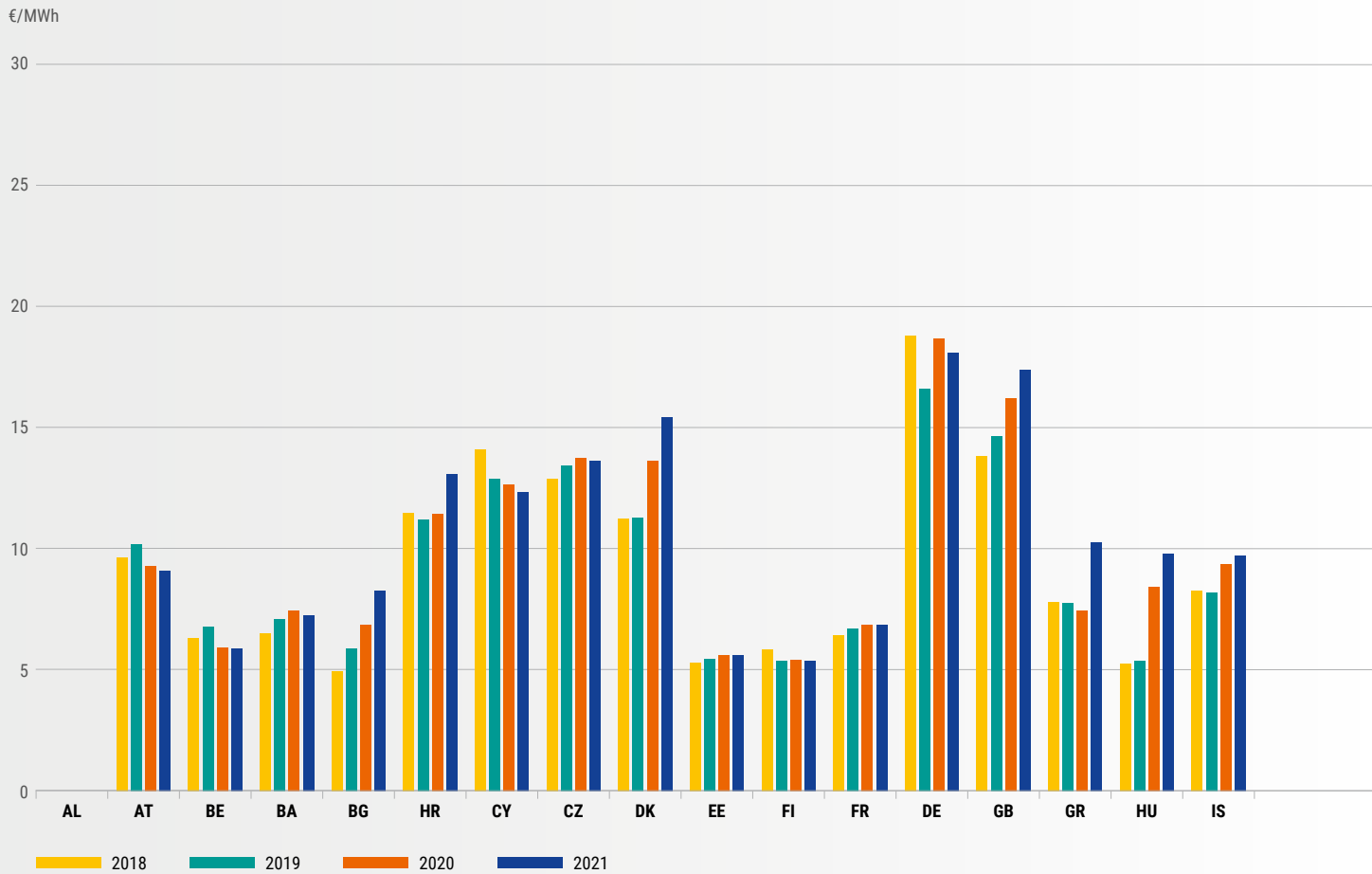


IE	IT	LV	LT	LU	ME	NL	MK	NI	NO	PL	PT	RO	RS	SK	SI	ES	SE	CH
1.17	0.48	0.55	2.07	0.29	1.44	0.95	1.07	1.17	0.18	1.06	0.71	0.99	1.50	0.88	0.37	0.59	0.52	2.31
15.92	7.75	0.33	10.41	2.64	0.47	3.91	2.14	18.70	0.11	2.89	0.40	2.90	0.92	5.45	0.72	2.55	0.46	1.48
8.62	5.21	4.97	6.85	4.67	7.27	3.12	0.03	6.40	5.26	3.23	4.84	2.70	1.78	7.89	0.62	5.36	2.85	6.16

7.7 Evolution of TSO components of Unit Transmission Tariffs

Transmission tariffs change over time. Chart 7.7 shows the evolution of the TSO components of the Unit Transmission

Tariffs over the period 2018 – 2021 in € using exchange rates on 31 December 2021.

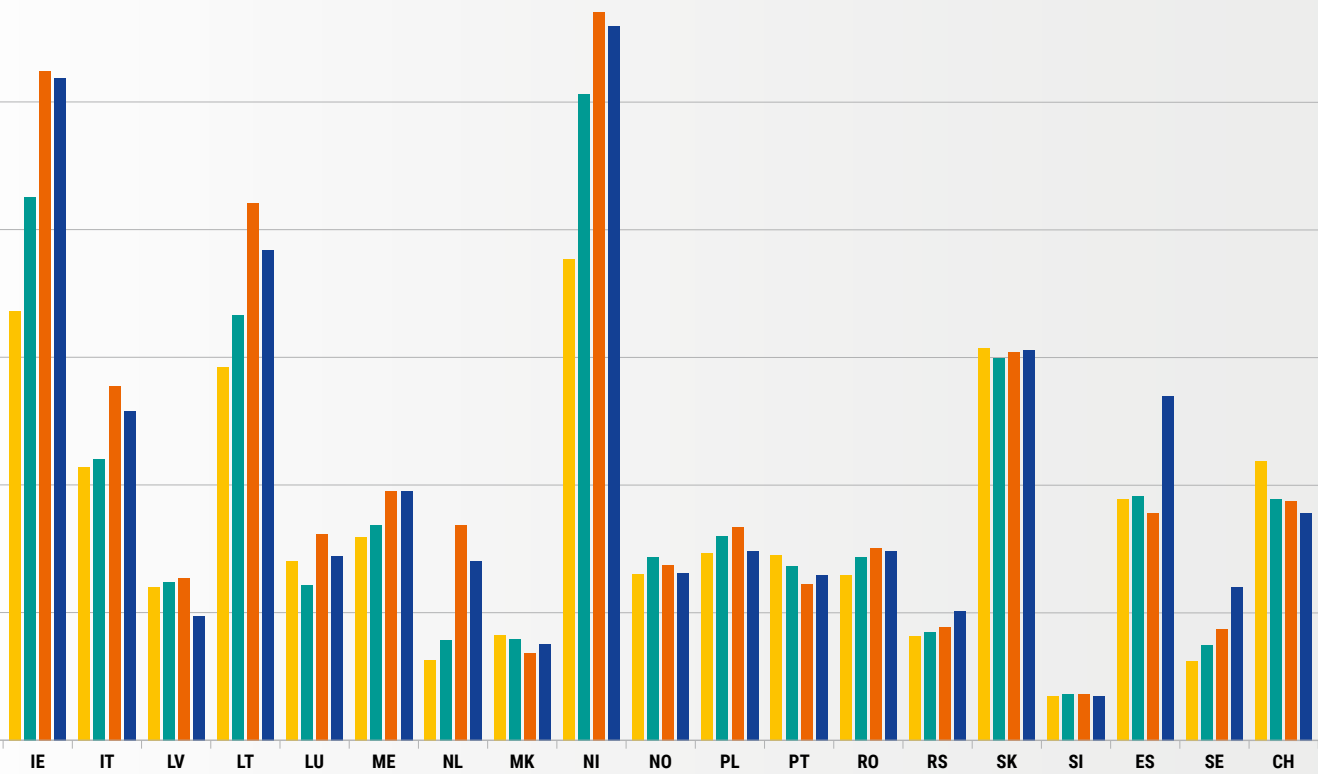


	AL	AT	BE	BA	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS
2018	0.00	9.64	6.31	6.48	4.93	11.46	14.10	12.91	11.25	5.31	5.83	6.42	18.80	13.84	7.82	5.23	8.26
2019	0.00	10.18	6.76	7.09	5.87	11.19	12.89	13.44	11.29	5.46	5.37	6.71	16.61	14.63	7.74	5.38	8.18
2020	0.00	9.27	5.95	7.44	6.89	11.43	12.65	13.75	13.63	5.58	5.43	6.84	18.66	16.21	7.44	8.43	9.37
2021	0.00	9.10	5.89	7.25	8.27	13.09	12.34	13.62	15.44	5.58	5.38	6.88	18.09	17.38	10.26	9.79	9.74

Remarks:

- The example taken for this comparison is the base case (see Section 3).
- Other charges not directly related to TSO activities (i. e. Non-TSO costs) **are not included** in the above graph.
- Prices have been updated to 2021 by using the annual average rate of change in the Harmonised Index of Consumer Prices (HICP) as provided by Eurostat. If it is not available, the official CPI data from the country is taken.
- For countries not in the Euro zone the exchange rate as for 31 December 2021 is used.
- See Country remarks for details. When annual changes exceed 10 % or 0.5 €/MWh compared to last year, reasons are provided.
- Country remarks regarding Austria, Belgium, Denmark, Germany, Great Britain, Hungary, Ireland, Italy, Lithuania, Luxembourg, Northern Ireland, Poland, Portugal, Spain and Sweden are to be found in Appendix 1.

Chart 7.7: Evolution of TSO components of the Unit Transmission Tariffs in 2021

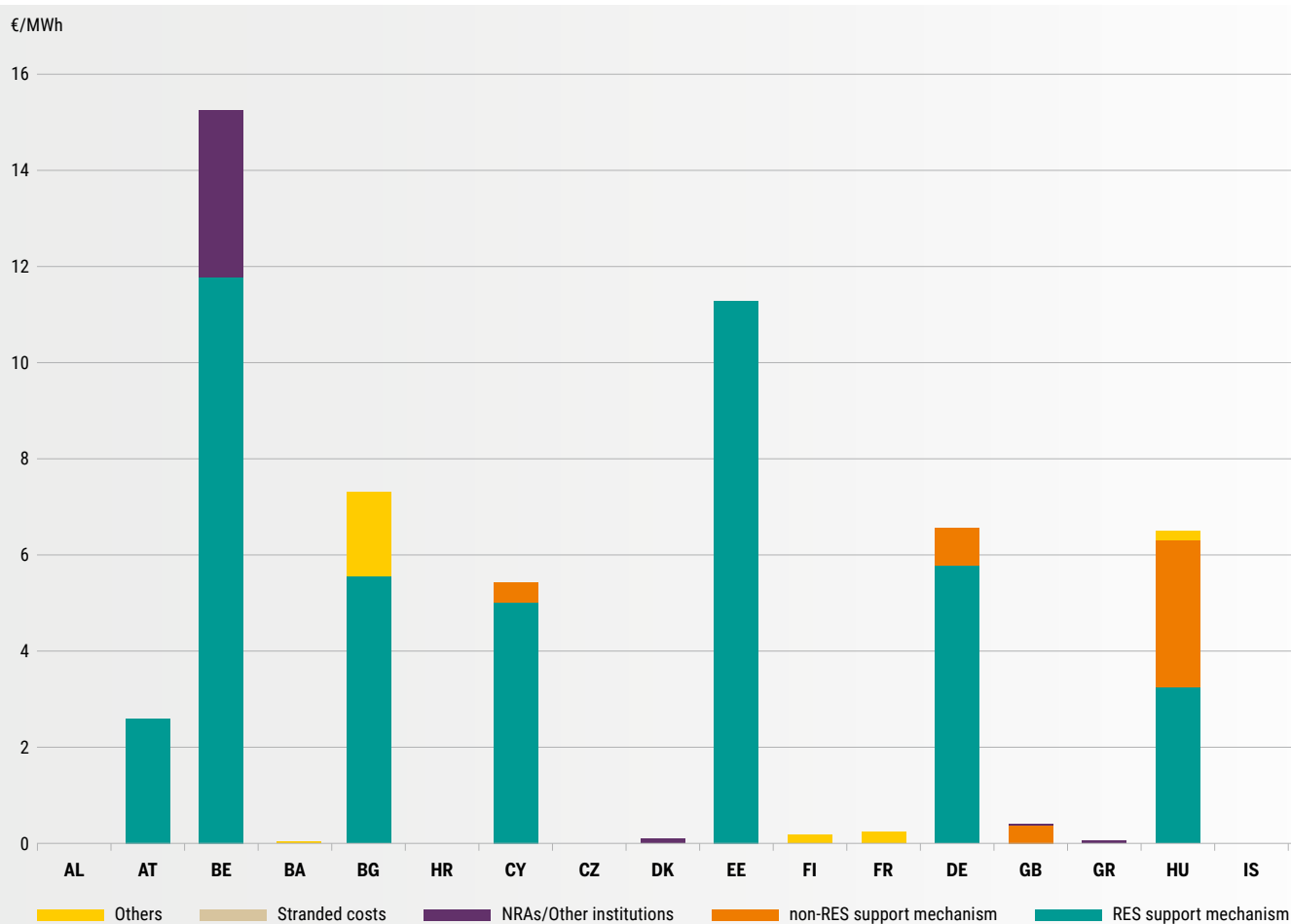


IE	IT	LV	LT	LU	ME	NL	MK	NI	NO	PL	PT	RO	RS	SK	SI	ES	SE	CH
16.79	10.69	6.02	14.61	7.00	7.96	3.16	4.13	18.83	6.51	7.33	7.26	6.48	4.09	15.37	1.75	9.44	3.11	10.94
21.27	11.01	6.17	16.64	6.07	8.44	3.92	3.96	25.32	7.20	8.01	6.82	7.15	4.23	14.93	1.81	9.57	3.71	9.45
26.20	13.88	6.34	21.02	8.06	9.76	8.43	3.41	28.49	6.86	8.35	6.12	7.52	4.46	15.20	1.80	8.89	4.33	9.38
25.93	12.89	4.88	19.19	7.23	9.76	7.01	3.79	27.96	6.57	7.41	6.45	7.41	5.08	15.30	1.73	13.49	6.02	8.89

8 Analysis of non-TSO components of Unit Transmission Tariffs

Many TSOs across Europe recover additional monies from their customers that are not directly related to TSO activities. TSOs are often obliged to recover these additional monies as a result of national or regional regulations and the charges may either form part of transmission tariffs directly or form part of separate charging mechanisms.

This section is divided in two parts. The first part details non-TSO costs by country and the second explores how non-TSO costs have evolved over recent years.



	AL	AT	BE	BA	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS
Others			0.05		1.78						0.18	0.24				0.21	
Stranded costs																	
NRAs/Other Institutions			3.47						0.11					0.05	0.07		
non-RES support mechanism							0.44						0.81	0.36	0.00	3.06	
RES support mechanism		2.60	11.76		5.54		5.00			11.30			5.76		0.00	3.24	

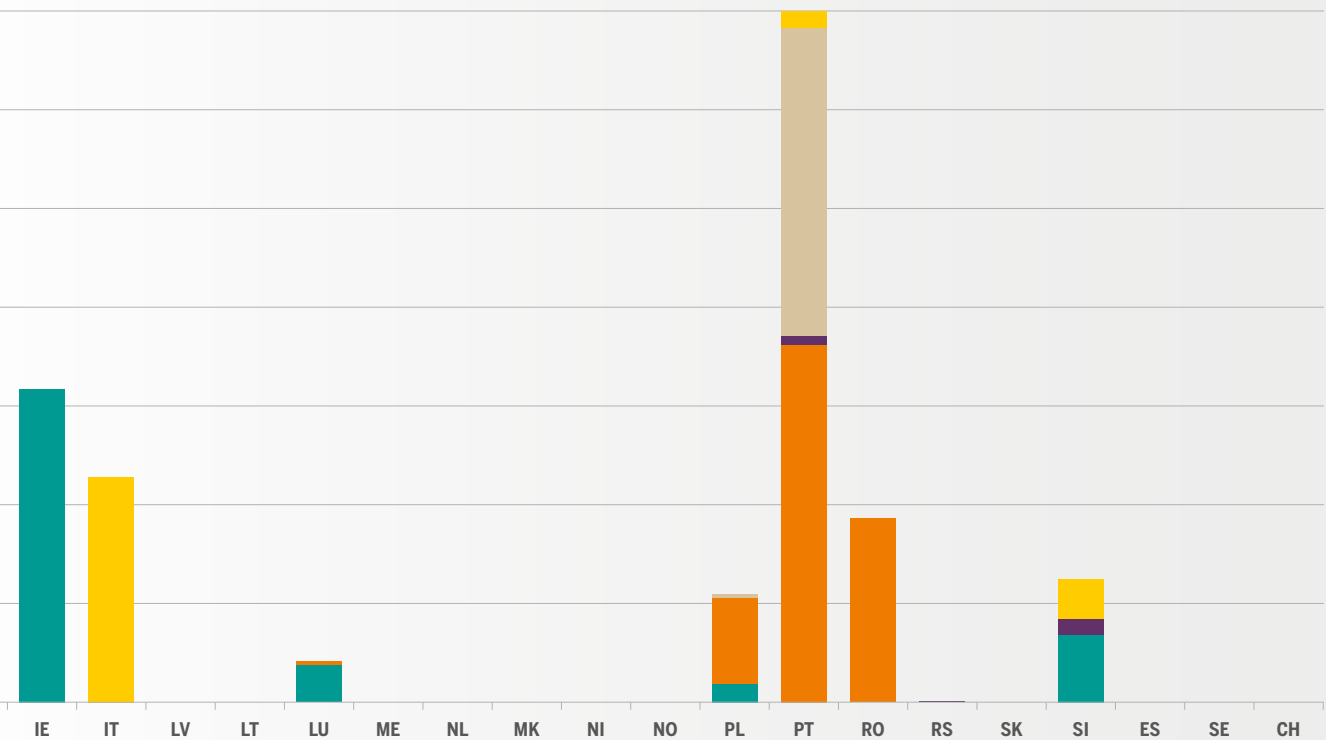
Chart 8.1: Overview of non-TSO charges in the Unit Transmission Tariffs (€/MWh)

8.1 Non-TSO Costs

Non-TSO costs broadly fall into five main categories:

- › Renewable Energy Support (RES) mechanisms: these are costs recovered through TSO charges aimed at supporting government targets to increase renewable generation. These costs are used to finance subsidies to grid-connected renewable generators. In terms of level, RES mechanisms represent the most important component of non-TSO costs;
- › Non-RES Support mechanisms: these are costs recovered through TSO charges generally aimed at providing financial support to other government objectives, such as energy efficiency or subsidising the costs of maintaining grid networks to rural areas, for example;
- › NRA/Other institutions: some costs are recovered through TSO charges that finance the activities of the relevant sector regulator or other institutions associated with the energy industry;
- › Stranded costs;
- › Others.

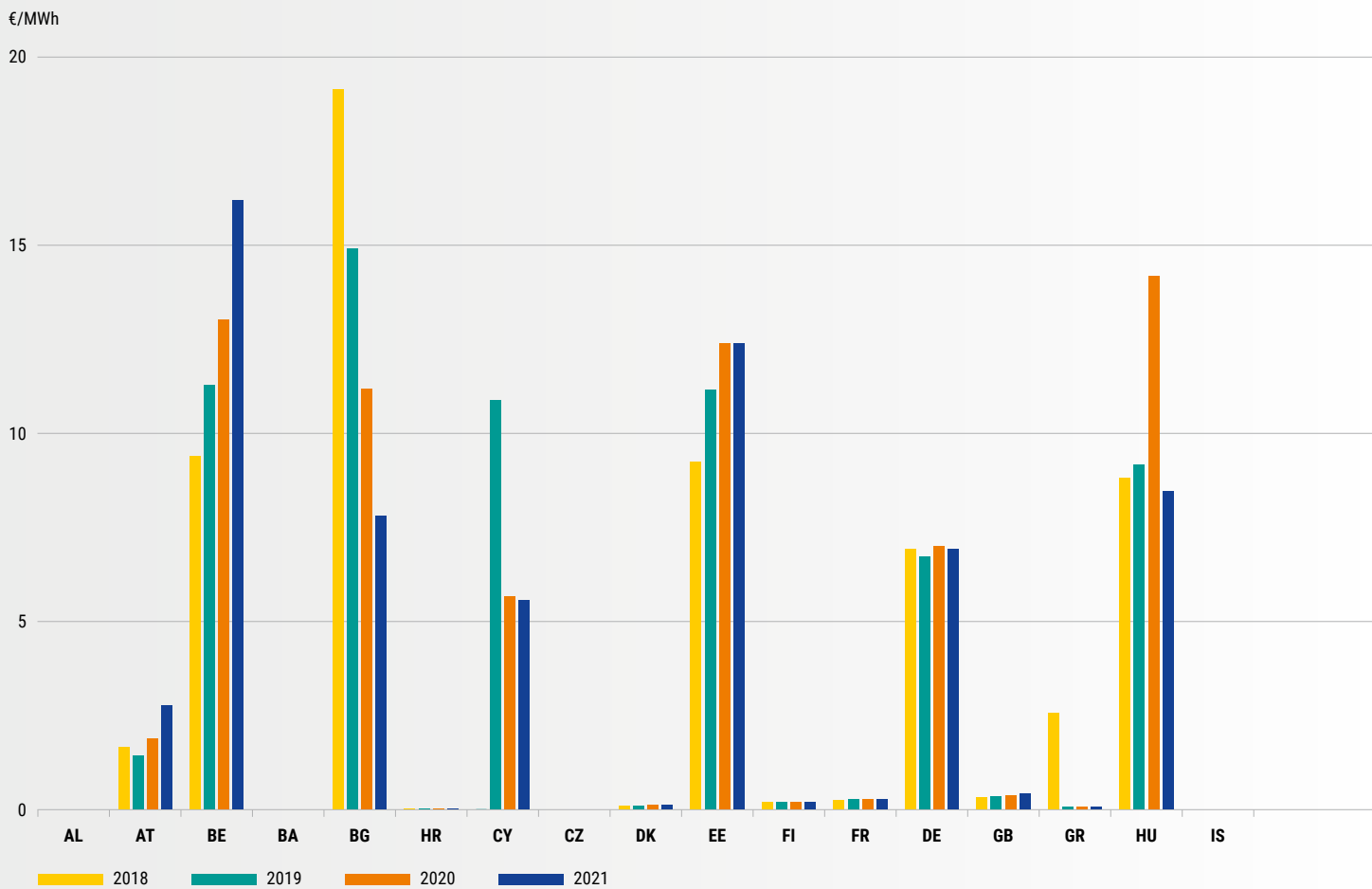
Also refer to Appendix 6 for additional information.



IE	IT	LV	LT	LU	ME	NL	MK	NI	NO	PL	PT	RO	RS	SK	SI	ES	SE	CH
	4.57										0.33				0.80			
										0.10	6.25							
											0.17		0.03		0.34			
				0.10						1.74	7.23	3.74						
6.34				0.75						0.36					1.35			

8.2 Evolution of Non-TSO costs

Non-TSO costs have received an increasing proportion of the Unit Transmission Tariffs and the data below show how these costs have changed over recent years:

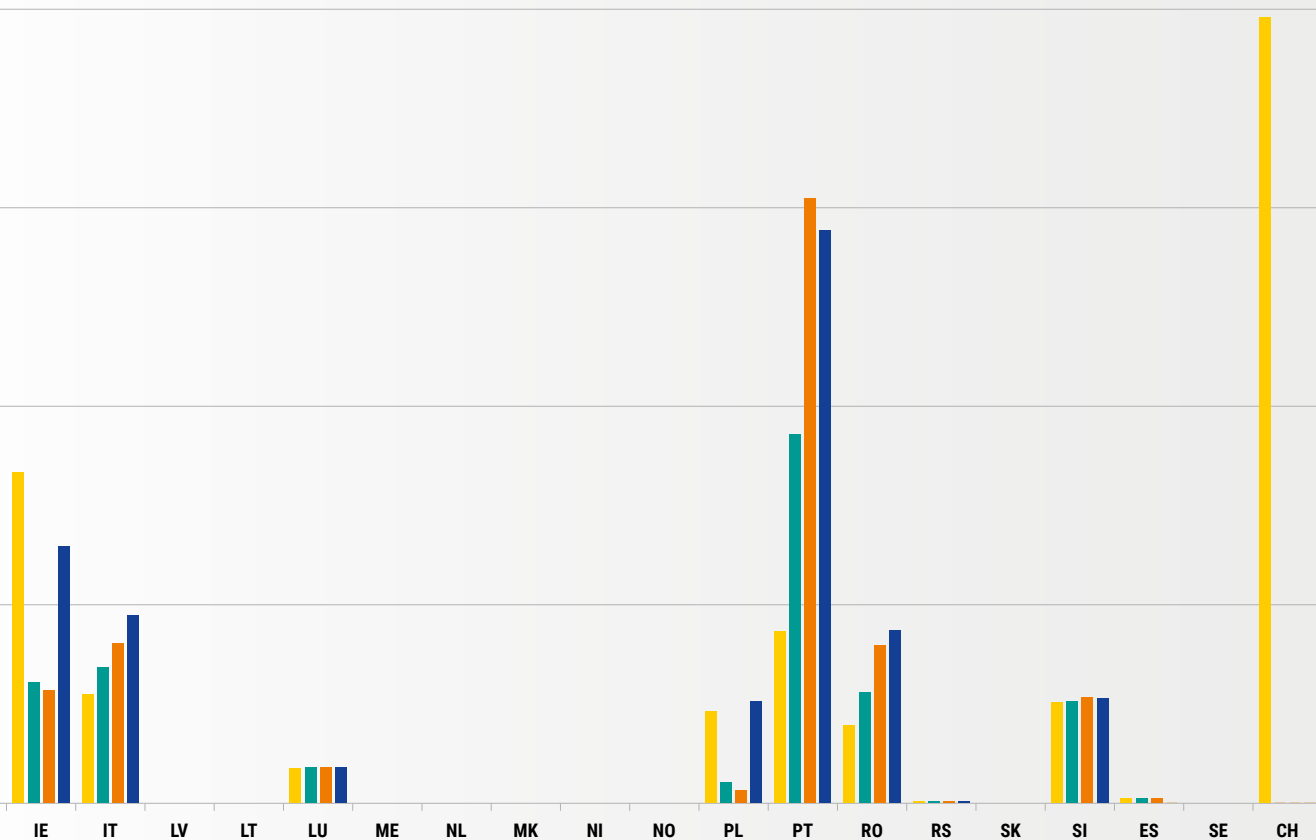


	AL	AT	BE	BA	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS
2018	0.00	1.67	9.39	0.00	19.15	0.01	0.00	0.00	0.09	9.22	0.18	0.24	6.93	0.31	2.57	8.82	0.00
2019	0.00	1.41	11.29	0.00	14.91	0.01	10.87	0.00	0.09	11.15	0.19	0.26	6.71	0.34	0.07	9.16	0.00
2020	0.00	1.86	13.00	0.00	11.16	0.01	5.66	0.00	0.12	12.39	0.19	0.26	7.00	0.37	0.07	14.19	0.00
2021	0.00	2.75	16.19	0.00	7.79	0.01	5.55	0.00	0.11	12.39	0.19	0.26	6.90	0.43	0.07	8.46	0.00

Remarks:

- The example taken for this comparison is the base case (see Section 3).
- Prices have been updated to 2021 by using the annual average rate of change in the Harmonised Index of Consumer Prices (HICP) as provided by Eurostat. If it is not available, the official CPI data from the country is taken.
- For countries not in the Euro zone the exchange rate as for 31 December 2021 is used.
- See Country remarks for details. When annual changes exceed 10 % or 0.5 € / MWh compared to last year, reasons are provided.
- Country remarks regarding Finland, Hungary, Ireland and Spain are to be found in Appendix 1.

Chart 8.2: Evolution of non-TSO costs in the Unit Transmission Tariffs 2021



IE	IT	LV	LT	LU	ME	NL	MK	NI	NO	PL	PT	RO	RS	SK	SI	ES	SE	CH
8.32	2.73	0.00	0.00	0.87	0.00	0.00	0.00	0.00	0.00	2.30	4.32	1.96	0.03	0.00	2.52	0.12	0.00	19.80
3.04	3.42	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.51	9.28	2.78	0.03	0.00	2.57	0.12	0.00	0.00
2.83	4.02	0.00	0.00	0.90	0.00	0.00	0.00	0.00	0.00	0.31	15.23	3.96	0.04	0.00	2.66	0.12	0.00	0.00
6.46	4.72	0.00	0.00	0.90	0.00	0.00	0.00	0.00	0.00	2.57	14.42	4.35	0.04	0.00	2.62	0.00	0.00	0.00

9 Appendices

Appendix 1: Country specific details

Appendix 2: Voltage levels operated by TSOs

Appendix 3: Comparison of network losses prices

Appendix 4: Comparison of system services prices

Appendix 5: Tariff areas in countries with generation/consumption tariffs with locational differentiation

Appendix 6: Other regulatory charges not directly related to TSO activities

Appendix 7: First connection charges

Appendix 8: Special Tariffs

Appendix 9: Treatment of Final Customers versus Distribution System Operators

Appendix 10: Reactive Energy

Appendix 11: Netting of flows for the application of transmission tariffs

Appendix 12: Exchange rates

Glossary of terms

Appendix 1:

Country specific details

Austria

— Main Characteristics

Only tariffs according to regulation are included in the Report. The Austrian tariff regulation does not assign cost components to the same categories as the Unit Transmission Tariff. For that reason, system services include only costs for provision of power for secondary reserve. The rest of system services costs are included in the infrastructure component.

— Unit transmission tariff

Network Level 2 in Austria is only a transformer level (transforming from 380/220 kV to 110 kV). Therefore the tariff of network level 2 is only applied, if the transformer is owned by the TSO (irrespective if transformed 380 kV/110 kV or 220/110 kV). If transformer is owned by a connected party then the tariff from Network Level 1 is applied.

— Range of components paid by generators and consumers

Base Case includes the following tariff components: Infrastructure, losses & secondary reserve. Generation pays: Secondary reserve & losses. Load pays: Infrastructure & losses. Losses is the only component which is paid by both (G+L).

— Components of the calculated unit transmission tariff

Tariffs for renewable energy (power, energy and losses) have increased in general due to new period for major parameters.

— Voltage levels operated by TSOs

Percentages based on route lengths.

Belgium

— Unit transmission tariff

There was for 2021 an important increase of the Federal Offshore Public Service Obligation (part of non-TSO activity).

Bulgaria

— Unit transmission tariff

The costs related to TSO increased because of access tariff paid by RES generators and lower access tariff paid by conventional generators. The non-TSO cost has decreased and finally the unit transmission tariff decreased in comparison with the last year.

— Components of the calculated unit transmission tariff

The infrastructure cost is covered by the transmission tariff paid by customers. The System services and losses costs are covered by the access tariffs paid by customers, RES generators and conventional generators.

Denmark

Components of the calculated unit transmission tariff

There was a significant change in the System service part of UTT 2021.

The increased costs relate to balancing the electricity grid due to the phasing out of thermal plants, new European rules for the markets and the need for more and new types of system services.

Finland

Unit transmission tariff

Non-TSO costs have decreased from 2020. For Fingrid they consist mainly of peak load capacity costs. As a result of tendering process for period 6/2020 – 6/2022 the amount of peak load capacity reserve was smaller than earlier, and the total cost are lower.

Other regulatory charges not directly related to TSO activities

Peak Load Capacity Fee is defined in the Finnish Peak Load Capacity Act and secures a balance between electricity production and consumption. Peak Load Capacity Fee is based on the decision by the Energy Authority of Finland. Finnish TSO has a public service obligation to do administrative duties and collect fees.

Cost items included in calculation of the unit transmission tariff

System balancing: Imbalance settlement fees invoiced by eSett (Nordic Imbalance Settlement) are not included in calculating TTO.

France

Main Characteristics

Time differentiation with 5 temporal classes for voltages lower than 350 kV. Three kinds of differentiation exist: summer/winter, mid-peak/off-peak, and peak hours only in January, February and December.

Energy and Power related components

Non-TSO charges apply on the power part of the tariff and only to industrial customers. Tariffs for the highest voltage have no power part, therefore no non-TSO charges. Among RTE customers with a utilisation time of 5,000 h, very few are industrial customers, the overwhelming majority are distribution loads which do not pay those non-TSO charges. The invoice here is calculated for industrial customers.

Range of components paid by generators and consumers

There is a G component only for generators connected at the 150 – 400 kV levels. It was 0.20 €/MWh from 01/08/2017 to 31/07/2021 and is 0.23 €/MWh since 01/08/2021. The figures provided on Charts 7.1, 7.2, 7.3 and 7.4 represent the costs of a generator and an industrial customer both connected at the 220 – 150 kV level (highest voltage level with statistically representative data).

Components of the calculated unit transmission tariff

Charges corresponding to the “220 – 150” voltage level (highest voltage level with statistically representative data). There is no specific allocation of system services or losses cost to any specific tariff, the values here are purely indicative.

Cost items included in calculation of the unit transmission tariff

The cost of contracting fast reserve and industrial load-shedding capacities is included in the tariff. “Other” includes the remuneration of interruptible customers.

Germany

Components of the calculated unit transmission tariff

The grid fees 2021 compared with the grid fees 2020 are mainly decreased due to the following facts:

1. Decreased estimated costs in congestion management and redispatch due to further grid expansion.
2. Decreased estimated costs for grid losses and control reserve due to falling market prices.

In addition, it should be noted that a gradual harmonization of TSO grid charges has been implemented within Germany since 2019.

Great Britain

Main Characteristics

The GB transmission tariff is composed of several parts, including the TNUoS (Transmission Network Use of System) charge, which is essentially charges for use of assets, and BSUoS (Balancing Services Use of System) charge, which has the generation/load split of approximately 50:50.

Cost items included in calculation of the unit transmission tariff

NG ESO do not finance the purchase of energy to cover the grid losses. Instead, the losses are covered by generators or loads through additional volumes.

If a generator wants to sell 100MWh to a load, it has to inject (for example) 104MWh of energy into the grid. Similarly if a supplier wants to withdraw 100 MWh from the grid, it has to purchase (for example) 106 MWh from a generator. These additional energy (4MW + 6MW) are grid losses. The ESO do not have visibility of the cost of energy (losses), as most of the energy transactions are done on the bilateral market.

Unit transmission tariff

Highest Demand tariffs have been added to highest generation tariffs, which is not a realistic reflection of transmission charges in a given zone.

Tariff areas in countries with generation/consumption tariffs with locational differentiation

Highest generation and lowest demand charges occur in the north (surplus area).
Lowest generation and highest demand charges occur in the south (shortage area).

Greece

Unit transmission tariff

In 2021 there was an increase of the unit cost compared to 2020 due to the addition of Creta and Cycladic Islands in the Interconnected System.

Hungary

Unit transmission tariff

The TSO tariff has increased significantly from the previous year. The tariff is slightly different between 132 kV and above 132 kV.

The lower tariff is valid for distributors and consumption of some generators.

The non-TSO part has changed significantly from previous year based on RES support mechanism, other items of the non-TSO component have increased.

Range of Components paid by Generators and Consumers

The new tariff came in force not on January 1., but only on April 1. 2021.

Components of the calculated unit transmission tariff

The components "Infrastructure", "System services" and "Losses" are determined by the Hungarian Energy and Public Utility Regulatory Authority year by year:

- The new tariff came into force not on January 1., but only on April 1. 2021;
- The component "Infrastructure" was growth mainly by the correction items from the previous year and the reduced congestion income;
- The component "System services" was increased mainly by the higher amount of aFRR system services;
- The component "Losses" was decreased by some corrections from the previous year additionally.

The non-TSO part is significantly higher than data from previous year caused by the higher unit price for non-RES support mechanism fixed in the Electricity Act for this year mainly. The other elements of the Non-TSO component didn't change.

Voltage levels operated by TSOs

The total reported value "330 kV and above" includes 61.69 % of 400 kV circuits and 5.44 % of 750 kV circuits. Other voltages are 220 kV (28.46 %) and 132 kV (4.41 %).

Other regulatory charges not directly related to TSO activities

All other regulatory charges not directly related to TSO activities are only paid by non-residential customers. In detail you can see the RES support mechanism here:

<http://www.mavir.hu/web/mavir-en/renewable-energy-sources>

Iceland

Unit transmission tariff

1 January 2022 the tariff for users linked to voltage level above 150 kV increased by 9,9 %.

1 January 2022 the tariff for users linked to voltage level below 150 kV increased by 5,5 %.

Ireland

Unit transmission tariff

"Non TSO cost i. e. the PSO levy for 2020/21 is entirely related to renewable electricity, whereas in previous years it would have included other elements such as peat and security of supply. The key drivers in this increase in the 2020/21 PSO levy (relative to the 2019/20 PSO year) are:

- The R-factor: The PSO levy calculation for each year is an estimate of the expected cost of the government subsidy to generators. This estimate is then adjusted/reconciled once the actual costs are known. These adjustments are called Rfactors. There is a significant increase in the R-factor that was applied in calculating the forthcoming levy (2020/21 PSO levy) compared to the R-factor applied in calculating the current levy (2019/20 PSO levy).
- The Benchmark Price: The PSO levy calculation estimates the expected market price for electricity for the forthcoming year (the Benchmark Price). The lower the expected market price, the larger the subsidy that will be needed. There is a lower estimated benchmark price of 53.66 €/MWh for 2020/21 PSO year, compared to an estimated benchmark price of 57.37 € for 2019/20 PSO year."

— Other regulatory charges not directly related to TSO activities

“PSO levy for 2020/21 is entirely related to renewable electricity, whereas in previous years it would have included other elements such as peat and security of supply. The key drivers in this increase in the 2020/21 PSO levy (relative to the 2019/20 PSO year) are:

- The R-factor: The PSO levy calculation for each year is an estimate of the expected cost of the government subsidy to generators. This estimate is then adjusted/reconciled once the actual costs are known. These adjustments are called Rfactors. There is a significant increase in the R-factor that was applied in calculating the forthcoming levy (2020/21 PSO levy) compared to the R-factor applied in calculating the current levy (2019/20 PSO levy).
- The Benchmark Price: The PSO levy calculation estimates the expected market price for electricity for the forthcoming year (the Benchmark Price). The lower the expected market price, the larger the subsidy that will be needed. There is a lower estimated benchmark price of 53.66 €/MWh for 2020/21 PSO year, compared to an estimated benchmark price of 57.37 € for 2019/20 PSO year.”

— Tariff areas in countries with generation/consumption tariffs with locational differentiation

The GTUoS capacity charge is calculated individually for each generator based on the location of its connection to the system. This GTUoS charge is capacity based (i. e. based on MEC of generator), there is no energy (MWh) component for GTUoS. The GTUoS tariff has a locational element; which is calculated considering the usage of current generation on future network using a “reverse MW mile” methodology.

Italy

— Main Characteristics

Losses on the Italian transmission network are purchased by load service entities on the basis of standard losses factors. Purely for comparison purposes, in this overview the value of losses has been estimated by applying an average losses factor related to 2021 (estimated on the total value of losses, including those on the grids lower than EHV).

System services costs are a passthrough component for the TSO.

Energy and Power related components

— Values reported have been estimated:

Starting from 2016 the Italian transmission tariff (“CTR”) - applied to distributors by the TSO - is binomial and it is split into an energy-related component, covering ~10 % of the transmission costs, and a capacity-related component, covering ~90 % of the transmission costs. In order to estimate the UTT, the Italian “TRAS” tariff has been considered (i. e. the tariff applied to final users by the DSOs in order to cover transmission costs); nevertheless, the above mentioned percentages have been considered in order to split the UTT into an energy component and a capacity component.

— Components of the calculated unit transmission tariff

Losses: losses on the Italian transmission network are purchased by load service entities on the basis of standard losses factors. Purely for comparison purposes, in this overview the value of losses has been estimated by applying an average losses factor related to 2021 (estimated on the total value of losses, including those on the grids lower than EHV).

System services: it is a passthrough component for the TSO. The value provided is an estimated value of the system services/ancillary services unitary cost, based on the 2021 average of the UPLIFT component.

Infrastructure component: it has been estimated considering the sum of the unitary fees related to transmission (based on the “TRAS” tariff, which is applied by distributors to final users) and dispatching (DIS tariff).

— Cost items included in calculation of the unit transmission tariff

In 2021, the ITC component has been considered in order to estimate the Unit Transmission Tariff (since starting from 2021 the ITC is included in the Italian transmission tariff “CTR”).

“NON-TSO component”: a 2021 estimated value has been reported. It includes other items that are not directly related to the Transmission activity (mainly aimed at providing system security).

— **Netting of flows for the application of transmission tariffs**

Starting from 2016, the Italian transmission tariff is binomial. As described in “Appendix 9”, Distributors pay to Terna the “CTR component” (infrastructure component of Transmission Tariff) for withdrawal of energy from NTG. The CTR component is split into two different subcomponents:

- CTRE: energy (volume) component, in “cent. €/kWh”;
- CTRP: power (capacity) component, in “cent. €/kW per year”.

Considering the energy component, it is applied on a monthly basis to the net energy withdrawn from distribution companies connected to the NTG. The transmission fee is applied only if the resulting balance is a withdrawal. For transmission fee purposes, the energy injected in the distribution grid at HV level (virtual interconnection points) is also considered as energy withdrawn from the NTG.

Lithuania

— **Unit transmission tariff**

The main reason for the tariff decrease in 2021 is that revenue (tariff) was reduced by extra profit (in excess of allowed by the regulator) earned in the previous years

Luxembourg

— **Components of the calculated unit transmission tariff**

Although the MAR (Maximum Allowed Revenue) is slightly higher in 2021 compared to 2020, the simultaneity factor in the tariff calculation leads to a much lower peak power tariff component, overcompensating the slightly higher energy tariff component, thus leading to a lower overall tariff in the 5,000 h base case.

Northern Ireland

— **Main Characteristics**

Seasonal price signal is implemented only on Load. Locational price signal is implemented on Generation.

— **Range of Components paid by Generators and Consumers**

Significant rise in average SMP (from 53.23 €/MWh to 92.37 €/MWh) has led to an increase in losses allocation contained within the TSO component of the G Charges.

— **Components of the calculated unit transmission tariff**

Significant rise in average SMP (from 53.23 €/MWh to 92.37 €/MWh) has led to an increase in losses allocation contained within the TSO component of the G Charges. Infrastructure increases are down to larger revenue associated with G and D tariffs.

— **Cost items included in calculation of the unit transmission tariff**

System Balancing has been interpreted as being included in the Unit Transmission Tariff

— **Tariff areas in countries with generation/consumption tariffs with locational differentiation**

The GTUoS capacity charge is calculated individually for each generator based on the location of its connection to the system. This GTUoS charge is capacity based (i. e. based on MEC of generator), there is no energy (MWh) component for GTUoS. The GTUoS tariff has a locational element; which is calculated considering the usage of current generation on future network using a “reverse MW mile” methodology.

Norway

Cost items included in calculation of the unit transmission tariff

Cost related to congestion management is not included in UTT calculation. Cost related to System Balancing is included. These points were incorrectly reported in TTO 2020 report.

Tariff areas in countries with generation/consumption tariffs with locational differentiation

Two components of the Norwegian transmission grid give locational signals. Energy component (loss element) and the Fixed L-component.

The energy component has an element of locational signal in the “marginal loss factor” (MLF).

MLF is the same factor for Generation (G) and Consumption (L), with opposite value.

Calculation of the energy component is as follows:

Marked price (€/MWh) × marginal loss factor (%) × energy consumption (L) or production (G) (MWh).

MLF is calculated for every connection point in the grid on a weekly basis.

Fixed components shall cover the remaining costs within the income cap.

The fixed element for G has no locational signals.

The fixed element for L has an element of localization signal in the so called “K-factor”. K-factor is calculated on a yearly basis for each connection point. The k-factor is constructed so that consumption in same connection point as generation pays a lower tariff than other consumption.

The K-factor is between 0.6 and 1. K-factor = 1 gives no tariff reduction. K-factor = 0.6 gives 40 % tariff reduction.

Poland

Components of the calculated unit transmission tariff

The increase of the UTT rate is mainly due to the implementation of capacity charge (part of non-TSO costs) in 2021. The decrease of system services part of UTT and TSO's part of UTT in 2021 results from the implementation of first phase of the reform of the balancing market.

Voltage levels operated by TSOs

The total reported value “330 kV and above” includes 52.54 % of circuits 400 kV and 0.72 % of circuits 750 kV. The other voltage are 220 kV (46.26 %) and 110 kV (0.48 %).

Netting of flows for the application of transmission tariffs

Transmission tariff system doesn't provide settlements with generators (G tariff = 0). Netting flows is applied to settlements between TSO and DSO and final consumers connected to transmission network. In case the total feed-in energy to transmission network in PoD in certain month is greater than total energy taken-off transmission grid in this point, monthly charge for DSO/final consumer is zero.

Portugal

Main Characteristics

Losses and system services are included in energy price.

Components of the calculated unit transmission tariff

Costs for losses and system-services costs are not recovered by a regulated tariff, but are recovered in the energy price. They have been included in this overview only for comparison purposes.

Cost items included in calculation of the unit transmission tariff

Costs for losses and system-services costs are not recovered by a regulated tariff, but are recovered in the energy price. They have been included in this overview only for comparison purposes.

Netting of flows for the application of transmission tariffs

Time frame used for netting (in min) is 15 (clocked field).

Spain

— Main Characteristics

Only access tariffs and system operator charges for generation and demand are considered. Losses and system services are not included in this calculation, as they are recovered through the energy market.

— Unit transmission tariff

New methodology for transmission tariffs has entry into force in mid 2021. For the sake of simplification, new tariffs have been applied for all the year. Tariffs periods are designed in order to provide signals for efficient demand. Contracted powers in the different periods shall be such that the contracted power in a period P_{n+1} is always greater than or equal to the contracted power in the previous period P_n . An average profile has been taken into account based on sector values

— Energy and Power related components

Methodology for applying system operator charges changed already for 2020, establishing a fixed charge for market agent (both for load and generation) and a variable charge for both generation and demand. The fixed charge per agent has been variabilized by dividing the amount of money obtained through this charge into the demand.

— Range of components paid by generators and consumers

The charge corresponding to the access tariff for generators has changed from 0.5 €/MWh to 0 €/MWh since 25 January 2020.

— Components of the calculated unit transmission tariff

System services and losses are provided only for comparison purposes, despite the fact that they are not included in the Spanish transmission tariff (they are recovered through the energy market)..

— Cost items included in calculation of the unit transmission tariff

System services and losses are not included in the Spanish transmission tariff because they are recovered through the energy market. This is indicated in the Table 5.1 with legend “estimated”.

— Other regulatory charges not directly related to TSO activities

With the new methodology (Circular 3/2020) access tariffs are set to cover transmission and distribution costs, not TSOs costs are no longer included.

Sweden

— Unit transmission tariff

Large prices compared to previous years since the energy component is partly based on the spot price. Low prices during 2020 and high prices during 2021.

— Tariff areas in countries with generation/consumption tariffs with locational differentiation

In order to provide long-term price signals the tariff model contains locational signals. In Sweden most production is situated in the north while most consumption is located in the south. Therefore it is more expensive to be a producer in the north than in the south. Vice versa is applicable to consumption.

Switzerland

— Other regulatory charges not directly related to TSO activities

RES charges are charged by Pronovo. Costs billed to TSO by NRA and energy ministry are included in transmission tariff. Since 2018, the tasks around renewable feed-in tariff (KEV) have been performed by a separate company – Pronovo. In previous years, the Pronovo task was done by a department within the Swiss TSO.

Appendix 2: Voltage levels operated by TSOs

Country	330 kV and above	220 – 150 kV	132 – 50 kV
Albania	13.0 %	37.4 %	49.6 %
Austria	34.0 %	47.0 %	19.0 %
Belgium	18.1 %	46.6 %	35.4 %
Bosnia & Herzegovina	14.1 %	28.6 %	57.3 %
Bulgaria	16.4 %	19.0 %	64.6 %
Croatia	16.0 %	17.0 %	67.0 %
Cyprus	0.0 %	0.0 %	100.0 %
Czech Rep.	67.5 %	31.0 %	1.5 %
Denmark	30.0 %	45.0 %	25.0 %
Estonia	31.4 %	2.9 %	65.7 %
Finland	38.5 %	10.2 %	51.3 %
France	20.9 %	26.6 %	52.5 %
Germany	65.0 %	35.0 %	0.0 %
Great Britain	53.0 %	27.4 %	19.5 %
Greece	25.8 %	73.8 %	0.4 %
Hungary	67.1 %	28.5 %	4.4 %
Iceland	0.0 %	29.5 %	70.5 %
Ireland	6.0 %	25.0 %	69.0 %
Italy	17.2 %	38.9 %	43.9 %
Latvia	31.1 %	0.0 %	68.9 %
Lithuania	29.6 %	0.0 %	70.4 %
Luxembourg	0.0 %	100.0 %	0.0 %
Montenegro	25.8 %	27.1 %	47.2 %
Netherlands	24.4 %	51.5 %	24.1 %
North Macedonia	27.2 %	0.0 %	72.8 %
Northern Ireland	0.0 %	38.2 %	61.9 %
Norway	77.6 %	4.8 %	17.6 %
Poland	53.3 %	46.3 %	0.5 %
Portugal	32.6 %	67.4 %	0.0 %
Romania	56.0 %	43.5 %	0.5 %
Serbia	18.1 %	17.5 %	64.4 %
Slovakia	71.6 %	25.7 %	2.7 %
Slovenia	22.7 %	11.1 %	66.2 %
Spain	48.6 %	45.0 %	6.4 %
Sweden	74.0 %	26.0 %	0.0 %
Switzerland	27.0 %	73.0 %	0.0 %

Remarks:

- Percentages are calculated as the ratio between the kilometers of circuits for each voltage level and total kilometers of circuits operated by each TSO.
- Values have been rounded.
- Country remarks regarding France, Hungary and Poland are to be found in Appendix 1.

Table A.2. Voltage levels operated by TSOs

Appendix 3:

Comparison of network tariff elements losses prices

Losses (€/MWh)	Country	Losses (€/MWh)	Country
Above 1	Greece	Below 1	Poland
	Albania		Slovakia
	Croatia		Estonia
	Ireland		Norway
	Northern Ireland		France
	Spain		Iceland
	Lithuania		Bulgaria
	Sweden		Hungary
	Bosnia & Herzegovina		Belgium
	Serbia		Portugal
	Germany		Netherlands
	Montenegro		Latvia
	Switzerland		Slovenia
	Czech Rep.		Italy
	Austria		Luxembourg
	North Macedonia		Cyprus
	Denmark		Great Britain
Finland			

Remarks:

The base case is taken (see Section 3)

A country remark regarding France, Great Britain, Italy, Netherlands and Spain can be found in Appendix 1.

Table A.3. Comparison of network losses prices

Appendix 4: Comparison of system services prices

System Services (€/MWh)	Country
Above 3	Northern Ireland
	Ireland
	Lithuania
	Germany
	Denmark
	Cyprus
	Italy
	Slovakia
	Great Britain
	Spain
	Hungary
	Czech Rep.
1 < --- < 3	Belgium
	Luxembourg
	Croatia
	Romania
	Netherlands
	Poland
	North Macedonia
	Greece
	Bulgaria
	Switzerland
	Finland
	Bosnia & Herzegovina
0.5 < --- < 1	Serbia
	France
	Sweden
Below 0.5	Slovenia
	Montenegro
	Iceland
	Portugal
	Latvia
	Norway
	Estonia
	Austria
Albania	

Remarks:

- The base case is taken (see Section 3).
- These figures cover the system services listed in Table 4.1
- A country remark regarding France, Germany, Great Britain, Italy and Spain can be found in Appendix 1.

Table A.4. Comparison of system services prices

Appendix 5: Tariff areas in countries with generation/ consumption tariffs with locational differentiation

Great Britain

Highest generation and lowest demand charges occur in the north (surplus area).
Lowest generation and highest demand charges occur in the south (shortage area).

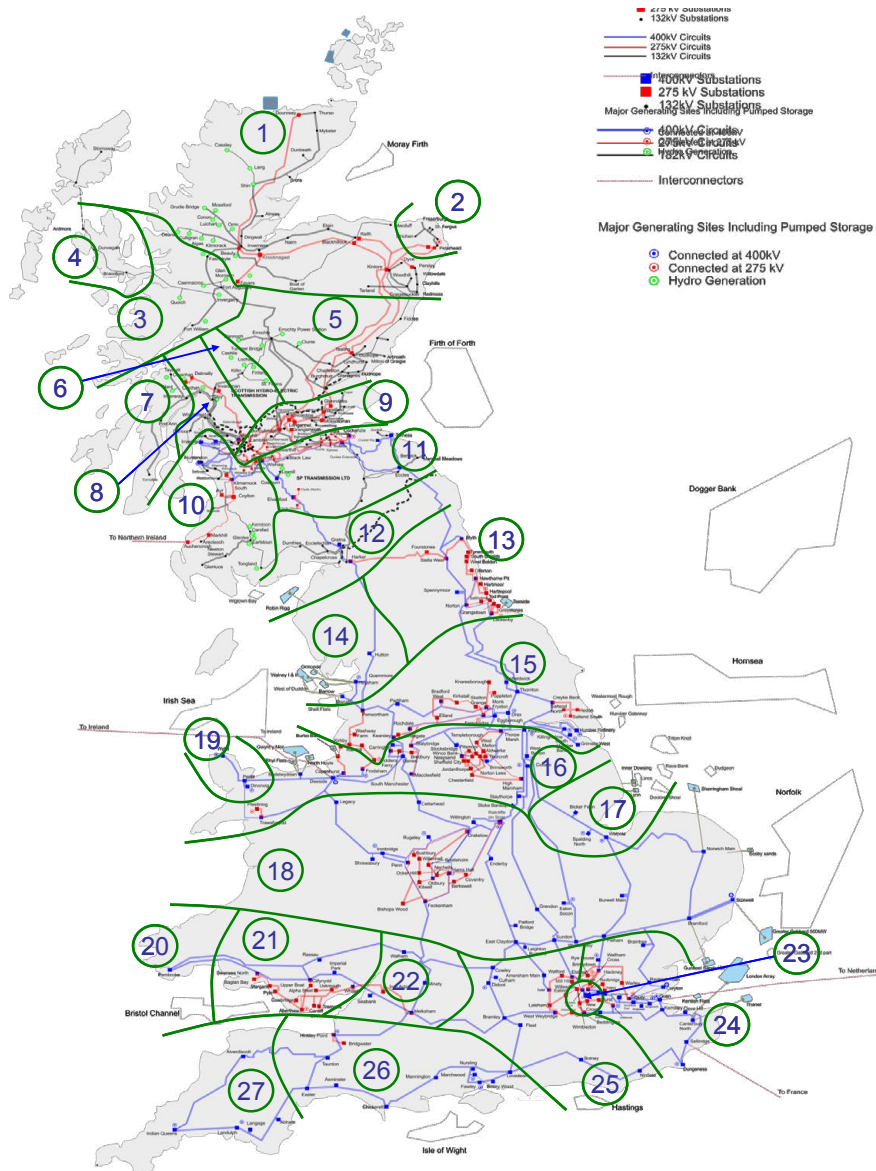


Chart A5.1 Great Britain

Ireland

The GTUoS capacity charge is calculated individually for each generator based on the location of its connection to the system. This GTUoS charge is capacity based (i. e. based on MEC of generator), there is no energy (MWh) component for GTUoS. The GTUoS tariff has a locational element; which is calculated considering the usage of current generation on future network using a “reverse MW mile” methodology.

Northern Ireland

The GTUoS capacity charge is calculated individually for each generator based on the location of its connection to the system. This GTUoS charge is capacity based (i. e. based on MEC of generator), there is no energy (MWh) component for GTUoS. The GTUoS tariff has a locational element; which is calculated considering the usage of current generation on future network using a “reverse MW mile” methodology.

Norway

Two components of the Norwegian transmission grid gives location signals: energy component (loss element) and the fixed L-component.

The energy component has an element of localisation signal in the “marginal loss factor” (MLF).

MLF is the same for Generation (G) and Consumption (L). Calculation of the energy component is as follows: Market price (€/MWh) × marginal loss factor (%) × energy consumption (L) or production (G) (MWh). MLF is calculated for every connection point in the grid on a weekly basis. (See map attached)

Fixed components shall cover the remaining costs within the income cap. The fixed element for G has no locational signals. The fixed element for L has an element of localisation signal in the so called “k-factor”. K-factor is calculated on a yearly basis for each connection point. The k-factor is constructed so that consumption in same connection point as production become a lower tariff than other consumption. The k-factor is between 0.5 and 1. K-factor = 1 gives no tariff reduction. K-factor = 0.5 gives 50 % tariff reduction.

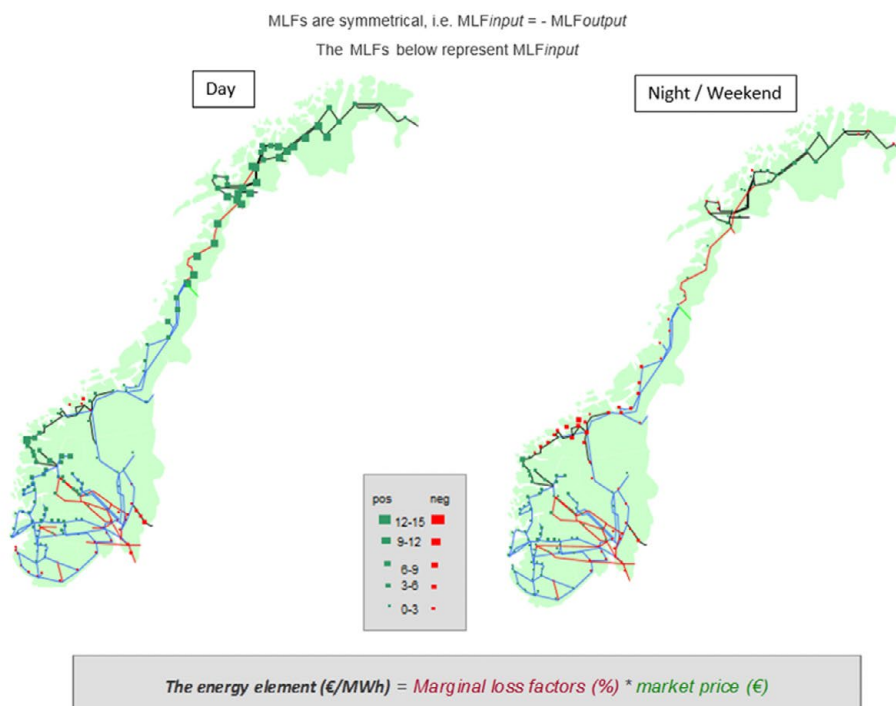


Chart A5.1 Norway. Marginal Loss Factors (MLF) Average 2014–15

Sweden

The locational signal is based on the connection point's latitude in the grid. This means that each connection point has its own locational cost. The locational cost is determined by the distance between the latitude of the connection point and the neutral latitude. In the current tariff model, the neutral latitude is 57° for injection and 67° for withdrawal.

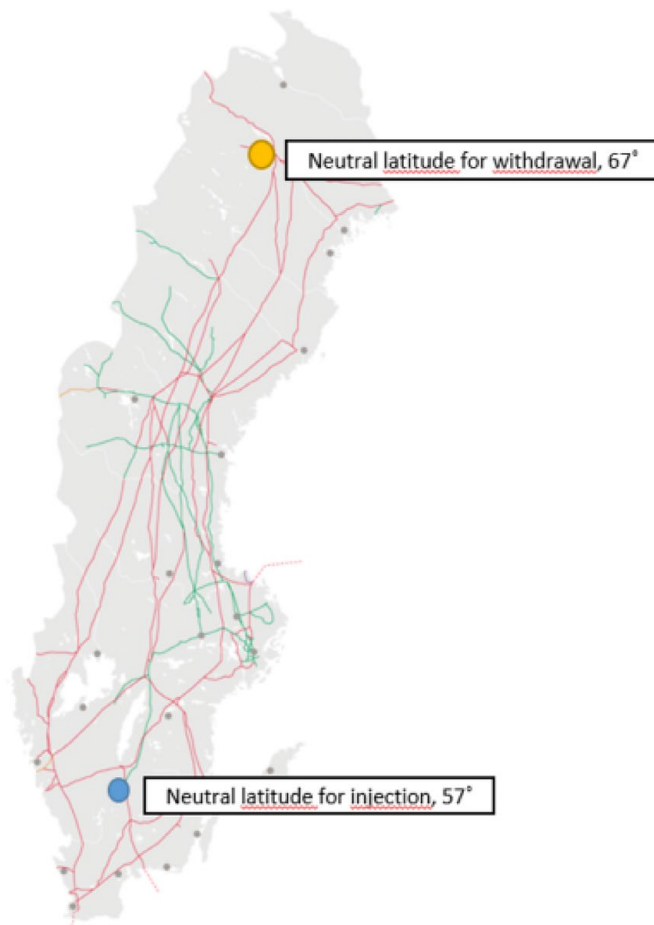


Chart A5.1 Sweden.

Appendix 6: Other regulatory charges not directly related to TSO activities

In some countries base case users are obliged to pay charges that are not directly related to TSO's activities but result from national/local regulation. These non-TSO costs are different in scope and are charged either through TSO tariffs or through separate charging mechanisms.

The table below summarises the main features of the charges/costs not directly related to TSO activities (non-TSO costs) and their charging mechanisms in force. For the listed countries, these non-TSO charges/costs are included in the calculation of the Unit Transmission Tariffs:

Country	Other regulatory charges not directly related to TSO activities			
	Cost item	Charge level (€/MWh)	Paid by	Description
Austria	RES support mechanism	2.6	L	APG collects and passes tariffs for RES support from directly connected customers through. In the customer bill these tariffs are not recorded in the network cost section but in the taxes & levies section.
	NRAs/Other Institutions	0.00	L	Included in infrastructure tariff.
Belgium	RES support mechanism	11.76	L	PSO for financing connection of offshore windturbine parks & PSO for financing green certificates
	NRAs/Other Institutions	3.47	L	Federal contribution
	Others	0.05	L	PSO for strategic reserve
Bosnia and Herzegovina	RES support mechanism	0.00	L/G	No RES support mechanism cost in the Transmission tariff
	non-RES support mechanism	0.00	L/G	No non-RES support mechanism in the transmission tariff
	NRAs/Other Institutions	0.00	L/G	No NRA/Other Institution in the Transmission tariff
	Stranded costs	0.00	L/G	No Stranded cost in the Transmission tariff
	Others	0.00	L/G	No others cost in the Transmission tariff
Bulgaria	RES support mechanism	5.54	L	In 2021 the non-TSO costs are split between RES support mechanism and CHP technologies
	Others	1.78	L	In 2021 the non-TSO costs are split between RES support mechanism, and CHP technologies
Croatia	NRAs/Other Institutions	0.00	L	All energy operators that carry out one or more energy activities, based on the licence for carrying out energy activities issued by HERA, pay 0.05 % of their total income for previous year into HERA's budget
Cyprus	RES support mechanism	5.00	L	This levy is administered by the Ministry of Energy in order to compensate RES generators.
	Non-RES support mechanism	0.44	L	This levy is administered by the Cyprus Energy Regulatory Authority in order to support vulnerable customers through reduced retail tariffs.
Denmark	NRAs/Other Institutions	0.11	L	Payment to the Danish Energy Regulatory Authority and to the Danish Energy Agency to cover their
Estonia	RES support mechanism	11.3	L/DSO	RES support mechanism, charged separately from TSO invoice. Not considered as a part of TSO tariffs

Country	Other regulatory charges not directly related to TSO activities			
	Cost item	Charge level (€/MWh)	Paid by	Description
Finland	Others	0.18	L/DSO	Peak load capacity fee.
France	Others	0.24	L	For the base case it is 0.245 €/MWh in 2021 for industrial customers only (0 for distributors). In 2005, the pensions system of people working in the gas and electricity industry was globally reformed. For the transmission tariff, it implied the creation of what is called in French, CTA, Contribution Tarifaire d'Acheminement – Transmission Tariff Contribution. It is calculated on the fixed part of the tariff (power part of the transmission tariff). All the customers pay the "CTA" which does not cover any RTE cost. The order of 29/12/2005 set the percentage applied to the fixed part at 8.20 % for the transmission activity. The order of 26/04/2013 increased this percentage to 10.14 % from 01/05/2013. The order of 20/07/2021 decreased this percentage to 10.11 % from 01/08/2021.
Germany	RES support mechanism	5.76	L	<ul style="list-style-type: none"> • Extra charge related to the connection of Offshore Windfarms to the grid. According to a new law (NEMoG) effective since 1.1.2019 all offshore grid connection costs are included in this extra charge and are not included in transmission tariffs anymore. An average value for privileged consumer is considered here. It has to be mentioned, that all surcharges and levies related to the TSO business are reported as Non TSO costs here. Offshore Grid connection costs are included in this surcharge since 2019. However, offshore connections belong to the core TSO business. • For comparability reasons of the report all RES support should be included in the report. Therefore also the general RES-support mechanism (so called "EEG Umlage") is included in this section. However, the "EEG Umlage" in Germany is not and has never been a part of the regulated transmission activities and thus has never been included in the transmission tariffs invoiced by German TSOs. Costs of RES-support are allocated by German TSOs through a separate charge which does not include any TSO-costs. <p>The value given here is the average value for a privileged industrial consumer in Germany. The base case for the defined Unit Transmission Tariff is deemed to be a privileged consumer. As the pricing level of each individual consumer is based on an individual approval of the relevant public authority the average value is the best estimate for a comparison. Further information is publicly available under https://www.netztransparenz.de/de/EEG-Umlage</p>
	non-RES support mechanism	0.81	L	<p>Extra charge for costs according to the German law for Combined Heat and Power Production Promotion (According to an amendment to the law effective since 1.1.2017 an individual approval for privileged consumer will be applied. An average value for privileged consumer is considered.)</p> <p>+ costs according to the German Grid Tariff Regulation Ordinance</p> <p>+ extra charge related to the Ordinance on Interruptible Load Agreements</p>
Great Britain	non-RES support mechanism	0.36	L	Assistance for Areas with High Electricity Distribution Costs. The intention of the AAHEDC Scheme is to reduce the costs to consumers of the distribution of electricity in certain areas. Currently the only Specified Area is the North of Scotland. National Grid therefore recovers an Assistance Amount through the Scheme, which is passed to the Relevant Distributor in the Specified Area, Scottish Hydro Electric Power Distribution Ltd. This enables distribution charges to be reduced.
	NRAs/Other Institutions	0.05	L/G	NRA Licence Fees. G 13.20 % / L 86.80 %
Greece	RES support mechanism	0.00	L	In the non TSO related costs, costs related to RES payments used to be included because they were collected by ADMIE (as a pass through item) but since 2019 they are completely irrelevant to ADMIE while RES Operator is responsible for collecting these amounts
	non-RES support mechanism	0.00	L	In the non TSO related costs, costs related to Public Services obligations payments used to be included because they were collected by ADMIE (as a pass through item) but since 2018 they are completely irrelevant to ADMIE while DSO is responsible for collecting these amounts.
	NRAs/Other Institutions	0.07	L	Regulatory Authority Support Cost.

Country	Other regulatory charges not directly related to TSO activities			
	Cost item	Charge level (€/MWh)	Paid by	Description
Hungary	RES support mechanism	3.24	L	The Renewable Energy Sources (RES) support scheme has two component parts:
	1) Feed-in Tariff (FIT): generated electricity shall be purchased from FIT Balance Group Members at the regulated price. Total generated electricity volumes of the FIT Balance Group are auctioned on the Hungarian Power Exchange	2.22	L	Separate for Aid linked to the stranded costs of conversion of the cogeneration process.
	2) Feed-in Premium (FIP): Generated electricity is sold by the power plants themselves on the electricity market. Monthly ex-post market reference price (average price of HUPX) will be supplemented with the subsidised price.	0.22	L	Financial support for the provision of discount-rate electricity to personnel described in specific other legislation based on their previous or existing employment in the electricity industry.
Ireland	RES support mechanism	3.06	L	Separate for Aid linked to the stranded costs of conversion of the cogeneration process.
Italy	Others	4.57	L	This estimate includes other items that are not directly related to the Transmission activity (mainly aimed at providing system security), are paid by dispatching users (i. e. not directly invoiced to the final consumers) and are passthrough for the TSO
Luxembourg	RES support mechanism	0.75	L	The tax "Mécanisme de compensation" (0.75 €/MWh for customers ≥ 65 kW) serves to encourage and subsidize national energy production projects based on renewable sources or cogeneration
	non-RES support mechanism	0.10	L	The tax "Taxe Electricité" is used to finance the "Assurance dépendance". 0.50 €/MWh (consumers cat. B)* 0.10 €/MWh (consumers cat. C)** * Cat. B: consumers > 25 MWh, except belonging to cat. C ** Cat. C: consumers > 25 MWh, electricity mainly used for chemical reduction, electrolysis or in metallurgical processes.
Netherlands	NRA/Other Institutions	0.00	L	The costs of the NRA are included in the total costs and not separately recognised as a tariff.

Country	Other regulatory charges not directly related to TSO activities			
	Cost item	Charge level (€/MWh)	Paid by	Description
Poland	RES support mechanism	0.36	L/DSO	Connected with settlements with RES energy producers. Those costs are recovered by a RES charge in the Tariff. Charge rate is set annually by the NRA. TSO charges final consumers connected to transmission network and DSOs at any voltage level (then DSO charge their final consumers). For 2021 the RES charge is 2.20 PLN/MWh. For UTT calculation, the RES charge was calculated as the average for PSE end-consumers (their payments depends on electricity intensity ratio of PSE end-consumers).
	non-RES support mechanism	1.75	L/DSO	Connected with settlements with cogeneration producers. Those costs are recovered by a cogeneration charge in the Tariff. Charge rate is set annually by the Minister responsible for energy affairs. TSO charges final consumers connected to transmission network and DSOs at any voltage level (then DSO charge their final consumers). For 2021 the cogeneration charge is 0.00 PLN/MWh. Connected with capacity mechanism settlements. Those costs are recovered by a capacity charge in the Tariff. Charge rate is set annually by the NRA. TSO charges final consumers connected to transmission network and DSOs at any voltage level (then DSO charge their final consumers). For 2021 the capacity charge is 76.20 PLN/MWh. For UTT calculation, the capacity charge was calculated as the average for PSE end-consumers in Q4 2021 (their payments depends on difference between average hourly electricity consumption in peak and off-peak periods in working days).
	Stranded costs	0.10	L/DSO	Stranded costs i.e. cost resulting from compensations paid to energy producers for dissolving (early termination) long term energy sales contracts concluded in the past with a single buyer company. The long term contracts obliged energy producers to modernize their production units, adjusting them to environmental standards. Those costs are recovered by a transition charge in the Tariff. Charge rates are calculated by NRA. TSO charges final consumers connected to transmission network and DSOs at any voltage level (then DSO charge their final consumers).
Portugal	non-RES support mechanism	7.23	L	Capacity payments, Island's tariff convergence costs, Interruptibility
	NRA's/Other Institutions	0.17	L	Regulator costs
	Stranded costs	6.25	L	Surplus costs for the remaining Power Purchase Agreements (PPAs)
	Others	0.33	L	Hydro power station land
Romania	non-RES support mechanism	3.74	L	Mechanism designed to provide financial support to cogeneration plants.
Serbia	NRA's/Other Institutions	0.03	L	Tax for the financing of NRA (0.68 % of Transmission tariff)
Slovenia	RES support mechanism	1.35	L	Mechanism applied
	NRA's/Other Institutions	0.34	L	Component
	Others	0.80	L	Component
Spain	non-RES support mechanism	0.00	L	
	NRA's/Other Institutions	0.00	L	
	Others	0.00	L	
Switzerland	RES support mechanism	0.00	L	Surcharges for Feed-in remuneration (KEV) are charged by Pronovo.
	NRA's/Other Institutions	0.00	L	Costs billed to TSO by NRA and energy ministry are included in transmission tariff.

Country remarks regarding Finland, Hungary, Ireland and Spain are to be found in Appendix 1.

Table A.6. Other regulatory charges not directly related to TSO activities

Appendix 7:

First connection charges

The connection charges types are characterised by costs that are taken into account to calculate the connection charge. For the purpose of this Overview, first connection charges are defined as:

- › **Super-shallow:** All costs are socialised via the tariff, no costs are charged to the connecting entity;
- › **Shallow:** grid users pay for the infrastructure connecting its installation to the transmission grid (line/cable and other necessary equipment);
- › **Deep:** Shallow + all other reinforcements/extensions in existing network, required in the transmission grid to enable the grid user to be connected.

In case applied charging rules do not exactly suit any of the three above definitions, but are between any of them, it is reported as e. g. Super-shallow/Shallow, Shallow/Deep etc. with the corresponding explanation.

The table below summarises the main features of charging mechanisms in force for first connection to transmission grid.

Country	Charge Type	Description
Albania	Shallow/Deep	Charges are based on the actual costs.
Austria	Shallow/Deep	Shallow for generation, deep for consumers In form of an admission charge for compensating all direct costs arising from the connection, payed by consumers and generators. Consumers pay a second charge for past and future system developments (system provision) based on load: <ul style="list-style-type: none"> • Network Level 1 – 8.70 € / kW • Network Level 2 – 9.80 € / kW
Belgium	Mainly Shallow	<ul style="list-style-type: none"> • Onshore: Everything is socialised, except all installations between the grid user and the connection bay at the substation. • Offshore: idem. For offshore wind farms with direct onshore connection, a support mechanism foresees in an additional subsidy for the cable connection up to 25 M €.
Bosnia and Herzegovina	Shallow	Charges are based on the actual costs. No differentiation of charges for L, G and DSO. No locational differentiation.
Bulgaria	Shallow	The price for connection is paid by the user, for installations up to the point of connection. The price for reinforcement of the grid is paid by the operator. There is no any different treatment of users.
Croatia	Deep	G – pays for the infrastructure connecting its installation to the transmission grid and extensions in existing network L – pays according to formula $NVN = cVN \cdot P$ (capacity kW \times 1,350.00 HRK = 181.39 € / kW or actual costs if difference between formula and real costs is more/less than 20 %
Cyprus	Mainly Shallow	The connection cost includes all new infrastructure that will need to be built, up to the point of connection, e. g. a new substation and transmission line. No other costs are charged, e. g. for upgrading existing equipment further into the transmission network.
Czech Republic	Shallow	No locational differentiation. Connection fees: 10.056 € / MW for energy withdrawal (load) 24.940 € / MW for energy injection (generation)

Country	Charge Type	Description
Denmark	Super-shallow to partially Shallow	In some cases charges are calculated to a fictitious point that can be closer than the physical connection point. Charges are not differentiated for L, G or DSOs and there is no locational differentiation. In most cases the costs are socialised in the tariffs – if not the charges to the grid user are based on actual costs.
Estonia	Deep	Includes both the direct costs of building the connection equipment as well as the necessary reinforcements in the grid, if applicable.
Finland	Shallow	Standard fee based on average costs of connection infrastructure. No differentiation of charges for L, G, DSO. No locational differentiation.
France	Shallow	<ul style="list-style-type: none"> • G, L, DSOs: the connection is made to the nearest substation where the appropriate voltage level is available and where this connection is technically possible. No locational differentiation, charges based on actual costs. Generators pay 100 % of the cost, consumers pay 70 % of the cost of their main connection. Offshore wind generators (except floating ones) don't pay their connection cost which is borne by tariff payers. • RES: Upstream network development costs due to RES integration are pooled on a regional basis, via a regional share in k€/MW paid by RES in proportion to their maximum power.
Germany	Shallow to Super-shallow	Charging is generally based on actual costs. Grid users pay for their own connection line and substation. General reinforcements of the grid are socialised via tariffs. No differentiation of charges for L, G or DSO.
Great Britain	Shallow	This applies to both generation and load and means that Connection charges relate only to the costs of assets installed solely for, and only capable of use by, an individual user. All other assets are assumed to be shared and their costs are included in the wider locational transmission tariff.
Greece	Shallow	Grid users pay for the infrastructure connecting its installation to the transmission grid. The charge includes studies, materials check, construction, supervision and delivery costs. The costs depend on distance or voltage level and they differentiate according to the installation location characteristics (e. g. ground morphology) or any other special project requirements.
Hungary	Shallow/Deep	Charging is based on actual costs. Establishing a new connection for a generator incurs a maximum 100 % of investment costs charged, same for a single customer is a maximum 70 % of the investment costs or 1 million HUF/MVA (2,710 €/MVA, exchange rate: 369 HUF/€), whichever larger. Multiple generators and/or customers on the new connection are charged proportionally. No locational differentiation.
Iceland	Shallow/Deep	Charges are based on the actual costs and borne by the producer (G) or a power intensive user (L).
Ireland	Shallow	All connecting parties pay for the connection to the system (using a Least Cost Chargeable methodology). Demand customers only pay 50 % while generators pay 100 % of connection charges.
Italy	Shallow	<p>Connection of production plants – G: When first requesting the connection, applicants pay upfront Terna a fixed amount of 2,500 € to get a general appraisal of the possible connection solution (“STMG”). Once obtained the authorisation, applicants pay upfront Terna an amount of 2,500 € + 0.5 €/kW (max 50,000 €) for a more detailed project plan (“STMD”). Grid user bears costs for building the grid connection plant. Enhancements of the NTG are socialised in tariff. Reduced fees apply in case of connection of production plants powered by renewable sources and for high-performance co-generation plants.</p> <p>Connection of consumption units – L: Applicants pay Terna the same amounts foreseen for STMG and STMD of production plant and a connection fee equal to 50 % of the expenditure for building grid connection plant including cost of the materials and labour costs as well as overheads, assumed equal to 20 % of these amounts.</p> <p>Connection of DSO: The DSO/TSO that implements the connection plant recovers the incurred costs through tariff.</p>
Latvia	Shallow/Deep	Includes both the direct costs of building the connection equipment as well as the necessary reinforcements in the grid, if applicable.
Lithuania	Deep	100 % of all actual connection costs.

Country	Charge Type	Description
Luxembourg	Shallow	Grid users (L, G and DSO) pay the actual costs for their own connection line and substation. General reinforcements of the grid are socialised in the tariffs.
North Macedonia	Shallow	Grid user has to pay for its own connection line and substation, to meet security criteria.
Montenegro	Shallow	There is no difference in cost for L, G and DSO.
Netherlands	Shallow	The connection charge consists of the costs to connect the client's installation to the client's circuit end connecting to the TenneT station.
Northern Ireland	Shallow	Load and generation over 1 MW pay 100 % shallow connection costs. Connection costs will be based on out turn cost or a fixed quotation.
Norway	Shallow	Cost related "customer-specific" network facilities must be fully covered by the customer. The customer must pay a construction contribution when a new connection entails an investment in increased capacity in the transmission network. The contribution is calculated in accordance with the given regulations.
Poland	Shallow	The enterprise which is going to be connected pay for all the expenditures to build the connection site which contains the direct line and extension or rebuilding costs for the substation (if necessary) where connection takes place. The reinforcement and development of existing network is performed by TSO. Connection charges are: <ul style="list-style-type: none"> • Final customers (load) pay 25 % of total investment expenditures. • RES units of installed capacity < = 5 MW pay 50 % of total investment expenditures. • Co-generation units of installed capacity < = 1 MW pay 50 % of investment expenditures. Other generators and distribution companies pay 100 % of total investment expenditures. RES units of installed capacity < = 40 kW don't pay connection charges.
Portugal	Shallow/Deep	G, L: Shallow/Deep DSO: Super-shallow The grid user, either generator (G) or consumer unit (L), has to pay for the cost of the infrastructure needed to connect its installation to the transmission grid. In June 2019, according to Decree Law n° 76/2019 from 3 June, new access rules to connect renewable generation (G) to the grid were approved by the Portuguese government, namely rules to access to present existing reception capacity in the grid (i), capacity auctions (ii) and the possibility to make direct agreements to develop grid reinforcements between Promotors and TSO (iii) when there is not enough reception capacity. In case of (i) and (ii), G has to pay a grid co-payment to the system, according to Ordinance ERSE 10/2019 published by the Regulator. In case of (iii), when necessary new grid reinforcements are not included and approved in the NDP (National Development Plan), and new reinforcements are needed or the ones approved has to be anticipated, G must pay the needed grid reinforcements, according to a contract model approved by the Government. Internal reinforcement/expansion of the grid is endorsed to TSO's responsibility. L has also to pay a grid co-payment to the system, according to Ordinance ERSE 10/2019 published by the Regulator. For L, there is the obligation to connect, according to the Commercial Relationship Code. After built, the connection facilities (lines, cables, equipment at substations, etc.) will be integrated in TSO asset; thus TSO is in charge of their O&M costs. Concerning the DSO reinforcement needs (there is just one in Portugal) all the costs are socialised via the tariff. The charges are based on the actual costs and no locational differentiation is applied.
Romania	Shallow/Deep	Connection equipment: the connecting entity (generator/load) fully covers the cost of the equipment that connects their installation to the transmission grid. Upstream grid reinforcement: costs associated to upstream grid reinforcements required to safely connect new users (generators/loads) are: <ul style="list-style-type: none"> • shared between the TSO and generators connecting to the grid; • fully paid by the TSO (and therefore socialized across all transmission users through the transmission tariff) in case of loads connecting to the grid Connection charge is calculated based on actual costs (on a case by case basis). No differentiation between G and L users (besides the one described above i. e. G users pay for upstream grid reinforcement as opposed to L users in case of which potential needed grid reinforcements are funded by the TSO). No locational differentiation.

Country	Charge Type	Description
Serbia	Shallow/Deep	Shallow: generators and DSOs have to pay fee for financing of the connection lines aimed to fulfill grid security criteria (the most frequent case is the building of 'in-out' connection toward an existing line) and for substation. Deep: industrial customers have to pay the fee for the further network development if such is required. Connection fees are: 16,030 € per approved power in MW for 110 kV level, and 20,360 € per approved power in MW for 220 kV level. Note: generally, in 110 kV network, grid users keep ownership over 110/x kV substations..
Slovakia	Shallow to Super-shallow	Distribution companies pay 40 % of actual costs for the infrastructure connecting its installation to the transmission grid and 60 % of actual costs for the infrastructure connecting its installation to the transmission grid are socialised via the tariff of TSO (40 % Shallow and 60 % Super-shallow). Direct customers and generators connected on the TSO pay 100 % of actual costs for the infrastructure connecting its installation to the transmission grid (100 % Shallow).
Slovenia	Shallow	L: pays the costs of the first connection for power specified in permission of connection. G: pays the costs of the first connection in accordance of consumer power. DSO: does not pay any costs for the first connection. There is no locational differentiation. Charging is based on tariff charges.
Spain	Shallow	Promoter (generator or consumer) pays for the infrastructure necessary to be connected to the transmission grid. All reinforcements that are needed as a consequence of this new connection are included in the National Planning and thus socialised via tariffs.
Sweden	Deep	Generators or consumers connecting to the grid will pay costs related to this (lines, substations, ...)
Switzerland	Shallow	No first connection charge for assets which can be used by other grid users.

Table A.7. First connection charges

Appendix 8: Special tariffs

Special tariff conditions can exist in some countries e. g. :

- › Special tariff conditions for low utilisation (auto production or own production units behind the connection site, second connection used for emergency situations, pumping stations ...);
- › Special tariff conditions for high consumption (for instance over 100 GWh per year);
- › Special tariff conditions for users fulfilling defined technical criteria of its production/connection site;
- › Special tariff conditions for any group of users (e. g. any public utilities, army, etc).

The table below summarises different charging rules/tariff conditions or exemptions from rules defined as “standard” and applied by TSO’s for specific groups of network users.

Country	Special Tariff Conditions
Albania	There are no special tariffs.
Austria	1) For pump storage: the grid usage charge for pumped storage plants for all network levels is: <ul style="list-style-type: none"> • energy: 0.215 c€/ kWh; • power: 100.00 c€/ kW. 2) Reduced infrastructure tariff for negative Ancillary Services <ul style="list-style-type: none"> • called energy: 0.085 c€/ kWh • additional power: 100.00 c€/ kW.
Belgium	Three kinds of special tariffs exist: <ol style="list-style-type: none"> 1) For an “additional” access point for the same electrical facilities of a grid user, there is a special tariff for the term “power put at disposal”. The additional access point can be on an ongoing basis (standard operations) or on an occasional basis (as a reserve), with no time limit. 2) For the mobile charges of the railway company, the power terms are reduced by 7 %. 3) For access point to an electricity storage facility an exemption of 80% of the access tariff (excluding connection) exists, under certain conditions, for a period of 5 years.
Bosnia and Herzegovina	No
Bulgaria	No
Croatia	No
Cyprus	No
Czech Republic	No
Denmark	1) For grid companies with autoproducers with net settlement, an adjusted settlement basis is applied that takes into account that the autoproducers shall not pay a grid tariff or a system tariff for the part of their consumption that they cover by their own production. 2) Customers with their own 132 kV transformers with settlement on the 132 kV side pay a reduced grid tariff.
Estonia	No
Finland	No.

Country	Special Tariff Conditions
France	<ul style="list-style-type: none"> • Specific tariff for a second connection used for emergency situations. • Specific tariff for multi-locations customers. This tariff considers a unique virtual site, summing all load of the concerned sites, and calculating an annual fee proportional of the necessary length of network to connect these sites. • A DSO directly connected to the lowest voltage level of a transformer that belongs to the TSO can use the tariff of the highest voltage level of this transformer. • A DSO owning lines of the same voltage level as the lines of the TSO it is connected to benefits from a discount. • When the actual temperatures are very low compared to average temperatures, DSOs may benefit from a discount on their capacity overrun. • Occasional planned overrun of contracted capacity: a customer can benefit from a discount on its tariff during 2 weeks, provided it informs the TSO in advance. • Industrial customers connected to the transmission grid can benefit from a reduction of their transmission invoice from 50% to 81% depending on their demand (annual consumption, annual usage duration, usage duration during peak period vs. usage duration during off-peak period) or whether they have storage capabilities or not.
Germany	<ul style="list-style-type: none"> • Monthly power price: For final customers with a temporary high power consumption and an obvious lower or no power consumption in the remaining time, a monthly price instead of a yearly price for the power component is offered. • Individual tariff: For final customers with a peak load occurring at a different time period than the maximal power in the grid, an individual tariff is offered. The individual tariff must not be lower than 20 % of the published regular tariff. • Grid fee reduction: For Energy intensive customers (typically heavy industry customers) with energy consumption that exceeds 7,000 full load hours per year and 10 GWh there is a fee reduction. Depending on full load hours, the grid fee has to be at least 10, 15 or 20 % of the normal grid fee. • Grid fee exemption: For pump-storage power stations a grid fee exemption is possible for 10 years if the amount of storage-energy has increased by 5 % minimum. • The agreement on both for individual tariffs and grid fee reduction and exemption requires the approval of the regulator. • Grid fee reduction for customer with an exclusive usage of storage (not less than 20 % of yearly power price).
Great Britain	<p>Small Generators' Discount: 2.748 €/MWh (11.546 GBP/kW based on 5,000 hours utilisation) paid to < 100 MW generators connected to the transmission network at 132kV (primarily Scotland). Recovered through a charge on demand 0.167 €/MWh (0.701 GBP/kW based on 5,000 hours utilisation).</p>
Greece	No
Hungary	No

Country	Special Tariff Conditions
Iceland	<p>Interruptible load (curtailable transmission) Customers with curtailable transmission pay an energy charge but no capacity charge is levied and a 17 % discount is granted on the charge for ancillary services.</p> <p>Supply voltage discount A discount of 5 % is granted on the capacity charge and energy charge pursuant to where electricity is delivered to distributors at a nominal voltage over 66 kV.</p> <p>Delivery charge discount A discount is granted on the out-feed delivery charge if the maximum power out-feed is as follows: In the range of 3.0 – 6.0 MW the discount is 40 %. In the range of 1.0 – 3.0 MW the discount is 70 %.</p> <p>DSO Delivery charge discount Distribution system operators shall pay out-feed charges for electricity produced in power plants connected to Landsnet through a distribution system, as follows: 1) For energy produced in power plants under 1.42 MW, no out-feed charge is paid. 2) For electricity produced in power plants in the size range of 1.42 – 3.1 MW, no out-feed charge is paid at the lower limit of the range, but the charge then increases proportionally up to 60 % of the full out-feed charge at the upper limit. 3) For energy from power plants of 3.1 – 10 MW, 60 % of the full out-feed charge is paid.</p>
Ireland	Autoproducers pay capacity based TUoS charges on the greater of either their contracted Maximum Import Capacity or contracted Maximum Export Capacity, not both.
Italy	Energy withdrawals for generation plants auxiliary services and for hydro pumping storage plants are exempt (if specific predetermined conditions are met) from transmission and distribution fees.
Latvia	No
Lithuania	Zero transmission tariff in pumping mode for hydro pump power plant. Zero tariff for system services component for DSO grid losses.
Luxembourg	No
North Macedonia	No
Montenegro	No
Netherlands	There is a special tariff for users with a maximum of 600 hours. Furthermore there is a volume discount for users with a stable base load profile in peak hours.
Northern Ireland	No.
Norway	Power intensive load (Large consumption): Large consumption pays 50 % of withdrawal tariff. Definition large consumption: Load > 15 MW , Consumption pr year > 100 GWh..
Poland	<p>A final consumer is entitled to pay 10 % of the quality charge if in the preceding year he fulfilled the following technical and economic conditions:</p> <ul style="list-style-type: none"> • yearly consumption was not less than 400 GWh; • utilisation of the contractual power was not less than 50 %; • overall costs related to electric energy (purchase and transportation) constitute not less than 15 % of the total production costs. <p>A final consumer is entitled to pay 30 % of the transition charge (covering stranded costs) if in the preceding year he fulfilled the following technical and economic conditions:</p> <ul style="list-style-type: none"> • yearly consumption was not less than 400 GWh; • utilisation of the contractual capacity was not less than 60 %; • overall costs related to electric energy (purchase and transportation) constitute not less than 15 % of the total value of their production. <p>A final consumer is entitled to pay: (i) 80 % or (ii) 60 % or (iii) 15 % of the RES charge or cogeneration charge if its electricity intensity ratio is respectively: (i) not lower than 3 % and not higher than 20 % or (ii) higher than 20 % and not higher than 40 % or (iii) higher than 40 %. Electricity intensity ratio is calculated as share of costs of electricity consumed for own use (cost of electricity, including the cost of fulfilling the RES obligations and the cost of all the network charges) in gross value added. The ratio is calculated as the arithmetic average of the three years preceding the year of obligation. If the business is conducted by less than 3 years, the period of business activity should be taken into account.</p> <p>Since October 2021, a final consumer is entitled to pay: (i) 83 % or (ii) 50 % or (iii) 17 % of the capacity charge if its difference between average hourly electricity consumption in peak and off-peak periods in working days is respectively: (i) not lower than 10 % and lower than 15 % or (ii) not lower than 5 % and lower than 10 % or (iii) lower than 5 %. The above difference is calculated on the basis actual data, and for each month separately.</p>

Country	Special Tariff Conditions
Portugal	Social tariff for vulnerable customers (domestic consumers with a contracted power less than 6.9 kVA, who benefit from social insertion income, invalidity and old age social pension). For 2020, the discount is 1.24 €/kVA at the fixed term of the access tariffs.
Romania	No. Small-sized generators (generators with installed capacity of up to 5 MW) are not subject to grid charges.
Serbia	For railways power is charged by total maximum demand, not by maximum demand per substation. Pump storage HPP are not subject of transmission tariff for load they consume. Generator's ancillary supply is subject of transmission tariff but only for its active energy part.
Slovakia	Consumers connected directly to transmission system pay in 2020: <ul style="list-style-type: none"> • Tariff for system services discounted by 95 % if their utilisation of maximum contractual capacity in 2018 were higher than 6,800 hours (average utilisation of the contractual capacity was not less than 77.63 %) and perpetual deviation of the subject of settlement was lower than 0.025. • Tariffs for access to transmission system and its management: <ul style="list-style-type: none"> • discounted by 30 % if their maximum contractual capacity in 2021 is higher than 200 MW and their energy supplied over transmission system in 2019 was higher than 1 TWh, • discounted by 50 % if their maximum contractual capacity in 2021 is higher than 250 MW and their energy supplied over transmission system in 2019 was higher than 2 TWh, • discounted by 70 % if their maximum contractual capacity in 2021 is higher than 350 MW and their energy supplied over transmission system in 2019 was higher than 2.5 TWh.
Slovenia	No
Spain	For 2020 the previous special tariff applied for pump-hydro stations has changed. From 2020 onwards this type of plants and storage devices will not pay access tariffs.
Sweden	No
Switzerland	Bundling of connection point for national railway operator (SBB).

Table A.8. Special tariffs

Appendix 9: Treatment of Final Customers vs Distribution System Operators

Both DSOs and final customers are seen as Load (L) from TSO's perspective.

There might be different tariffs, charges calculation procedures or settlement rules for final customers and distribution system operators. Justification for different treatment might be the load volume of a given network user, the number of connection points to the transmission grid (simultaneous off-take), the network configuration conditions and the co-operation scheme of DSOs with the TSO (often DSOs' network plays a role of sub-transmission grid).

The table below summarises the main features of different treatment/charging mechanisms of final customers and distribution system operators per TSO.

Country	Different treatment between final customer and distributor	Difference from the total charge applied to the base case scenario (%)
Albania	No	0 %
Austria	No	
Belgium	Yes	The limit value for capacitive reactive power for DSOs is 5 Mvar for the voltage levels 132 – 50 kV, whereas for final customers the limit value is 2.5 Mvar for the same voltage levels.
Bosnia and Herzegovina	No	
Bulgaria	No	
Croatia	Yes	TSO charges only transmission fees for customers connected directly to TSO network. For customers connected directly to distribution network, transmission fee is collected by DSO and transferred to the TSO.
Cyprus	No	
Czech Republic	No	
Denmark	No	The TSO does not charge the customer directly. It is the electricity supplier that charge the customers.
Estonia	No	
Finland	No	
France	Yes	<ul style="list-style-type: none"> • A DSO directly connected to the lowest voltage level of a transformer that belongs to the TSO can use the tariff of the highest voltage level of this transformer. • A DSO owning lines of the same voltage level as the lines of the TSO it is connected to benefits from a discount. • When the actual temperatures are very low compared to average temperatures, DSOs may benefit from a discount on their capacity overrun.
Germany	No	
Great Britain	No	
Greece	No	

Country	Different treatment between final customer and distributor	Difference from the total charge applied to the base case scenario (%)
Hungary	Yes	<p>The transmission tariff is regulated by the type of customers as well. Distributors pay the same tariff as the base case customers to MAVIR. The customers who connect to the transmission system through a HV not larger than 132 kV pay a 8.07 % higher amount. It means that the final customers pay a slightly higher tariff on average than the distributors.</p> <p>Thus:</p> <p>Transmission charge for base case customers: 7.552846 €/MWh</p> <p>Transmission charge for customers connecting not higher than 132 kV: 8.162602 €/MWh</p> <p>Transmission charge for distributors: 7.552846 €/MWh</p>
Iceland	No	
Ireland	No	
Italy	Yes	<p>LV, MV, HV, EHV final users (different from LV domestic users) pay Distributors the "TRAS component" covering transmission costs.</p> <p>The TRAS component is split into two different subcomponents:</p> <ul style="list-style-type: none"> • TRASE: energy (volume) component, in "cent. €/kWh" → it is applied to LV, MV, HV, EHV users; • TRASP: power (capacity) component, in "cent. €/kW" → it is applied to HV, EHV users. <p>LV domestic users pay Distributors a different tariff component (TD) structured in three different subcomponents (a.k.a. "sigma" components).</p> <p>Distributors pay to the TSO the "CTR components" (infrastructure component of Transmission Tariff) for power and energy withdrawal from NTG. The CTR component is split into two different subcomponents:</p> <ul style="list-style-type: none"> • CTRE: energy (volume) component, in "cent. €/kWh" → it is applied to the sum of the energy withdrawn from NTG and the energy injected in the "NTG virtual interconnection points" (i. e. the energy injected in the distribution grid at HV level); • CTRP: power (capacity) component, in "cent. €/kW per year" → it is applied to the interconnection capacity between NTG and distribution grid withdrawn from the NTG.
Latvia	No	
Lithuania	No	
Luxembourg	No	
North Macedonia	No	
Montenegro	No	TSO charges only transmission fees for customers connected directly to TSO network. Customers who are not directly connected to TSO network, transmission fee is collected by DSO.
Netherlands	No	
Northern Ireland	No	
Norway	No	
Poland	No	<p>There is no differentiation between final consumers and distributors but between kinds of points of delivery (PoD). There are two different rates for access to the transmission network: one called "final" PoD (where end consumption is connected) and other called "network" PoD (which are PoD of DSOs having more than two PoDs, and these PoDs are nodes of meshed distribution network 110 kV).</p> <p>In final PoD contractual capacity is reserved by and extra charges applied in case of exceeding, in network PoD contractual capacity is determined based on actual energy flows, no extra charges in case of exceeding.</p> <p>The total charge (without non-TSO charges) for users connected in "final PoDs" amounts to 68 % of the charge paid by DSO in "network PoDs".</p>
Portugal	No	
Romania	No	
Serbia	No	
Slovakia	No	
Slovenia	No	
Spain	Yes	DSOs do not pay access tariffs. Instead, access tariffs paid by users include network costs not only at their voltage level but also costs of networks at higher voltages, including transmission networks.
Sweden	No	
Switzerland	No	

Table A.9. Treatment Final Customers vs Distribution System Operators

Appendix 10: Reactive Energy

In some countries, charges for reactive energy are applied.

The tariff rates may be applied to every MVarh of measured reactive energy or only under pre-defined conditions.

Two charging schemes for reactive energy exist:

- › **Reactive Tariff:** A regular tariff rate is applied to each MVarh of reactive energy produced and/or consumed.
- › **Penalty:** Reactive energy produced and/or consumed is charged only if some pre-defined conditions are met. Examples can be excesses of energy off-taken/fed-in during a given period or excess levels of $\cos \varphi$ or $\text{tg } \varphi$.

The table below summarises main features of charging mechanisms applied by TSO's for reactive energy for users connected to transmission network.

Country	Reactive Tariff Y/N	Penalty Y/N	Quantity / Conditions of application
Albania	No	No	
Austria	No	No	
Belgium	No	Yes	<p>In case the offtaken active energy does not exceed, on a quarterly basis, 10 % of the yearly peak in a given offtake point, the offtake of additional reactive energy is defined in respect of 32.9 % of the 10 % of the yearly peak in this offtake point.</p> <p>The tariff for the offtake of additional reactive energy is function of the exceeding level. Zone 1 starts for the quarter-hourly deliveries of reactive energy exceeding $\text{tg } \varphi = 0.329$ for each offtake point. Zone 2 starts for the quarter-hourly deliveries of reactive energy exceeding $\text{tg } \varphi = 0.767$ for each offtake point.</p> <p>In case the capacitive reactive power of the customer being in offtake regime doesn't exceed the following limit values, penalty for supplementary deliveries of reactive energy equals 0 €/ Mvarh.</p> <p>Voltage level (kV) // Limit values capacitive reactive power (Mvar):</p> <p>400 – 380 // 9</p> <p>220 – 150 // 9</p> <p>132 – 50 // 2.5</p>
Bosnia and Herzegovina	No	No	
Bulgaria	No	Yes	<p>Different rules for injected and consumed reactive power are imposed to consumers and DSOs. The consumed reactive power for which the penalty is imposed to consumer is calculated on the basis of a formula:</p> $E_{rp} = E_{rconsumed} - 0.49 \times E_{aconsumed}$ <p>where E_{rp} is the quantity of reactive power for which penalty is imposed, $E_{rconsumed}$ is the consumed reactive power for an 15 min interval, 0.49 is a coefficient, adequate to a power factor 0.9, $E_{aconsumed}$ is a quantity of active power consumed for a 15 min interval.</p> <p>The formula for DSOs is the same, but $E_{rconsumed}$ and $E_{aconsumed}$ are replaced by $E_{rtransmitted}$ and $E_{atransmitted}$ (transmitted energy from transmission to distribution network).</p> <p>The penalty for consumed (transmitted) reactive power is 10 % of the wholesale price of the active power. The penalty for injected reactive power is 100 % from the wholesale price of the active power.</p>

Country	Reactive Tariff Y/N	Penalty Y/N	Quantity/Conditions of application
Croatia	No	Yes	There is tariff for excess reactive energy. It is paid monthly according to metered consumption. Tariff for excess reactive energy is 0.0212 €/kvarh. It is paid by L directly connected to the 110 kV transmission network.
Cyprus	No	No	
Czech Republic	No	No	
Denmark	No	No	
Estonia	Yes	No	1.54 €/Mvarh.
Finland	Yes	Yes	The new reactive power tariff was introduced in the beginning of 2017.
France	No	Yes	From 01/11 to 31/03, from Mondays to Saturdays and from 6 h to 22 h, if the connection point is withdrawing reactive energy from the grid and reactive energy is larger than 0.4 * active energy, the customer pays 10.3 €/MVar.h for the excess reactive energy withdrawn. If the customer is a DSO, the 0.4 factor is defined on a per connection point basis. From 01/04 to 31/10, if the customer is injecting reactive energy into the grid above a certain level (Qf) and is injecting active energy or is withdrawing active energy below a certain level, the customer pays 0.9 €/MVar.h for reactive energy injected in excess of Qf.
Germany	Yes	Yes	Charging schemes for reactive energy are not equally applied due to different contractual arrangements between TSOs and customers. In particular circumstances customers are charged for reactive power usage (charge up to 9.20 €/Mvarh). Power Plants are reimbursed for the provision of reactive power.
Great Britain	No	No	
Greece	No	No	
Hungary	No	No	
Iceland	No	Yes	Landsnet's tariff scheme assumes a minimum average power factor of $\cos \varphi = 0.9$ at the out-feed for distribution system operators and for power intensive users, at each point of delivery.
Ireland	Yes	Yes	Generator Performance Incentives. Reactive Power Leading/lagging 0.32 €/Mvarh.
Italy	No	Yes	A charge in c€/kvarh is applied for reactive energy (inductive) withdrawn from the transmission/distribution grids where $\cos \varphi$ exceeds a set threshold. $\cos \varphi$ is calculated for each connection point unless there is a HV distribution connection between points; in such a case $\cos \varphi$ is calculated on the aggregation of connection points. In both cases a charge is applied as a function of: <ul style="list-style-type: none"> the ratio of reactive to active energy, the relevant time slot (F1, F2 or F3) and it is between 0 and 1.1 c€/kvarh. Then DSOs pay Terna for reactive energy withdrawn from the transmission grid and Terna pays DSOs for reactive energy withdrawn from the distribution grid. The difference paid/received by Terna increases/decreases the amount of the ancillary services. There is also a charge paid to DSOs by final consumers for reactive energy withdrawn from the distribution above a set $\cos \varphi$ threshold (charge is between 0 and 1.1 c€/kvarh for final customers HV/EHV).
Latvia	Yes	No	Reactive power tariffication between TSO and DSO not applied in Latvia.
Lithuania	Yes	No	Applied to all consumers for each connection point: 0.83 €/Mvarh for consumption and 1.46 €/Mvarh for generation of reactive energy.
Luxembourg	No	No	
North Macedonia	Yes	Yes	Allowed $\cos \varphi = 0.95$. Price Q = 1.1 €/Mvarh
Montenegro	Yes	No	Direct users on 110 kV transmission grid are charged for reactive energy. Excessive take-on of reactive power will be collected from direct users, at different prices depending on the technological procedure that the user is conducted, and it is 23 % of the cost of active energy.

Country	Reactive Tariff Y/N	Penalty Y/N	Quantity / Conditions of application
Netherlands	No	No	
Northern Ireland	Yes	Yes	Leading Lagging Charges included in Generator Performance Incentives. Reactive Power Leading 0.32 €/ Mvarh. Reactive Power Lagging 0.32 €/ Mvarh. See Other System Charges in Statement of Charges.
Norway	Yes	No	Reactive power that is detrimental to the system will be invoiced to the customer.
Poland	No	Yes	<p>PSE S.A. apply penalties for excess reactive power by final consumers connected to transmission network in nodes where end consumption is connected and DSOs having only one connection point.</p> <p>The penalty is calculated for each MVahr of passive energy taken-off the HV and EHV network when phase factor $\text{tg}\varphi$ is above 0.4 and for each MVahr of passive energy fed into the transmission network regardless the value of phase factor.</p> <p>The charge for excess take-off passive energy (above $\text{tg}\varphi = 0.4$) is calculated according to the following formula:</p> $O_b = k \times C_{rk} \times \left(\sqrt{\frac{1 + \text{tg}^2 \varphi}{1 + \text{tg}^2 \varphi_0}} - 1 \right) \times A$ <p>where:</p> <p>k – coefficient equal 0.5, C_{rk} – unit price of active energy, $\text{tg}\varphi$ – measured value of phase factor in period used for settlement of the charges for excess take-off of passive energy, $\text{tg}\varphi_0$ – value of phase factor = 0.4 determined in a Agreement between PSE S.A. and customer, A – amount of active energy taken-off the transmission network by customer in a settlement period.</p> <p>The charge for passive energy fed into transmission network (capacity reactive energy) is calculated as a product of the amount of passive energy, the price of active energy C_{rk} and coefficient k = 0.5.</p>
Portugal	Yes	Yes	<p>Penalty: The Inductive reactive energy supplied by the transmission network outside the off-peak hours, is charged as follows:</p> <p>7.623 €/ Mvarh, if $0.3 < \text{tg}\varphi < 0.4$ 23.1 €/ Mvarh, if $0.4 < \text{tg}\varphi < 0.5$ 69.3 €/ Mvarh, if $\text{tg}\varphi > 0.5$</p> <p>Tariff: The reactive energy received by the transmission network in the off-peak hours, is charged to 17.3 €/ Mvarh.</p>
Romania	Yes	Yes	<p>Rate applied is 16.68 €/ Mvarh (calculated as 30 % of the estimated price of electricity purchased by the TSO to offset network losses).</p> <p>Charged to both G and L. Both capacitive and inductive.</p> <p>If $\cos \varphi < 0.65$ the penalty applied is three times the reactive tariff for:</p> <ul style="list-style-type: none"> Recorded capacitive energy Inductive energy with the difference between the consumed reactive energy and the related reactive energy for $\cos \varphi = 0.9$.
Serbia	Yes	Yes	All users on transmission grid except generators, PSPP and auxiliary power for power plants are charged for reactive energy. If consumed reactive energy exceeds level of $\cos \varphi = 0.95$ the charge for the exceeding reactive energy is double. The base reactive energy tariff is 1.6516 €/ Mvarh. The reactive energy tariff for $\cos \varphi < 0.95$ is 3.3033 €/ Mvarh. These tariffs are applied both to capacitive and inductive reactive energy.
Slovakia	No	No	
Slovenia	No	Yes	<ol style="list-style-type: none"> The charges are applied to L and DSO. In case of $\cos \varphi < 0.95$ inductive and capacitive. There is no differentiation about voltage levels, time/period (15 min) and location. The charges are applied for all connection points of given user. The rate applied is 3.348 €/ Mvarh.

Country	Reactive Tariff Y/N	Penalty Y/N	Quantity/Conditions of application
Spain	Yes	Yes	A charge in €/Mvarh is applied to the reactive energy consumption exceeding 33% of the active energy consumption. Applicable to consumers connected above 1 kV. With few exceptions, this charge is the following for all tariff periods: (i) for $0.80 \leq \cos \varphi < 0.95$, 0.041554 €/kvarh; (ii) for $\cos \varphi < 0.80$, 0.062332 €/kvarh. (Resolución de 18 de marzo de 2021, de la Comisión Nacional de los Mercados y la Competencia, por la que se establecen los valores de los peajes de acceso a las redes de transporte y distribución de electricidad de aplicación a partir del 1 de junio de 2021.).
Sweden	No	No	
Switzerland	Yes	Yes	13.31 €/Mvarh to be paid for individual use of reactive energy, 2.89 €/Mvarh premium for delivery of reactive energy.

Table A.10. Reactive Energy

Appendix 11: Netting of flows for the application of transmission tariffs

When there is a situation of connected generation and load at the same connection point to the grid, those cases can be treated differently in transmission tariff settlement.

One example of such case is connection of thermo generation units, where there are both directions of energy flows possible – injection of energy to the grid during regular generator operation, and extraction of energy from the grid when generator is down or during preparatory regime for the operation.

Second possible example is the situation when grid user is having generation and another separate load connected to the same substation bus bars, acting as connection point. In this case energy can flow from user's generation to user's separate load via substation bus bars, without actually entering the grid.

The overview of particular national treatment of such situation is presented in the following table:

Country	Only G is considered in the settlement	Only L is considered in the settlement	G and L are treated separately in the settlement	Netting between G and L is performed in the settlement, and tariff for predominant value is applied	Time frame used for netting (in min.)	Such cases are not existing or not allowed in the grid
Albania						X
Austria			X			
Belgium				X	15 Min	
Bosnia and Herzegovina			X			
Bulgaria			X			
Croatia		X				
Cyprus						X
Czech Republic		X				
Denmark				X	60 Min	
Estonia		X				
Finland				X	60 Min	
France				X	10 Min	
Germany		X				
Great Britain			X			
Greece		X				
Hungary		X				
Iceland		X				
Ireland						X

Country	Only G is considered in the settlement	Only L is considered in the settlement	G and L are treated separately in the settlement	Netting between G and L is performed in the settlement, and tariff for predominant value is applied	Time frame used for netting (in min.)	Such cases are not existing or not allowed in the grid
Italy						X
Latvia		X				
Lithuania				X	60 Min	
Luxembourg		X				
North Macedonia		X				
Montenegro			X			
Netherlands		X				
Northern Ireland						X
Norway			X			
Poland				X	60 Min	
Portugal			X			
Romania			X			
Serbia			X			
Slovakia			X			
Slovenia		X				
Spain			X			
Sweden				X	60 Min	
Switzerland						X

Country remarks regarding Italy, Poland, and Portugal are to be found in Appendix 1.

Table A.11. Netting of flows for the application of transmission tariffs

Appendix 12: Exchange rates

For countries for which currency is not €, the tariff figures in this report were converted into € by using the exchange rate dated 31 December 2021.

The table below summarises exchange rates applied.

Country	Exchange rate
Albania	1 ALL = 0,008281 €
Bosnia and Herzegovina	1 BAM = 0.511292 €
Bulgaria	1 BGN = 0.510000 €
Croatia	1 HRK = 0,133028 €
Czech Republic	1 CZK = 0,040225 €
Denmark	1 DKK = 0,134460 €
Great Britain	1 GBP = 1,190080 €
Hungary	1 HUF = 0,002710 €
Iceland	1 ISK = 0,006775 €
North Macedonia	1 MKD = 0,016226 €
Northern Ireland	1 GBP = 1,190100 €
Norway	1 NOK = 0,100110 €
Poland	1 PLN = 0.217420 €
Romania	1 RON = 0,202098 €
Serbia	1 RSD = 0.0085 €
Sweden	1 SEK = 0,093000 €
Switzerland	1 CHF = 0,964600 €

Table A.12. Exchange rates

Glossary of terms

Active and Reactive Power	The instantaneous power can be decomposed into two time-varying functions: (i) the real or active power (P), which is measured in watts (W) and is always positive (or zero); and (ii) the reactive power (Q), which is measured in voltamperes reactive (vars) and has an average value of zero. The real or active power P represents the useful power being transmitted. The reactive power Q is capable of no useful work, but is required to control system voltages within adequate ranges for the reliability of the power system.
Black-Start	Black-Start is the procedure of reestablishing the electricity supply within a control area after a total disruption of the supply.
Cross-border congestion	Situation in which an interconnection linking national transmission networks cannot accommodate all physical flows resulting from international trade requested by market participants, because of a lack of available capacity of the interconnectors and/or the national transmission systems concerned.
Depreciation	TSO Investment costs (sometimes referred to as Capital Expenditures or CAPEX) are not charged to the users at the same time they are incurred. Instead, TSO investment costs are distributed over a regulated useful lifetime of the asset. Depreciation is the annual result of that distribution. Depreciation is charged to users through tariffs, thus allowing the TSO to recover its investment and renew the assets once they are completely depreciated.
Energy-related component	Components of charges allocated to energy (expressed in MWh) consumed, off-taken or injected (consumption and off-taken energy can be different in the case where generation is connected on the same transmission access point)
First Connection charges	Charges borne by new grid users (producer or consumer) aiming to connect to the transmission grid, consisting of TSO's costs for the build of the transmission facility to enable the connection.
G component	Transmission tariff component applied to energy injected into the grid (generation).
Internal congestion	Situation in which an internal national transmission network cannot accommodate all physical flows resulting from internal trade requested by market participants, because of a lack of capacity of the internal transmission system concerned.
ITC	The Inter TSO Compensation Agreement is a multiparty agreement concluded between ENTSO-E, ENTSO-E member countries. It is designed to compensate parties for costs associated with losses resulting with hosting transits flows on networks and for the costs of hosting those flows.
L component	Transmission tariff component applied to energy off-taken from the grid (load).
Locational signals	Tariff signals designed to promote the efficient location of generation and consumption.
Losses	The energy losses that occur in the transmission system as a result of the system operating conditions (MW and Mvar flows, Voltage levels, system topology, etc.).
OPEX	Operating Expenses needed to operate TSO assets (maintenance costs, staff costs, etc).
Other Regulatory Charges	Charges resulting from provisions imposed by national laws or regulations that are recovered or invoiced by TSOs, but are not directly related to TSO activities. Examples of costs recovered through these types of charges might include: stranded costs, costs of supporting renewable or cogeneration energy production, regulatory levies, Public Service Obligation costs, etc.

Power-related components	Components of charges allocated to contracted power and/or peak power (expressed in MW) which consumed, off-taken or injected.
Primary Reserve	Power which is reserved to respond to frequency changes and which have a very fast response time.
Public Service Obligation	<p>Public Service Obligations (PSOs) are compulsory services that regulators or governments may apply to companies in the public interest.</p> <p>The transmission system operator and grid owners may be subject to a number of PSOs, such as supply security; payment of subsidies for environmentally-friendly electricity; and research and development of environmentally-friendly production technology, etc.</p>
Return on capital	It is the regulated revenue that allows the TSO to be remunerated for investments. It is charged to users through tariffs.
Stranded costs	Costs incurred in the past by a stakeholder that, after the introduction of some policy change, are considered as not recoverable. In some jurisdictions, the regulator may allow stranded costs to be charged through transmission tariffs.
Seasonal/Time-of-day differentiation	Variation of tariff rates depending on the time of use. Tariffs may vary according to seasons, daily demand profiles, holiday periods, and peak usage times for example.
Secondary reserves	Power which is reserved to respond to frequency changes and which have a higher time of response than primary reserves.
System balancing	System service which involves activating secondary and tertiary reserves for correcting in real time energy deviations from the values specified in contractual schedules of market participants.
System Services or Ancillary Services	Ancillary service means a service necessary for the reliable operation of a transmission or distribution system. Depending on the jurisdiction, the ancillary services may include spinning reserves, frequency reserves, voltage control, black start, etc.
Tertiary reserve	Power available from generators which is reserved to respond to frequency changes which are manually activated.
Unit Transmission Tariff	It is the transmission tariff that is built specifically for the analysis carried out in this Overview. For each country, the Unit Transmission Tariff (UTT) is computed under the hypothesis of a pre-defined "base case" which is described in Section 3.
Transmission Voltage levels	Voltage levels of transmission networks vary across ENTSO-E members, especially the lowest voltage level classified as "transmission". However, in all Member States the voltage levels of 220 kV and above are included as transmission network.
Voltage Control	Voltage Control means the control actions designed to maintain the set voltage level or the set value of Reactive Power.

Drafting team:

Drafting team: Igor Jurišević (Serbia), Konrad Godzisz (Poland), Evdoxia Koutsoula (Greece), Ketil Røn (Norway), Martin Sekač (Czech Republic), Benedikt Stöfl (Germany), Nathan Appleman (ENTSO-E).

Bastian Henze (Convenor, Germany), Artur Kurti (Albania), Lukas Mader (Austria), Alexandre Duquesne (Belgium), Aleksandar Miliša (Bosnia and Herzegovina), Viktoria Popovska (Bulgaria), Krešimir Šušnić (Croatia), George Economou (Cyprus), Kasper Bjornlund Krogshave (Denmark), Riina Kai (Estonia), Rami Saajoranta (Finland), François Regairaz (France), Izabela Netkova (North Macedonia), Justus Irmen (Germany), Benedikt Fiedler (Germany), Christian Parsons (Great Britain), Lajos Ravasz (Hungary), Svandís Hlin Karlsdóttir (Iceland), Utkarsh Agarwal (Ireland), Luigi Mauro (Italy), Mara Grava (Latvia), Darius Zagorskis (Lithuania), Marc Schintgen (Luxemburg), Željko Adžić (Montenegro), Ruben van Bruggen (Netherlands), Stephen McClure (Northern Ireland), Gro Ballestad (Norway), Paula Almeida (Portugal), Felix Ciorbagiu (Romania), Jan Orac (Slovakia), Mojca Cafuta Dežman (Slovenia), Patricia Bonet Cifuentes (Spain), Sophie Balint (Sweden), Avni Maxhara (Switzerland).

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ENTSO-E AISBL
8 Rue de Spa | 1000 Brussels | Belgium
www.entsoe.eu | info@entsoe.eu

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