ENTSO-E

Overview of Transmission Tariffs in Europe: Synthesis 2022

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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

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

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 consider 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 characterised by a pre-defined voltage level to which load and generation are connected, and pre-defined power demand and utilisation 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 2022 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 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 2022:

	2022	real change 2022/2021
Average European UTT	13.47 €/MWh	−0.57 %
• Due to TSO Costs	12.15 €/MWh	+12.89 %
• Due to Non-TSO Costs	1.32 €/MWh	−52.60 %

See Country remarks for details of the UTT changes. When annual changes exceed 15 % compared to last year, reasons are provided.

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

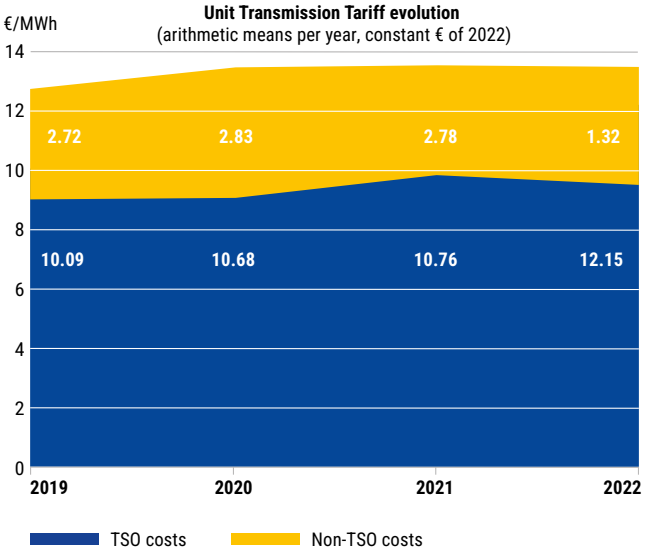


Figure 1.1: Evolution of UTT from 2019 – 2022

On average, in 2022 the TSO cost component of the UTT is divided 47.2 % for the infrastructure, 34.3 % for the system services and 18.5 % for the losses. On average, 65.8 of the TSO cost components is invoiced based on energy (i. e. on a volume, or MWh basis), while 34.2 % 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 19 countries, whereas in 18 countries only load is charged. The average of the TSO part of the UTT is 11.20 €/MWh for load and 1.23 €/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 must 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 consider 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, 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 2022. 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.

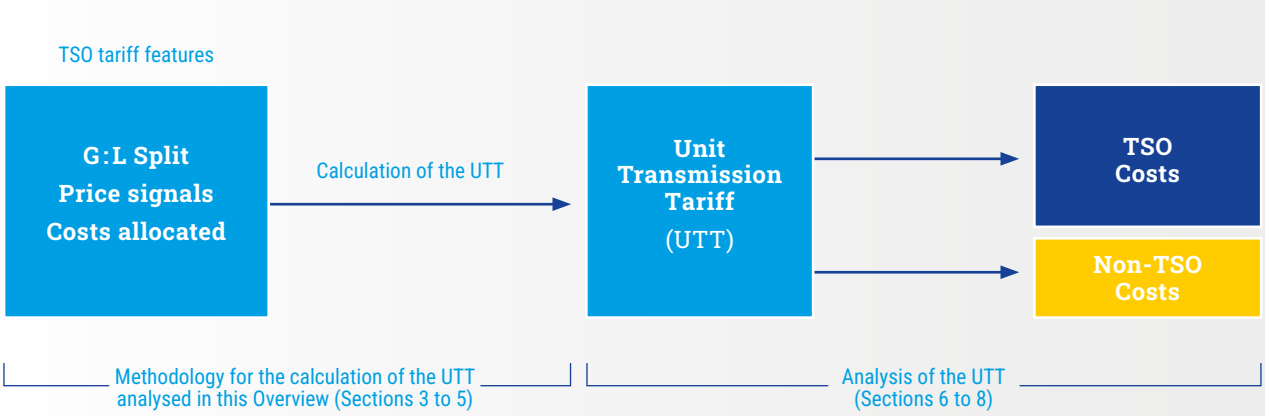


Figure 2.1: Summary of document structure

3 Methodology

The main purpose of this ENTSO-E overview is to present a comparison of calculated 2022 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), 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.

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) 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 Eurozone, local currency exchange rates as of 31st December 2022 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:

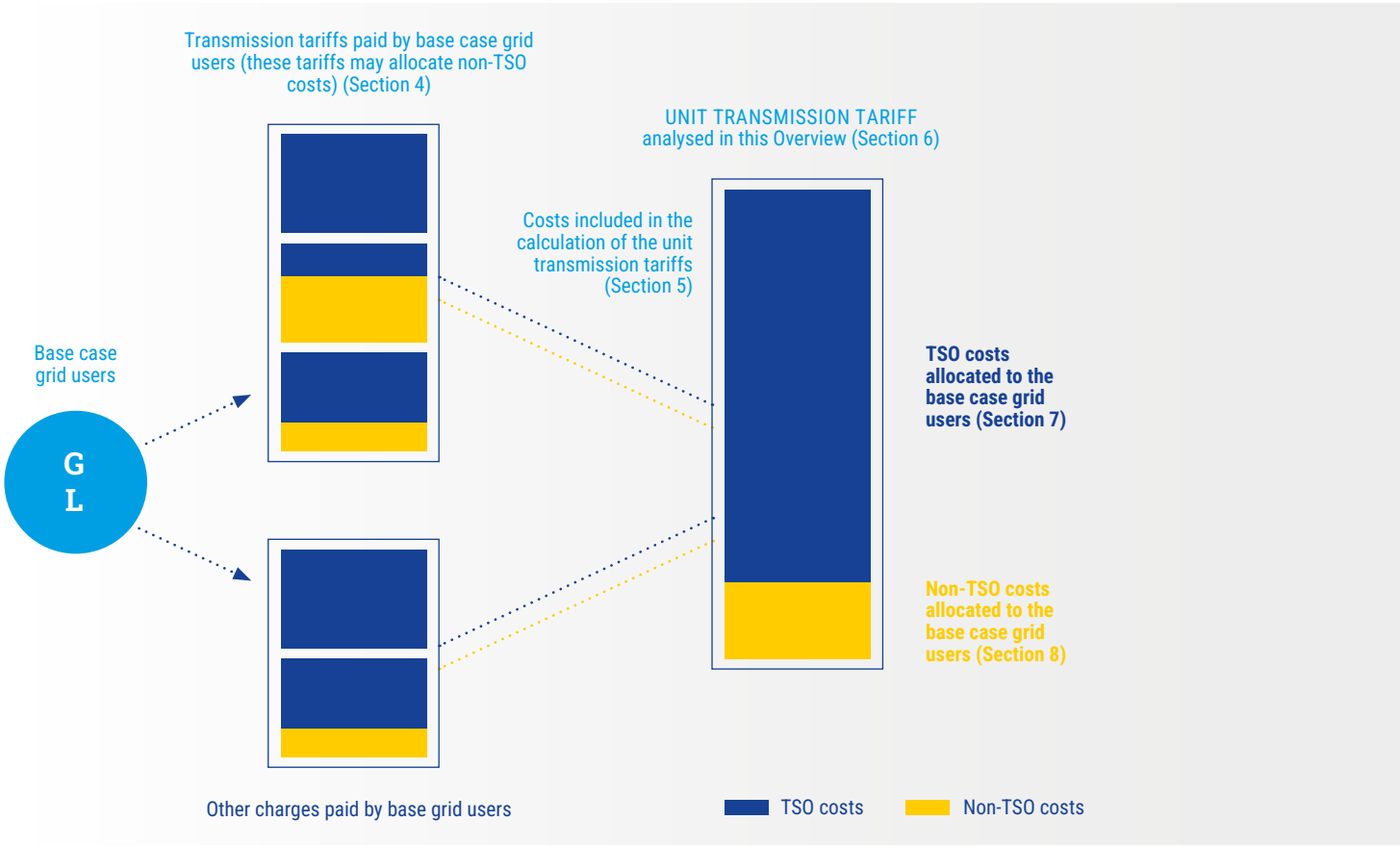


Figure 3.1: Methodology

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%	X	No	Yes	Yes
Austria	11.0%	89.0%	No	No	Yes	Yes
Belgium	11.81%	88.19%	X	No	Yes	Yes
Bosnia and Herzegovina	0.3%	99.7%	No	No	Yes	Yes
Bulgaria	19.0%	81.0%	No	No	Yes	Yes
Croatia	0.0%	100.0%	X	No	Yes	Yes
Cyprus	0.0%	100.0%	X	No	Yes	Yes
Czech Republic	0.0%	100.0%	No	No	Yes	Yes
Denmark	2.85%	97.15%	No	No	Yes	Yes
Estonia	0.0%	100.0%	XX	No	Yes	No
Finland	26.9%	73.1%	X	No	Yes	Yes
France	2.1%	97.9%	XXX	No	Yes	Yes
Germany	0.0%	100.0%	No	No	Yes	Yes
Great Britain	37.0%	63.0%	XXX	Yes	No	Yes
Greece	0.0%	100.0%	XX	No	No	Yes
Hungary	0.0%	100.0%	No	No	Yes	Yes
Iceland	8.76%	91.24%	X	No	Yes	Yes
Ireland	25.0%	75.0%	X	Yes	No	Yes
Italy	0.0%	100.0%	X	No	Yes	Yes
Latvia	3.0%	97.0%	No	No	Yes	Yes
Lithuania	0.0%	100.0%	X	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	37.73%	62.27%	X	No	Yes	Yes
Netherlands	0.0%	100.0%	No	No	Yes	Yes
North Macedonia	0.0%	100.0%	X	No	Yes	Yes
Northern Ireland	25.0%	75.0%	X	Yes	No	Yes
Norway	2.0%	98.0%	XX	Yes	Yes	Yes
Poland	0.0%	100.0%	No	No	Yes	Yes
Portugal	0.0%	100.0%	XX	No	No	No
Romania	4.17%	95.83%	No	No	Yes	Yes
Serbia	0.0%	100.0%	X	No	Yes	Yes
Slovak Rep.	2.72%	97.28%	No	No	Yes	Yes
Slovenia	0.0%	100.0%	XX	No	Yes	Yes
Spain	0.88%	99.12%	XXX	No	No	No
Sweden	38.0%	62.0%	X	Yes	Yes	Yes
Switzerland	0.0%	100.0%	X	No	Yes	Yes
Ukraine	15.24%	84.76%	No	No	Yes	Yes

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.

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	
	ITC	OPEX	Depreciation	CAPEX Return	Primary reserve	Secondary reserve
Albania	C	C	C	C	N	C
Austria	B/C	C	C	C	N	C
Belgium	B/C	C	C	C	C	C/B
Bosnia & Herzegovina	C/B	C	C	C	C	C
Bulgaria	B/C	C	C	C	C	C
Croatia	B/C	C	C	C	N	C
Cyprus	N	C	C	C	C	C
Czech Republic	B/C	C	C	C	C	C
Denmark	B/C (estimated)	C/B (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)
Estonia	B/C	C	C	C	N	N
Finland	B/C	C	C	C	C	C
France	C	C	C	C	N	N
Germany	C/B	C/B	C	C	C	C
Great Britain	C/B	C	C	C	C	C
Greece	C/B	C	C	C	C (estimated)	C (estimated)
Hungary	C/B (estimated)	C	C	C	C (estimated)	C (estimated)
Iceland	N	C	C	C	C	C
Ireland	C	C	C	C	C	C
Italy	C	C	C	C	C	C
Latvia	C/B (estimated)	C	C	C	C	C
Lithuania	B/C	C	C	C	N	C
Luxembourg	C	C	C	C	C	C
Montenegro	B/C	C	C	C	N	C
Netherlands	B/C	C (estimated)	C	C	C	C
North Macedonia	C/B (estimated)	C	C	C	N	C
Northern Ireland	C	C	C	C	C	C
Norway	C	C	C	C	C	C
Poland	N	C	C	C	C	C
Portugal	C/B	C	C	C	N	N
Romania	C	C	C	C	N	C
Serbia	B/C	C	C	C	C	C
Slovakia	B/C	C	C	C	C	C
Slovenia	C/B	C/B	C/B	C	C	C
Spain	N	C (estimated)	C (estimated)	C (estimated)	N	C (estimated)
Sweden	B/C	C	C	C	C	N
Switzerland	B/C (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)
Ukraine	N	C	C	N	C	C

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.

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.

System services							
Tertiary reserve	**Congestion Management** (internal)	**Congestion Management** (cross border)	**Black-Start**	**Voltage Control Reactive Power**	**System Balancing**	**Losses**	**Other**
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
C	C	C	C	N	N	C	C
C	N	N	C	C	C/B	C	C
C	N	N	C	C	N	C	C
C	C	C	C	C	C/B	C	N
C (estimated)	C/B (estimated)	C/B (estimated)	C (estimated)	C (estimated)	C/B (estimated)	C (estimated)	C (estimated)
C	N	C	C	C	N	C	C
C	C	C	C	C	C	C	C
N	C	B/C	C	C	C	C	C
C	C	C	C	C	N	C	C
C	C	N	C	C	C	N (cost is not included in UTT)	C
N	N	B/C	N (cost is not included in UTT)	N	N	C (estimated)	C
C (estimated)	N	B/C	C (estimated)	C (estimated)	B/C (estimated)	C (estimated)	C/B
C	N	N	C	C	C	C	N (cost is not included in UTT)
C	C	C	C	C	C	C	C
C	B/C	B/C	C	C	C	C (estimated)	N
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 (estimated)	N	N	C	C	N
C	C	C	C	C	B/C (estimated)	C	N (cost is not included in UTT)
C	N	B/C (estimated)	N	N	C	C	N
C	C	C	C	C	N	C	C
C	C	C	C	C	C	C	N (cost is not included in UTT)
C	C	B/C (estimated)	C	C	C	C	C
N	N	B/C	C	B/C	N	C	C
C	C	N	N	C	N	C	N
C	C	C/B	C	C	C	C	C
C	C	N (cost is not included in UTT)	C	C	N	C	N
C	C	C	C	C	B/C	C	C
C (estimated)	C (estimated)	N	C (estimated)	N	C (estimated)	C (estimated)	N
N	N	N	C	C	N	C	N
C (estimated)	C (estimated)	B/C (estimated)	C (estimated)	N (cost is not included in UTT)	C (estimated)	C (estimated)	N (cost is not included in UTT)
C	C	N	C	N	C	C	C

– N if a given cost is not considered in the calculation of the Unit Transmission Tariff.

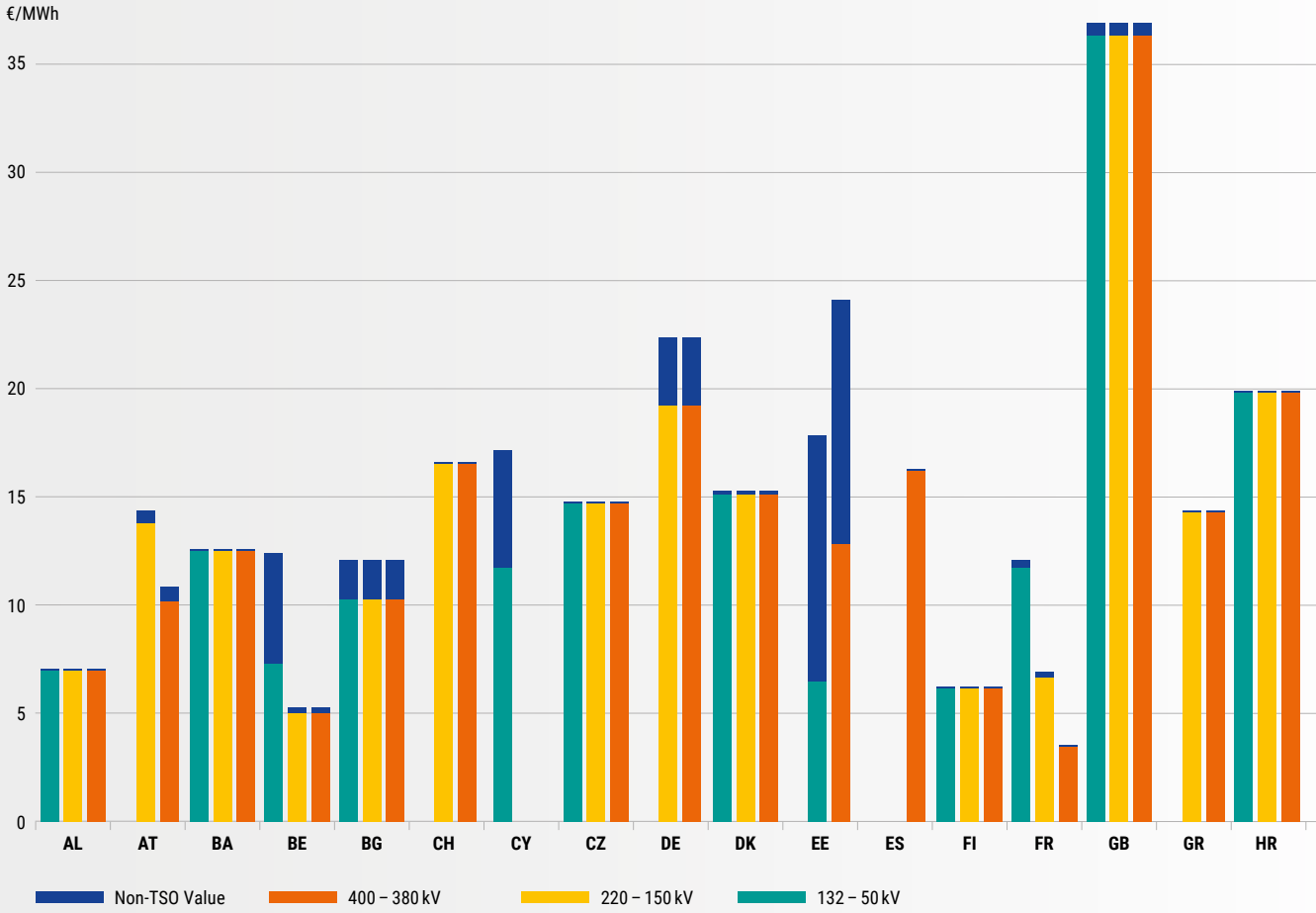
– C or C/B or B/C marked as "estimated" indicate that the cost item is not invoiced by the TSO and estimated values are provided for comparability purposes.

Remarks:

– This chapter is referring to total costs (TSO costs and non-TSO costs) included in the calculation of the Unit Transmission Tariff.

6 Unit Transmission Tariffs in 2022

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 light blue (132 – 50 kV), yellow (220 – 150 kV) and red (330 kV and above), whereas other regulatory charges not directly related to TSOs´ activities are marked in dark blue.

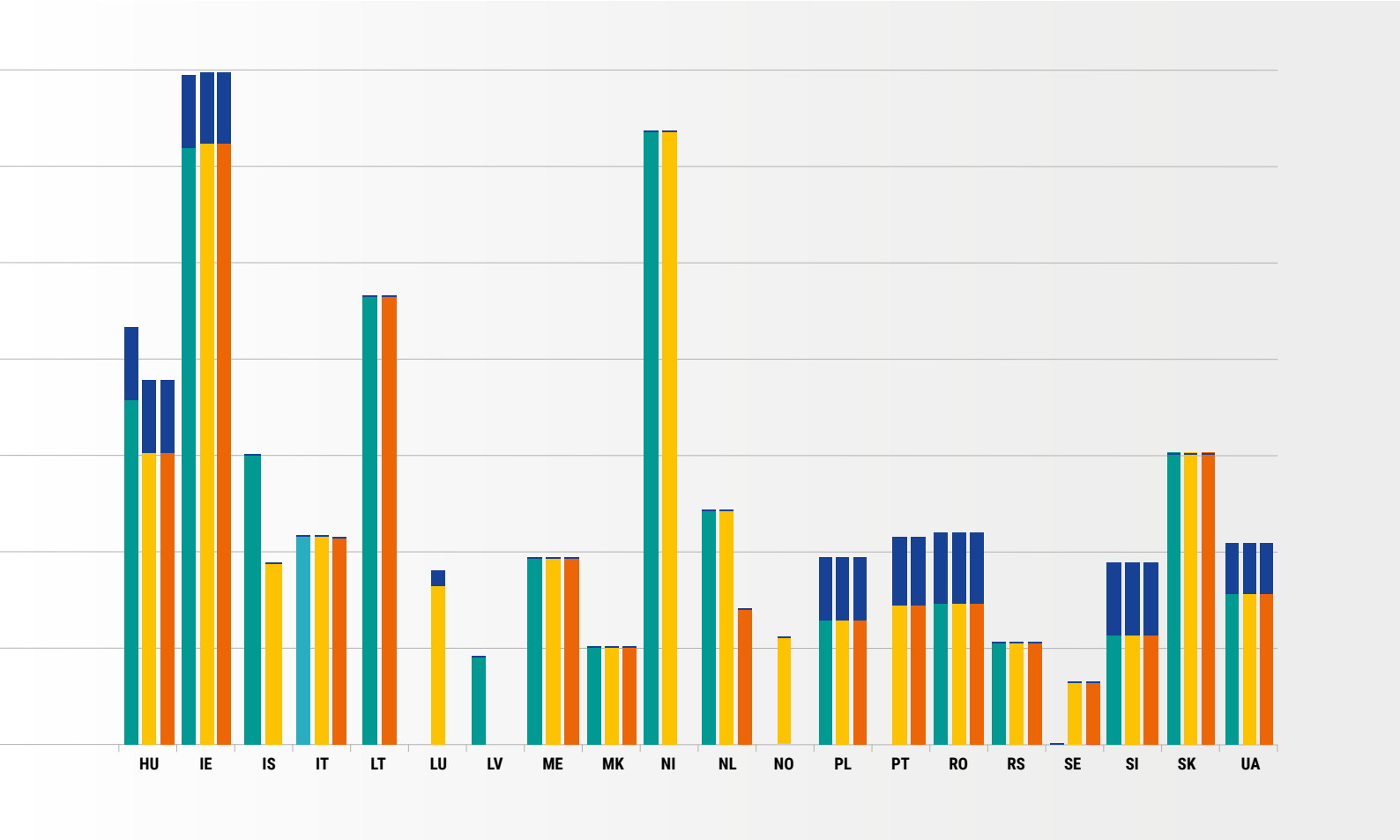


		AL	AT	BA	BE	BG	CH	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR
Total	400 – 380 kV	7.10	10.86	12.58	5.23	12.08	16.59		14.81	22.36	15.28	24.13	16.29	6.25	3.53	36.90	14.41	19.91
	220 – 150 kV	7.10	14.40	12.58	5.23	12.08	16.59		14.81	22.36	15.28			6.25	6.89	36.90	14.41	19.91
	132 – 50 kV	7.10		12.58	12.45	12.08		17.15	14.81		15.28	17.83		6.25	12.12	36.90		19.91
TSO Value	400 – 380 kV	7.10	10.24	12.58	5.05	10.25	16.59		14.81	19.28	15.17	12.83	16.29	6.18	3.53	36.33	14.34	19.90
	220 – 150 kV	7.10	13.78	12.58	5.05	10.25	16.59		14.81	19.28	15.17			6.18	6.65	36.33	14.34	19.90
	132 – 50 kV	7.10		12.58	7.32	10.25		11.80	14.81		15.17	6.53		6.18	11.80	36.33		19.90

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.
- Values have been rounded.

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



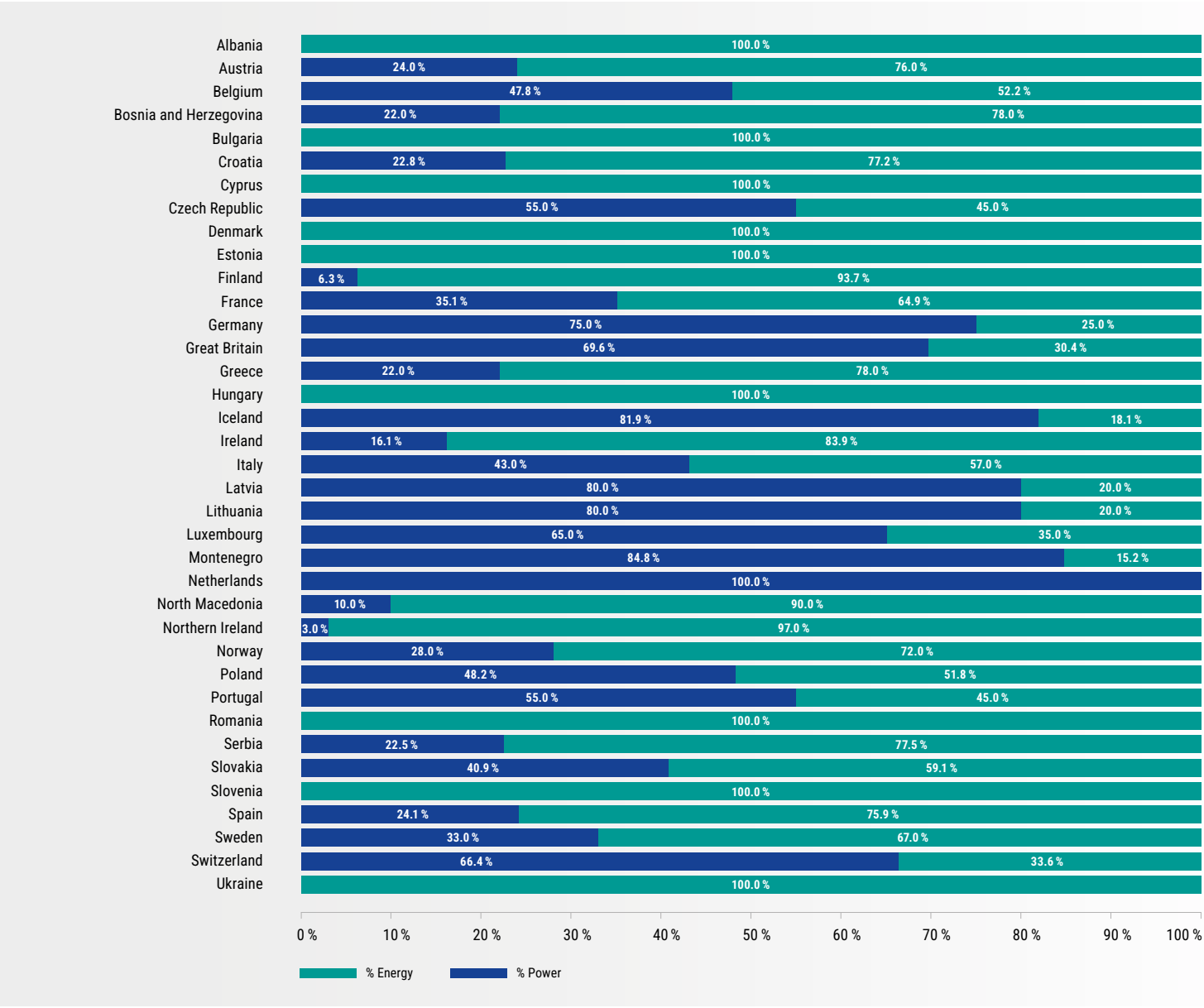
HU	IE	IS	IT	LT	LU	LV	ME	MK	NI	NL	NO	PL	PT	RO	RS	SE	SI	SK	UA
18.94	34.86		10.81	23.24	0.00		9.67	5.10		7.06		9.71	10.81	11.02	5.39	3.21	9.42	15.14	10.47
18.94	34.86	9.44	10.82		9.06		9.67	5.10	31.82	12.20	5.48	9.71	10.81	11.02	5.39	3.21	9.42	15.14	10.47
21.64	34.67	15.06	10.82	23.24	0.00	4.59	9.67	5.10	31.82	12.20		9.71		11.02	5.39	0.00	9.42	15.14	10.47
15.12	31.15		10.81	23.24	0.00		9.67	5.10		7.06		6.38	7.25	7.36	5.35	3.21	5.71	15.14	7.85
15.12	31.15	9.44	10.82		8.21		9.67	5.10	31.82	12.20	5.48	6.38	7.25	7.36	5.35	3.21	5.71	15.14	7.85
17.82	30.95	15.06	10.82	23.24	0.00	4.59	9.67	5.10	31.82	12.20		6.38		7.36	5.35	0.00	5.71	15.14	7.85

Country remarks regarding Austria, Belgium, Bulgaria, Finland, Great Britain, Greece, Chez Republic, Germany, Hungary, Iceland, Ireland, Lithuania, Luxembourg, Poland, Portugal, Slovakia, Slovenia and Spain 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.



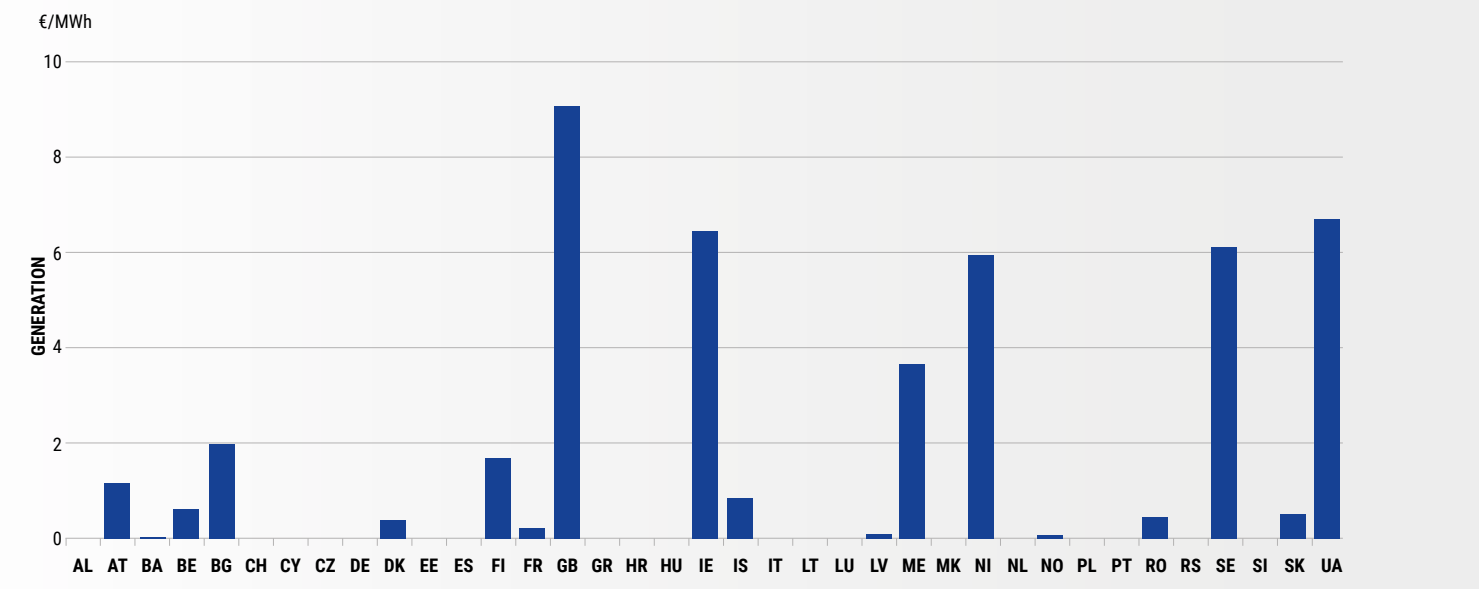
Remarks:

- 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.

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:

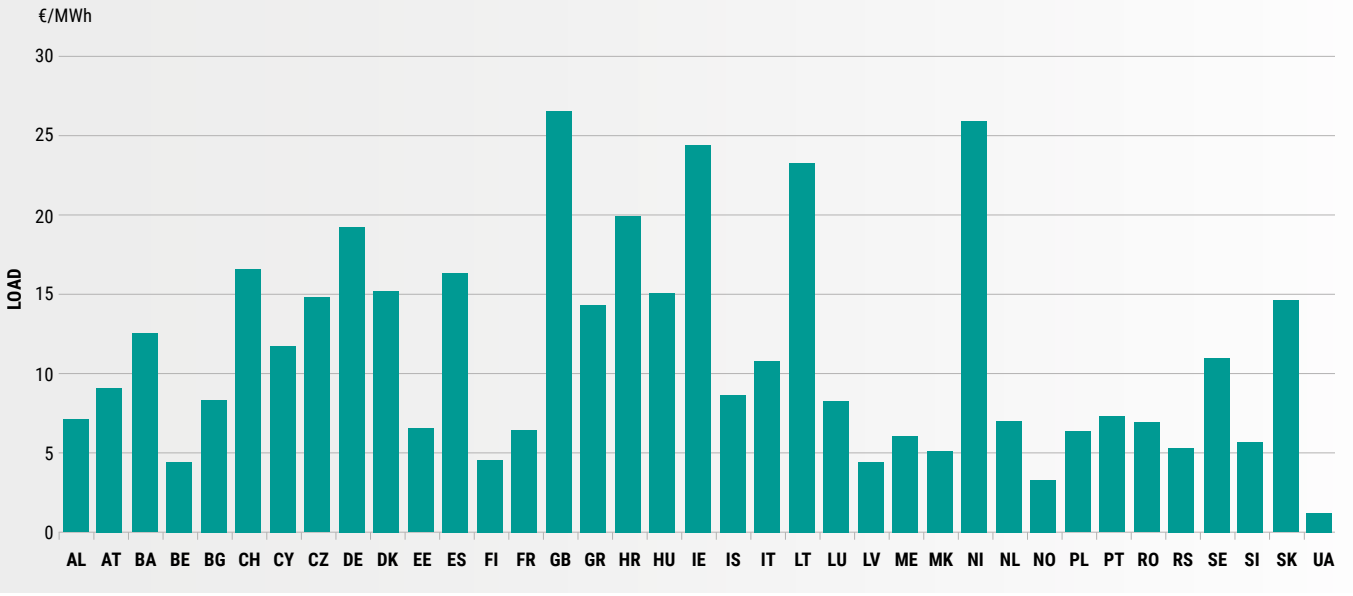
- The example taken for this comparison is the base case (see Section 3).
- Other charges not directly related to TSO activities (i.e. non-TSO costs) **are not included** in the above graph.
- Values have been rounded.
- Commission Regulation (EU) no 838/2010 places limits on annual average transmission 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 2022

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.



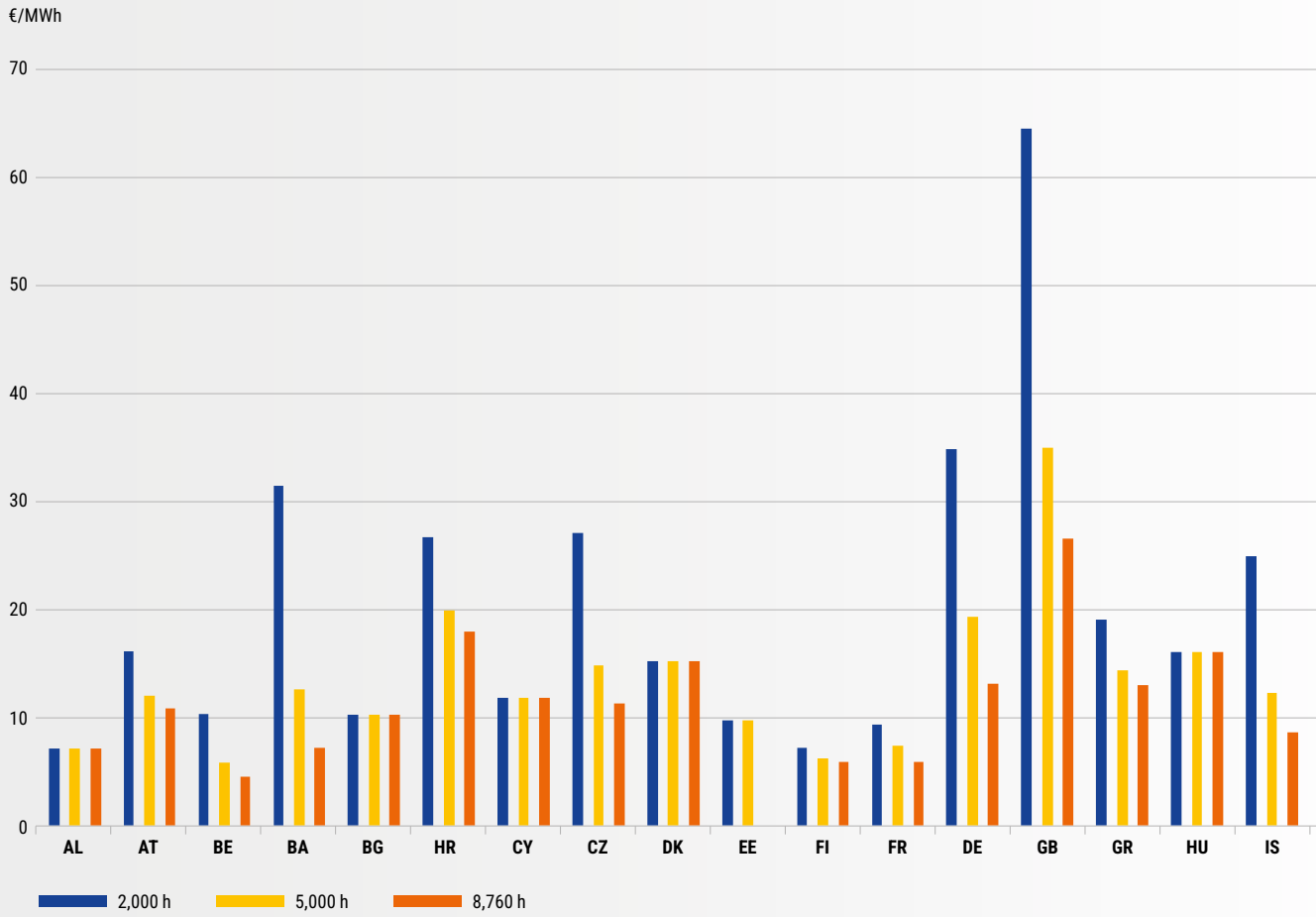
Remarks:

- 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.

Chart 7.3: L components of the TSO components of the Unit Transmission Tariffs in 2022

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.

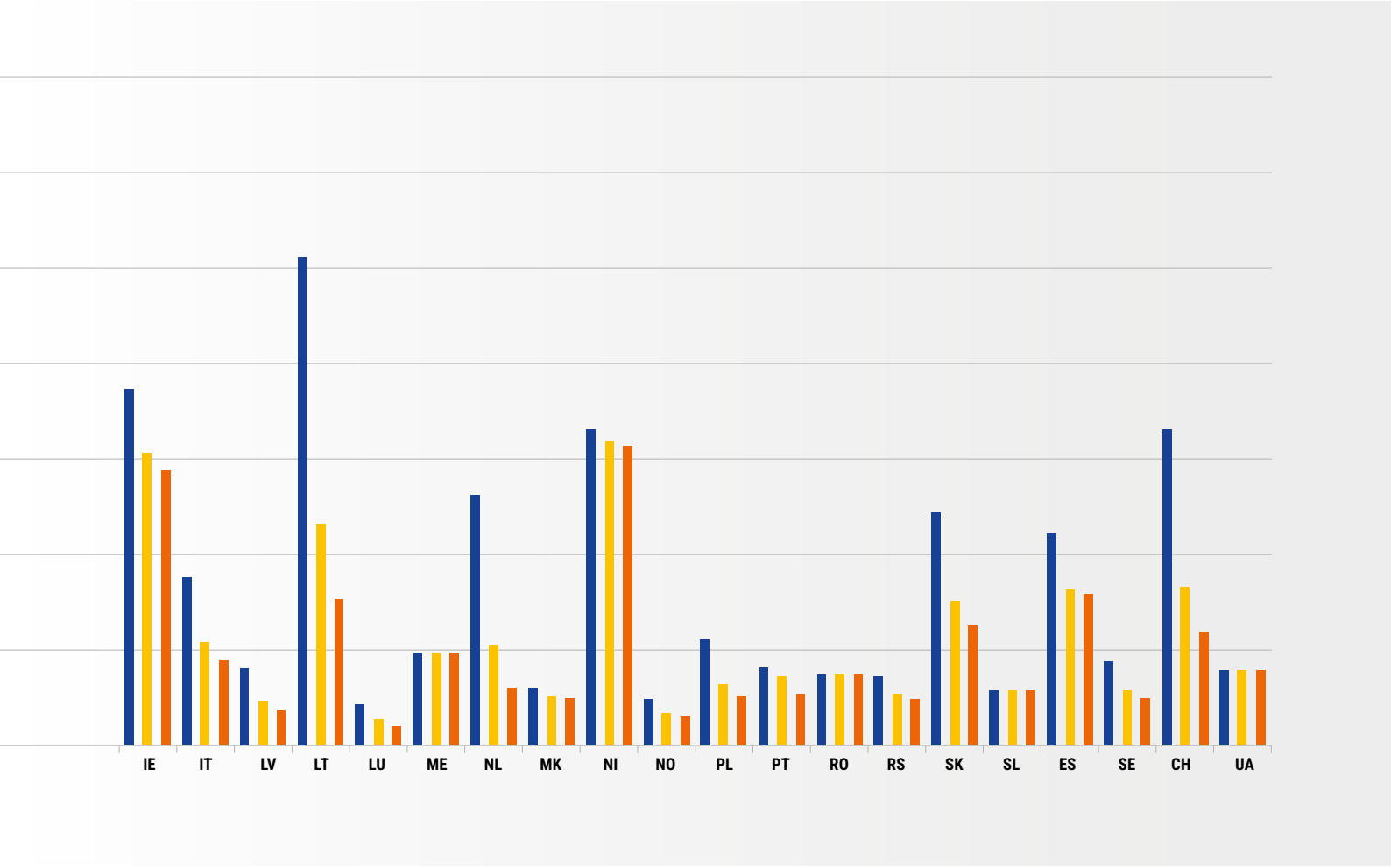


Remarks:

- 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 utilisation 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, to illustrate how fixed components of the tariffs impact on the average transmission charges.

Country remarks for Czech Republic, Iceland and the Netherlands are to be found in Appendix 1.

Chart 7.4: Impact of utilisation time on the TSO components of the Unit Transmission Tariffs in 2022


IE
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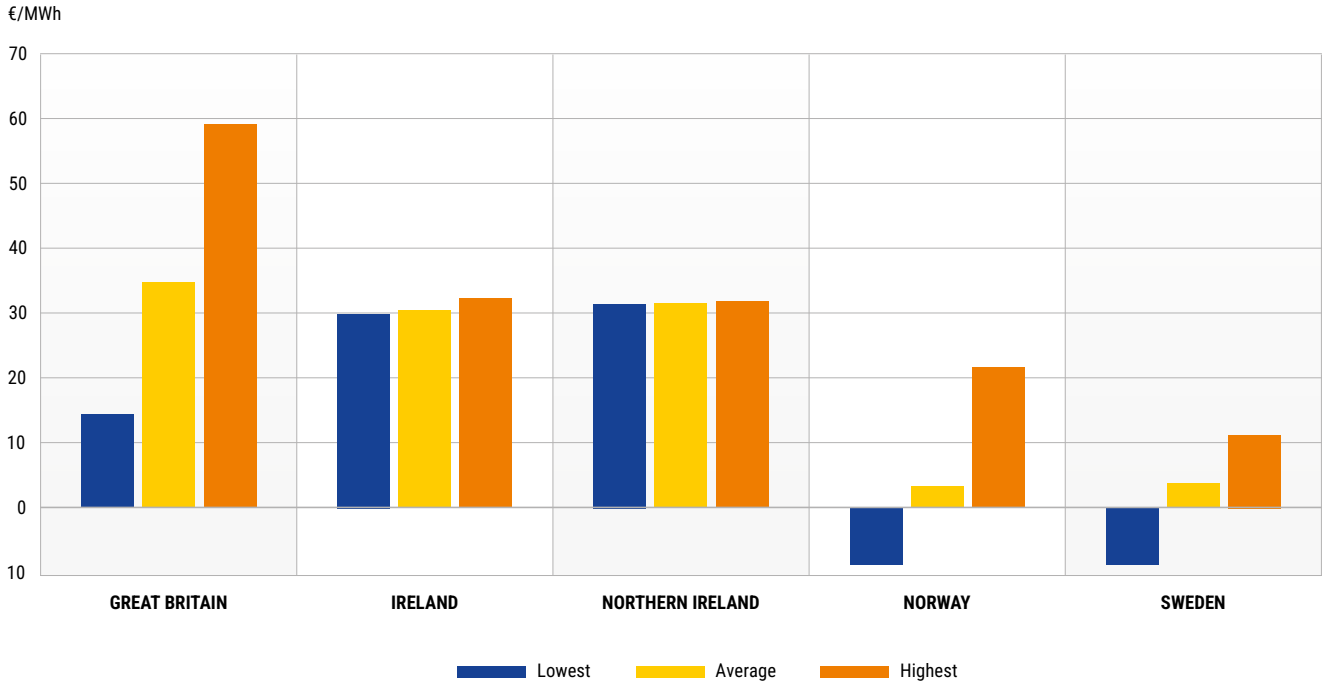
7.5 Impact of location

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

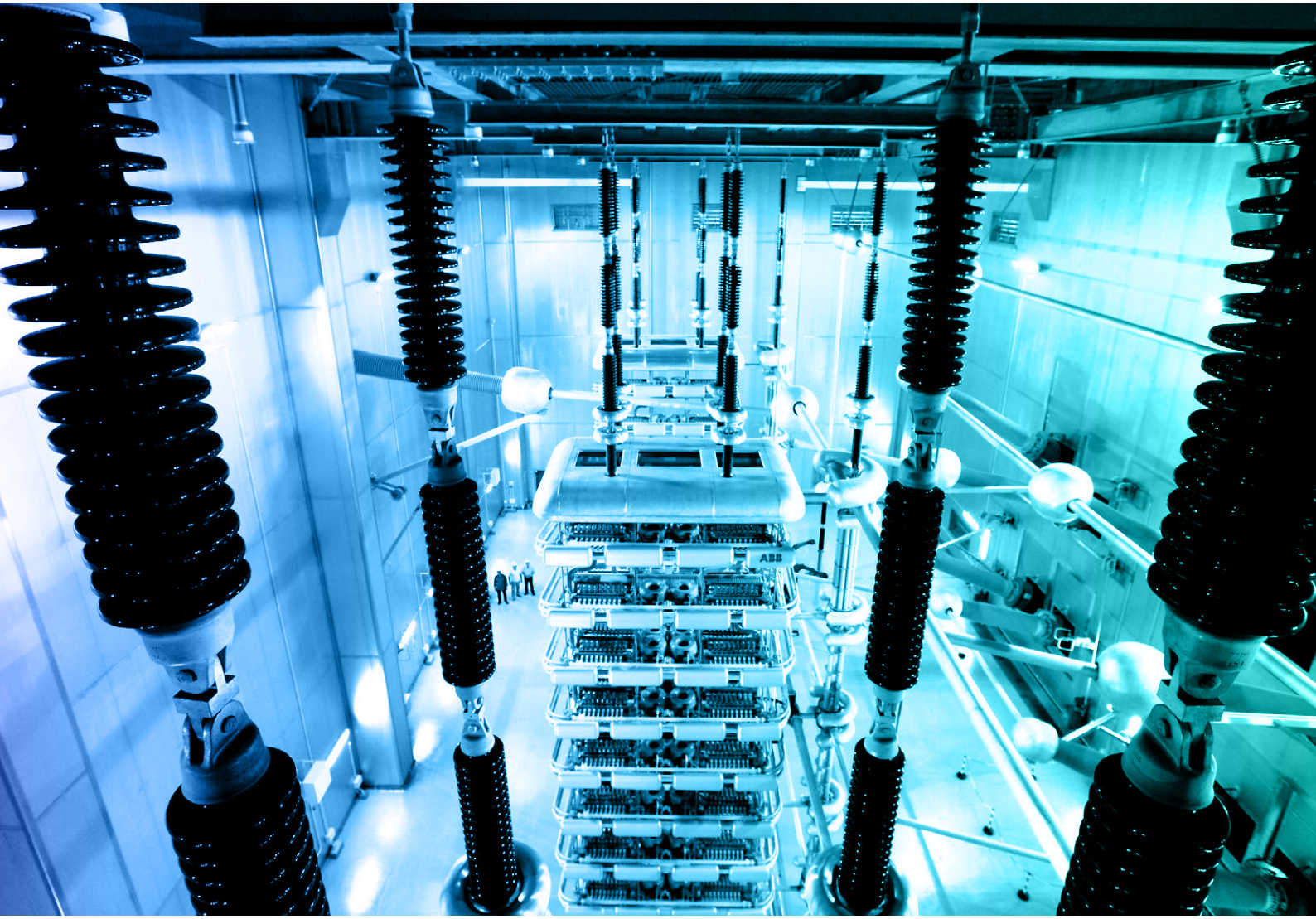


Remarks:

- 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.

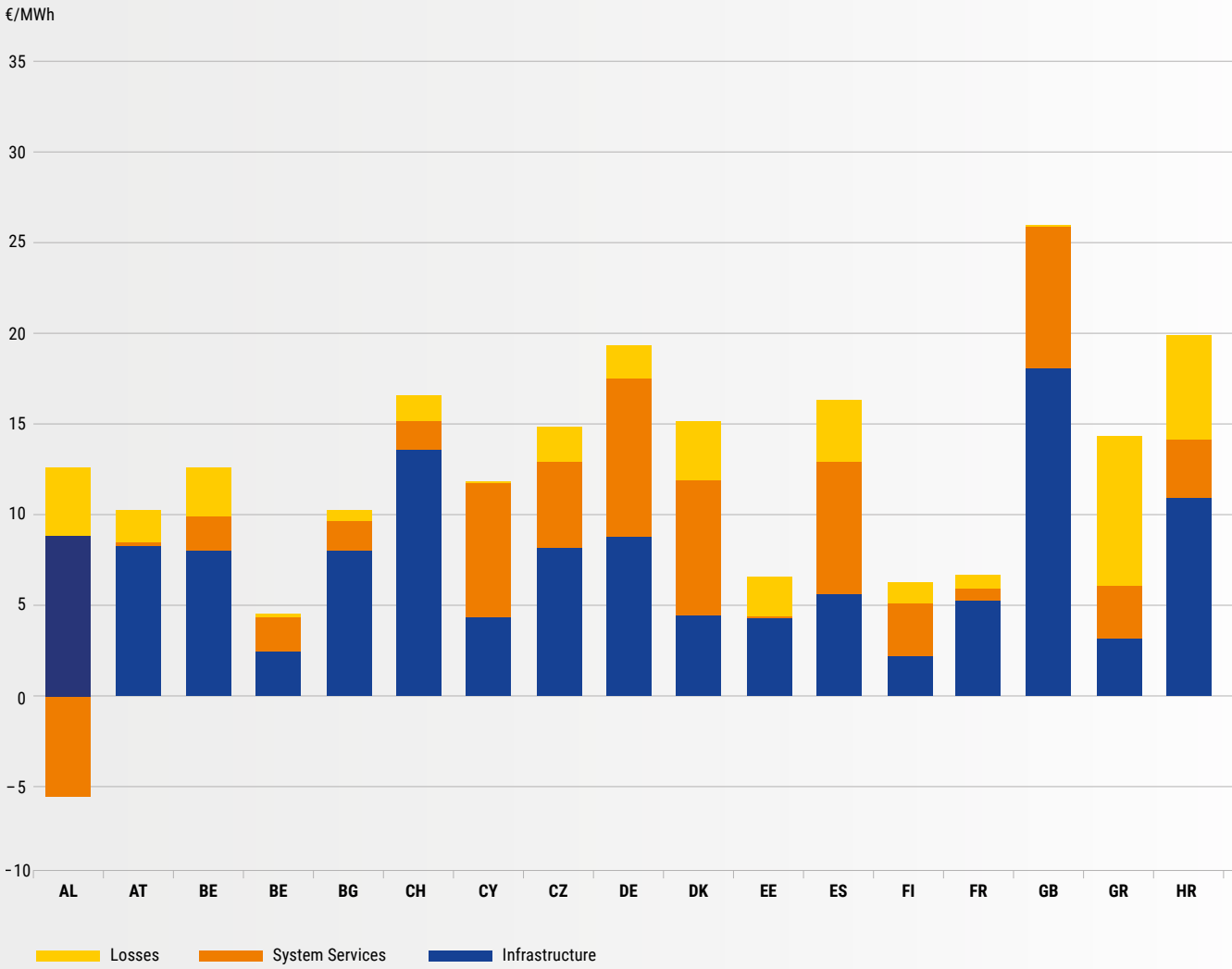
Chart 7.5: Impact of location on the Unit Transmission Tariffs in 2022



ABB

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.



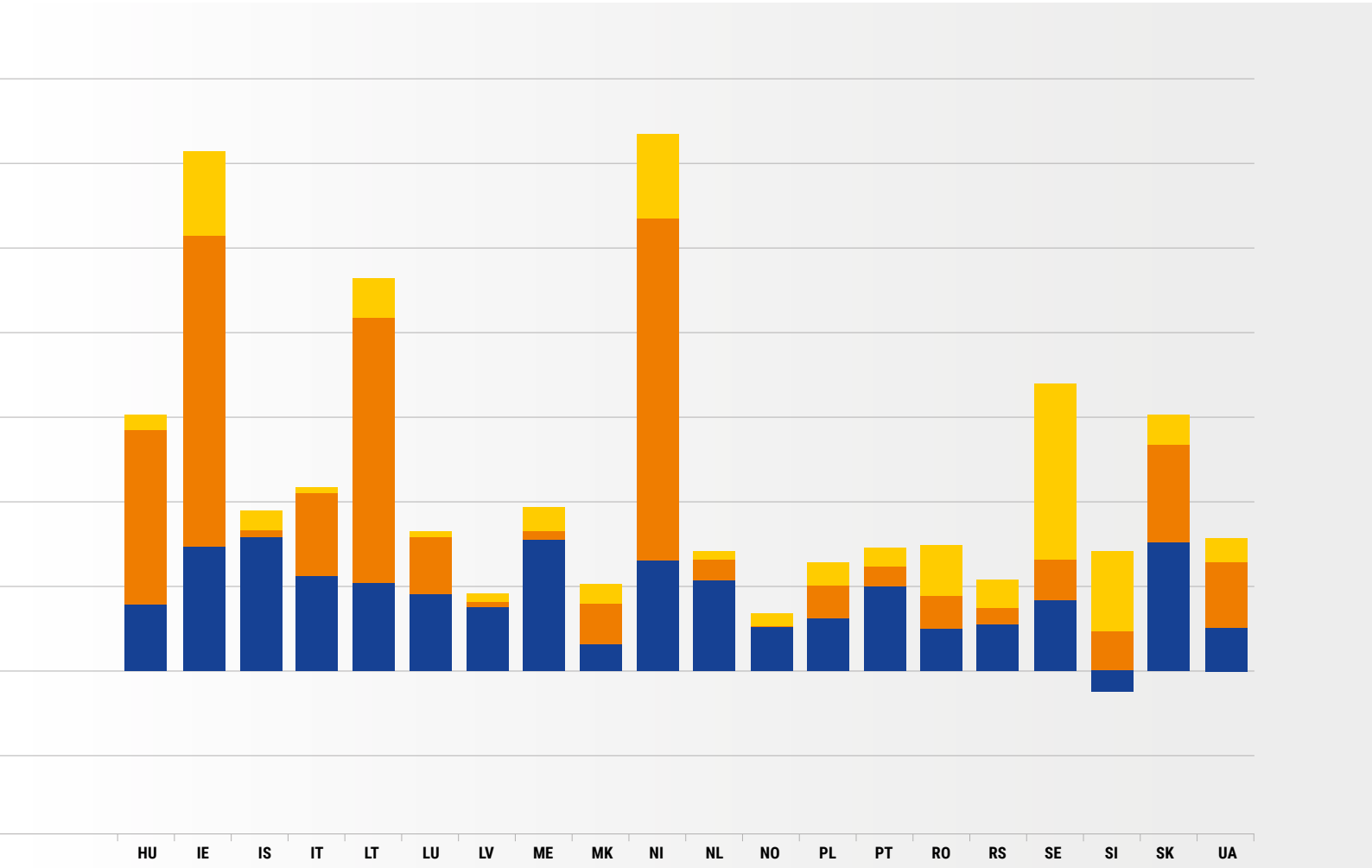
	AL	AT	BA	BE	BG	CH	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR
Losses	3.77	1.76	2.69	0.11	0.60	1.42	0.00	1.92	1.83	3.26	2.15	3.40	1.10	0.77	0.00	8.29	5.79
System Services	−5.52	0.28	1.93	1.91	1.65	1.62	7.50	4.71	8.72	7.55	0.20	7.31	2.98	0.64	7.92	2.91	3.25
Infrastructure	8.86	8.20	7.96	2.41	8.00	13.55	4.30	8.18	8.74	4.36	4.18	5.57	2.10	5.24	18.11	3.14	10.86

Remarks:

- The example taken for this comparison is the base case (see Section 3).
- Other charges not directly related to TSO activities (i.e. nonTSO 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.

Country remarks regarding Czech Republic and Great Britain can be found in Appendix 1.

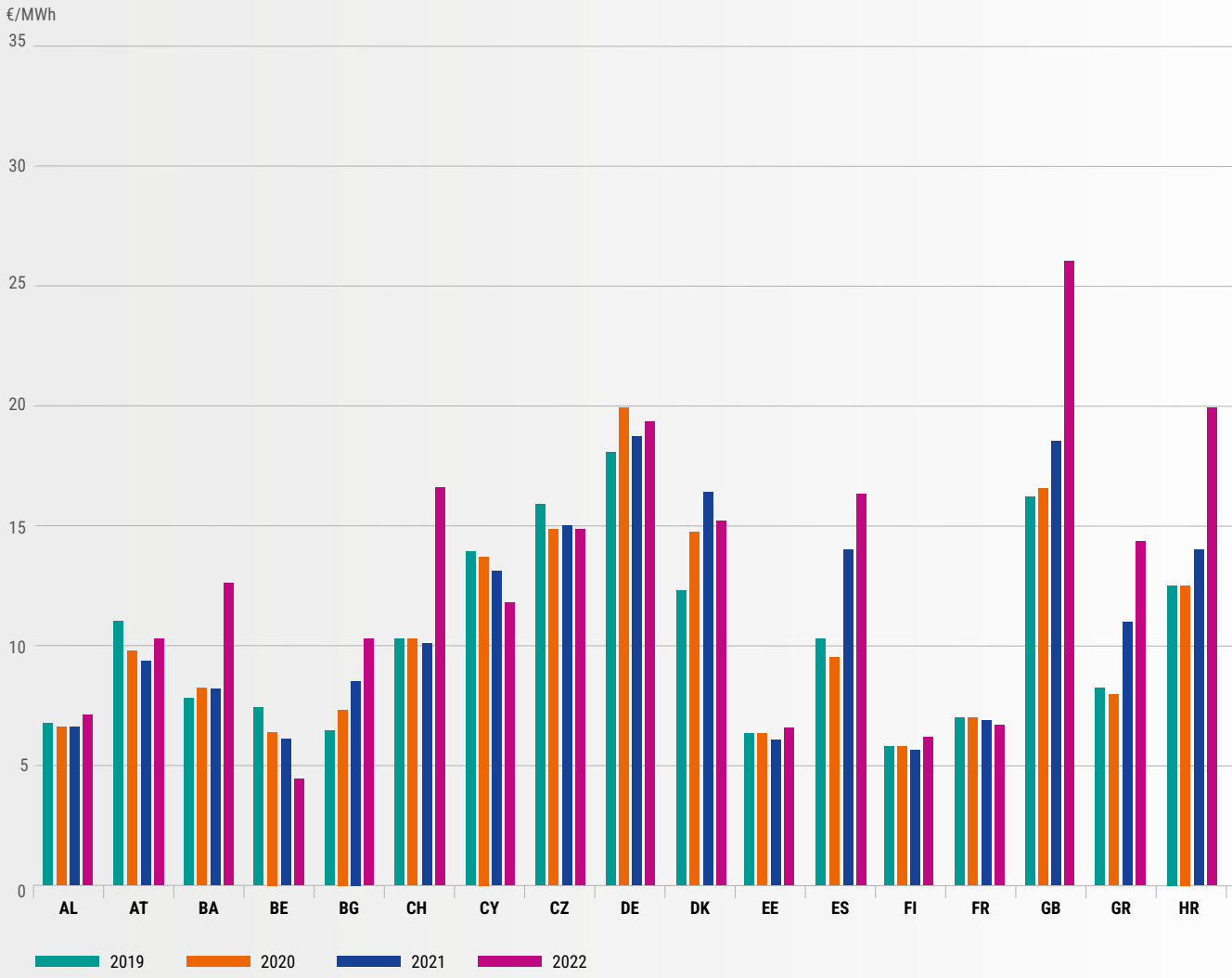
Chart 7.6: Components of TSO costs of the Unit Transmission Tariffs in 2022



HU	IE	IS	IT	LT	LU	LV	ME	MK	NI	NL	NO	PL	PT	RO	RS	SE	SI	SK	UA
0.85	4.98	1.09	0.31	2.35	0.31	0.51	1.47	1.12	4.96	0.54	0.74	1.30	1.13	2.99	1.64	10.49	4.70	1.72	1.36
10.42	18.44	0.46	4.94	15.75	3.43	0.33	0.51	2.40	20.31	1.18	0.10	2.00	1.13	1.88	0.96	2.38	2.32	5.88	3.98
3.85	7.32	7.89	5.56	5.14	4.47	3.75	7.69	1.58	6.47	5.34	2.57	3.07	5.00	2.48	2.75	4.16	−1.31	7.54	2.51

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 2019 – 2022 in € using exchange rates on 31st of December 2022.

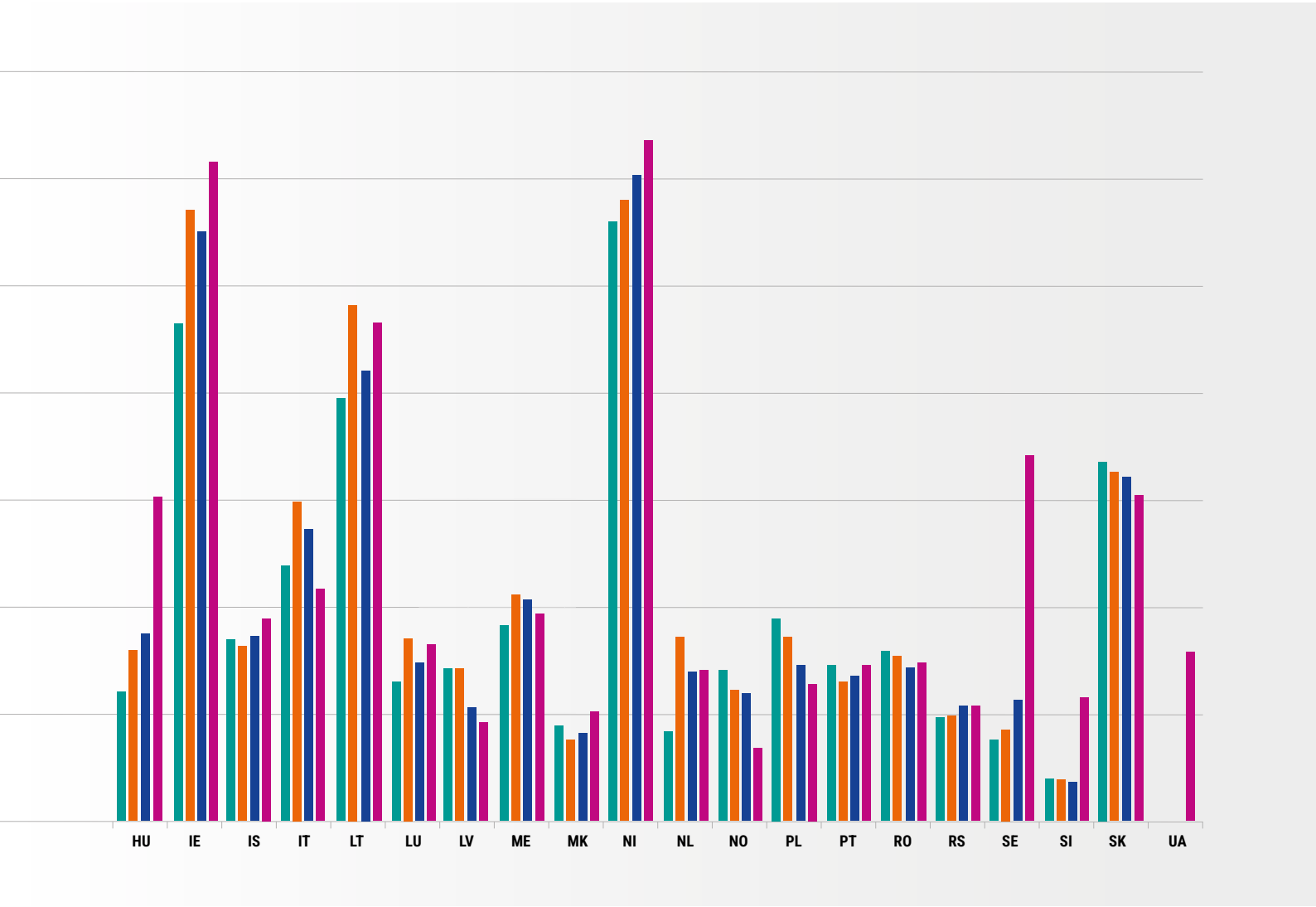


	AL	AT	BA	BE	BG	CH	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR
2019	6.77	11.03	7.78	7.39	6.46	10.24	13.88	15.86	18.05	12.27	6.31	10.25	5.78	7.00	16.19	8.24	12.48
2020	6.61	9.77	8.25	6.40	7.30	10.27	13.71	14.82	19.92	14.72	6.35	9.48	5.76	7.00	16.53	7.98	12.48
2021	6.62	9.33	8.17	6.13	8.51	10.09	13.08	15.01	18.72	16.36	6.08	13.96	5.59	6.89	18.49	10.95	13.96
2022	7.10	10.24	12.58	4.43	10.25	16.59	11.80	14.81	19.29	15.17	6.53	16.29	6.18	6.65	26.03	14.34	19.90

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.

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



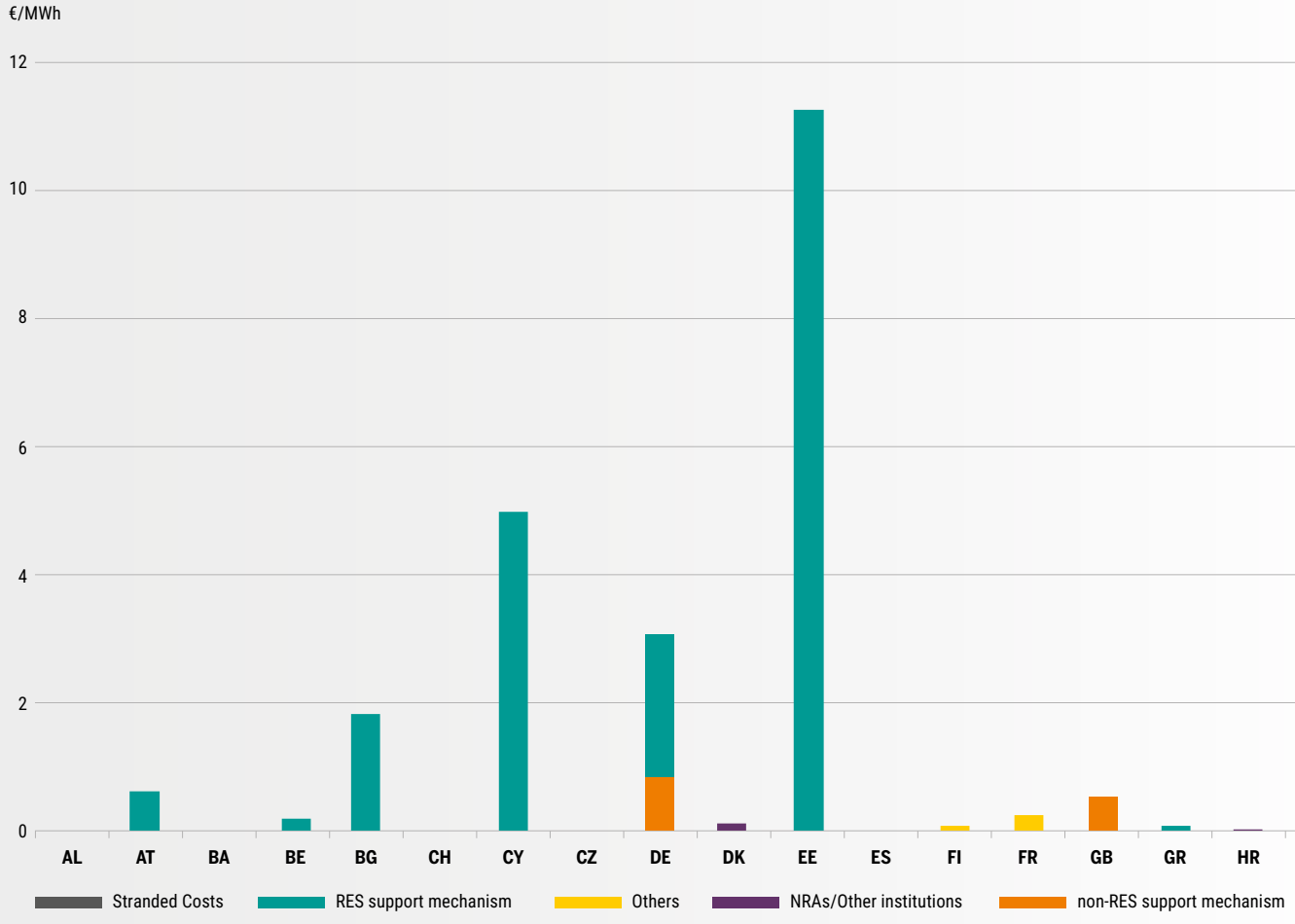
HU	IE	IS	IT	LT	LU	LV	ME	MK	NI	NL	NO	PL	PT	RO	RS	SE	SI	SK	UA
6.01	23.19	8.43	11.87	19.67	6.52	7.09	9.11	4.43	27.90	4.12	7.06	9.42	7.23	7.91	4.80	3.75	1.94	16.75	
7.97	28.45	8.14	14.89	24.05	8.52	7.08	10.54	3.75	28.94	8.54	6.13	8.56	6.48	7.68	4.88	4.25	1.91	16.27	
8.71	27.51	8.64	13.57	20.98	7.38	5.28	10.29	4.10	30.12	6.90	5.92	7.24	6.77	7.15	5.35	5.62	1.79	16.05	
15.12	30.74	9.44	10.81	23.24	8.21	4.59	9.67	5.10	31.74	7.06	3.41	6.38	7.25	7.36	5.35	17.03	5.71	15.14	7.85

– Prices have been updated to 2022 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 31st December 2022 is used.
– See Country remarks for details. When annual changes exceed 15% compared to last year, reasons are provided.

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 due to 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 into 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	BA	BE	BG	CH	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR
Stranded Costs																	
RES support mechanism		0.62		0.18	1.83		5.00		2.25		11.30					0.07	
Others													0.07	0.23			
NRAs/Other Institutions										0.10							0.01
non-RES support mechanism									0.83						0.52		

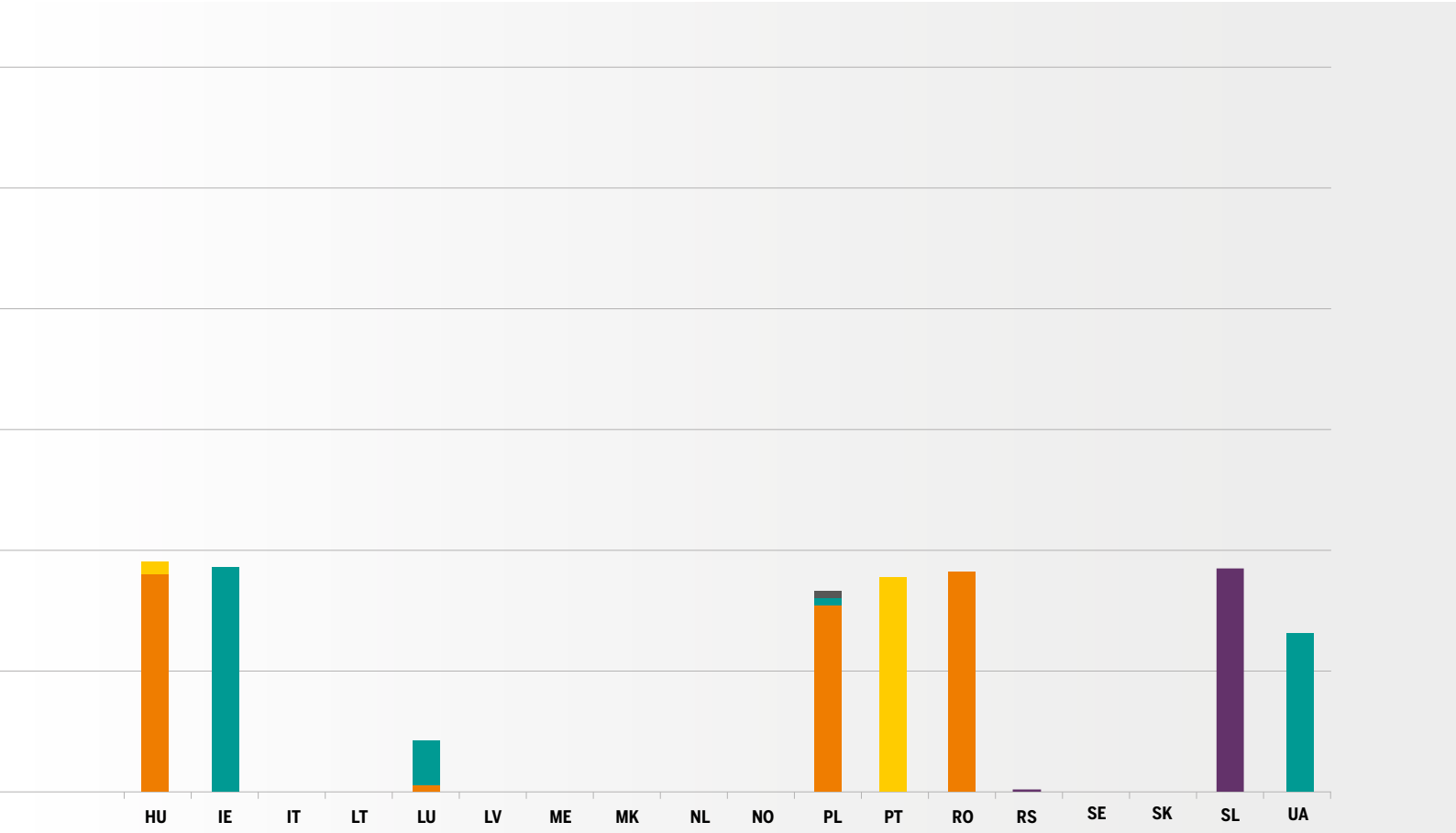
Chart 8.1: Overview of non-TSO charges in the Unit Transmission Tariffs (€/MWh)

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, or others.
- 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.

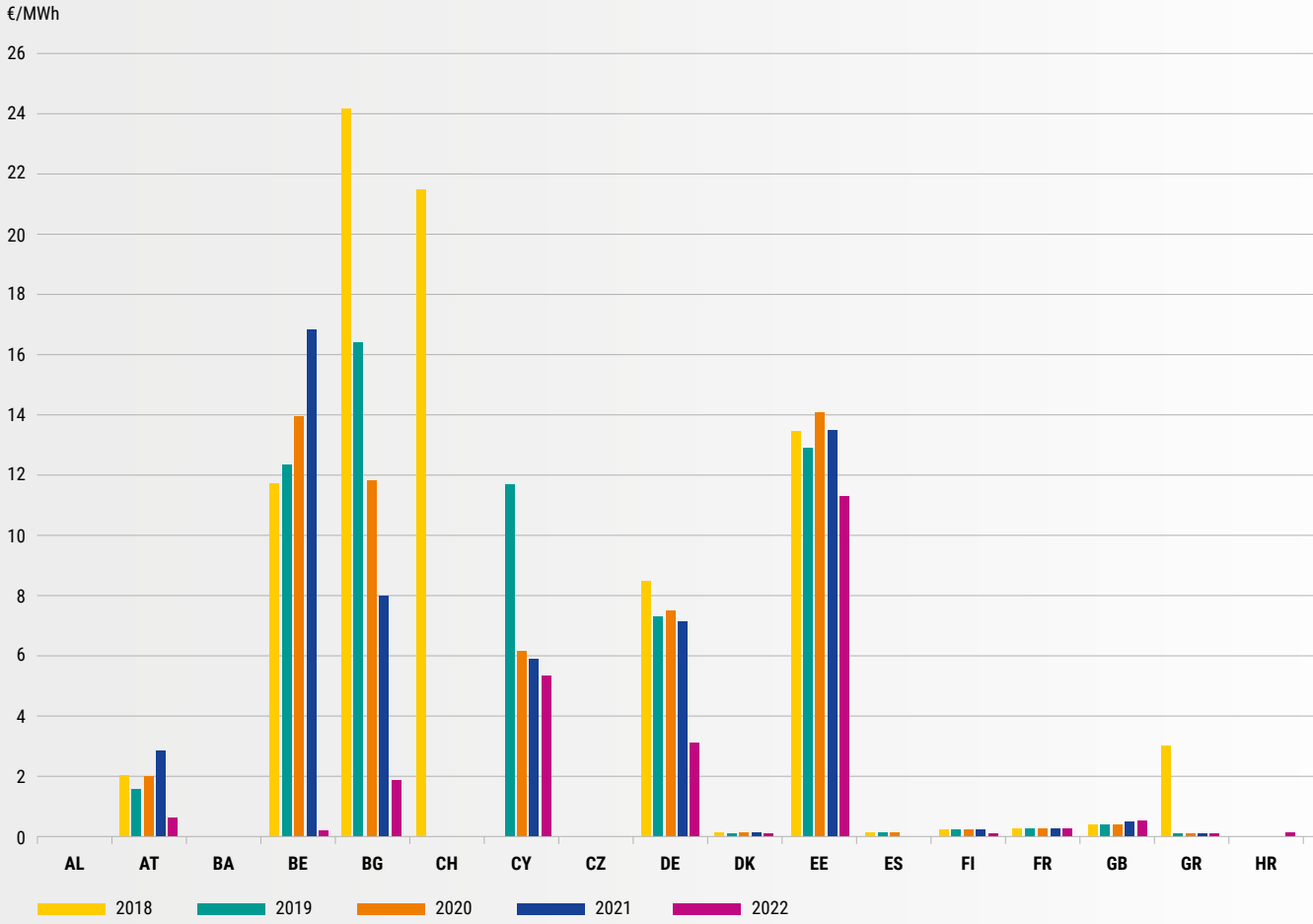
Also refer to Appendix 6 for additional information.



HU	IE	IT	LT	LU	LV	ME	MK	NL	NO	PL	PT	RO	RS	SE	SK	SL	UA
										0.10							
	3.72			0.75						0.14							2.62
0.20											3.55						
													0.03			3.71	
3.62				0.10						3.09		3.66					

8.2 Evolution of Non-TSO costs

For some countries non-TSO costs attribute to a significant proportion of the Unit Transmission Tariffs, and the data below shows how these costs have changed over recent years:



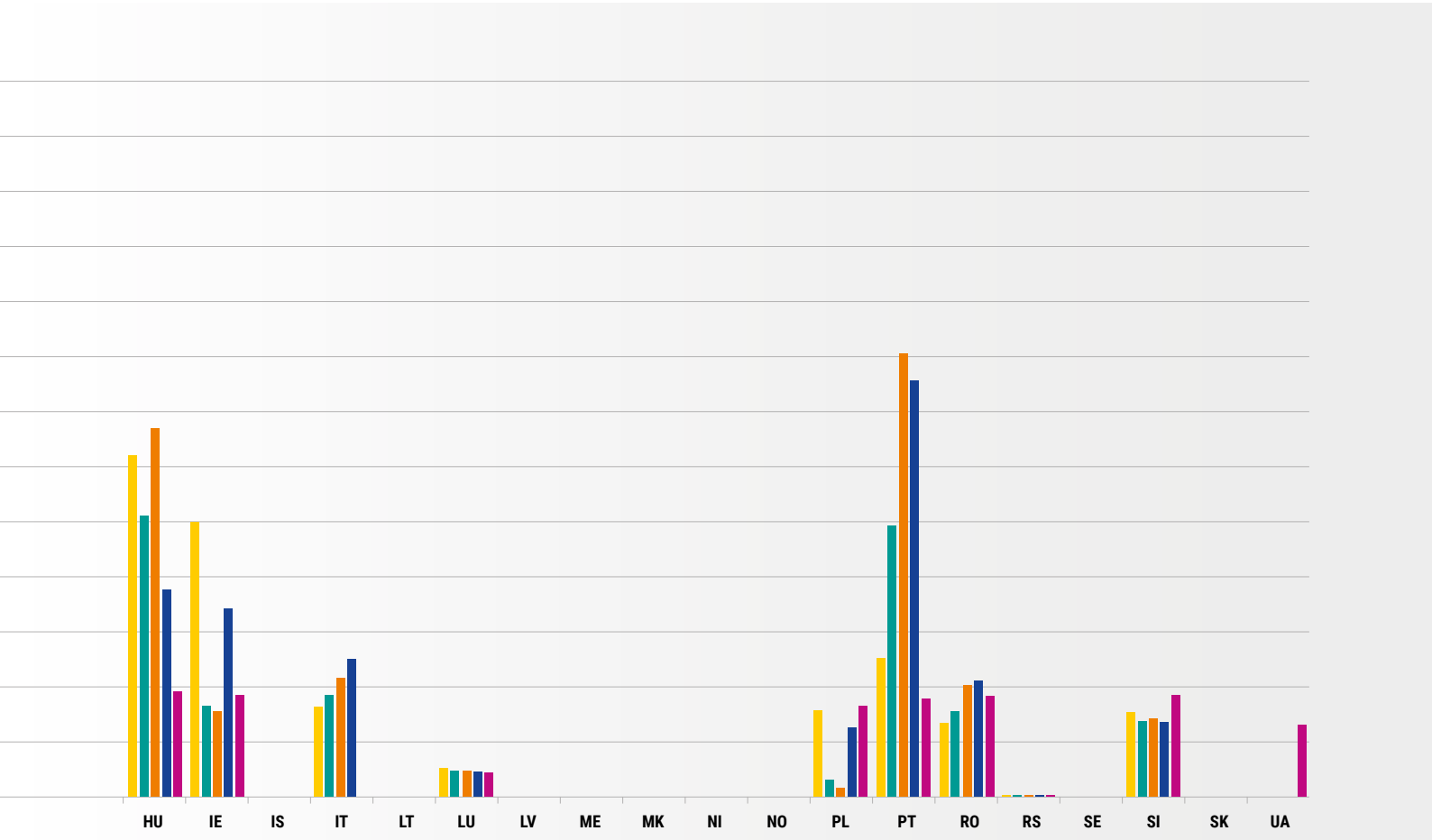
	AL	AT	BA	BE	BG	CH	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR
2018	0.00	2.03	0.00	11.74	24.20	21.49	0.00	0.00	8.45	0.11	13.47	0.14	0.22	0.28	0.37	3.03	0.01
2019	0.00	1.53	0.00	12.35	16.40	0.00	11.71	0.00	7.29	0.10	12.89	0.13	0.21	0.27	0.37	0.08	0.01
2020	0.00	1.96	0.00	13.98	11.81	0.00	6.14	0.00	7.47	0.13	14.10	0.13	0.20	0.27	0.38	0.08	0.01
2021	0.00	2.82	0.00	16.87	8.02	0.00	5.88	0.00	7.14	0.12	13.49	0.00	0.20	0.26	0.46	0.08	0.01
2022	0.00	0.62	0.00	0.18	1.83	0.00	5.35	0.00	3.08	0.10	11.30	0.00	0.08	0.24	0.51	0.07	0.14

Remarks:

- The example taken for this comparison is the base case (see Section 3).
- Prices have been updated to 2022 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 31st December 2022 is used.
- See Country remarks for details. When annual changes exceed 15% compared to last year, reasons are provided.

Country remarks regarding Austria, Belgium, Croatia, Cyprus, Finland, France, Germany, Great Britain, Greece, Hungary, Ireland, Luxembourg, Montenegro, Poland, Portugal, Romania, Serbia, Slovenia, Switzerland and Ukraine are to be found in Appendix 6.

Chart 8.2: Evolution of non-TSO costs in the Unit Transmission Tariffs 2022



HU	IE	IS	IT	LT	LU	LV	ME	MK	NI	NL	NO	PL	PT	RO	RS	SE	SI	SK	UA
12.42	9.97	0.00	3.26	0.00	1.05	0.00	0.00	0.00	0.00	0.00	0.00	3.13	5.02	2.69	0.04	0.00	3.07	0.00	
10.23	3.31	0.00	3.68	0.00	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.60	9.84	3.08	0.03	0.00	2.76	0.00	
13.41	3.08	0.00	4.31	0.00	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.32	16.13	4.04	0.04	0.00	2.82	0.00	
7.52	6.85	0.00	4.97	0.00	0.92	0.00	0.00	0.00	0.00	0.00	0.00	2.51	15.12	4.19	0.04	0.00	2.72	0.00	
3.82	3.72	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0.00	3.33	3.55	3.66	0.03	0.00	3.71	0.00	2.62

9 Appendices

Appendix 1: Country specific details

Albania

Components (first connections charges)

Charges are based on actual costs.

Austria

Other Regulatory Changes

APG collects and passes tariffs for RES support from directly connected customers through. In the customer bills, these rariffs are not recorded in the network cost section but in the taxes & levies section.

NRAs/Other Institutions are paid by "L" and included in the infrastructure tariff.

Components (first connections charges)

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:

- Network Level 1 – 8.70 €/kW
- Network Level 2 – 9.80 €/kW

Belgium

Unit transmission tariff

Decrease of the non-TSO tariffs due to transfer of federal levers and taxes from the electricity invoice to the state tax

Other Regulatory Changes

Cost coverage for regional taxes for towers and cables

Components (first connections charges)

The tariff for using the first connection bay encompasses:

- an annual fee for the installation substantial modification dismantling or renovation of the connection bay; and
- an annual fee for managing the connection bay.

Bosnia and Hercegovina

Components (first connections charges)

Grid users pay for the infrastructure connecting its installation to the transmission grid plus all other reinforcements in existing network.

Bulgaria

Components (First connections charges)

The price for connectionis paid by the grid user for installations up to the point of connection. The price for reinforcement of the grid is paid by the operator. There is not any different treatment of users.

Croatia

Components (First connections charges)

The connection power for calculating the fee for connection to the network is determined from the formula: P = max (P12 P22) where is P12 – connection power in the direction of download from the network (kW) and P22 – connection power in the direction of transmission to the grid (kW).

Other Regulatory Changes

All energy operator that carries 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 NRA – HERAs budget

Cyprus

Components (First connections charges)

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.

Other Regulatory Changes

This levy is administered by the Ministry of Energy to support the growth of RES production and energy savings.

Czech Republic

Unit transmission tariff

Same UTT applied for all voltage levels.

Components (First connections charges)

Charge is 25,710 €/MW for power (2022 and 2023 charge were the same difference due to the exchange rate).

Main Characteristics

No time differentiation on EHV and HV.

Denmark

Components (First connections charges)

Generation pays for the actual costs for connection to the substation. Load does not have initial charge. All are payed over the general tariffs.

Estonia

Components (First connections charges)

Includes both the direct costs of building the connection equipment as well as the necessary reinforcements in the grid if applicable

Finland

Components (First connections charges)

Standard fee based on average costs of connection infrastructure. No differentiation of charges for L G DSO. No locational differentiation.

Other regulatory charges

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.

France

Main Characteristics

Generators pay only if they are connected to 150 kV or above. Generators only pay an energy charge. A year is divided into five periods: summer/winter mid-peak hours /off-peak and from December to February a peak period.

Locational differentiation

A year is divided into five periods: summer/winter mid-peak hours/off-peak and from december to february a peak period.

Components (First connection charges)

G, L and 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.

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.

Other Regulatory Changes

For the base case it is 0.228 €/MWh in 2022 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 20/07/2021 decreased this percentage to 10.11 % from 01/08/2021.

Germany

Components (First connection charges)

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.

Other Regulatory Changes

Extra charge related to connection of Offshore Windfarms to the grid. According to 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 consumers is considered here. It must 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.

Unit transmission tariff

The grid fees 2022 compared with the grid fees 2021 are increased due to different facts, e. g.:

1. Increased estimated costs for congestion management (e. g. redispatch/countertrading/grid reserve).
2. Increased estimated costs for grid losses and control reserve.
3. Increased estimated costs for investments.

The reasons for the overall increase differ from one German control area to the other.

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

Great Britain

Main Characteristics

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.

Locational Differentiation

Part of the GB transmission tariffs are dependent on the seasons (only for large demand users). For generators and small demand users their tariffs are not seasonal. Small demand users also have time-varying transmission tariffs (part of the transmission charge for small demand users is based on peak hours use).

TNUoS is locational, while BSUoS is non-locational.

Generation charges highest in the north and lowest (negative) in the south where generation is scarse and demand highest. Demand charges highest in the south and lowest in the north where there is surplace generation.

Charges are based on gross flows except where demand locational charges are applied to generators where the net station demand in the half hour of system peak demand is used.

Components (First connection charges)

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.

Unit transmission tariff

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

Other Regulatory Changes

Non-RES support mechanism: Assisstance 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. (0.456825 paid by L). NRAs: (0.059557 paid by All). NRA Licence Fees for Generation 13.2% and for Load 86.8%.

Netting of flows for the application of transmission tariffs

Charges are based on gross flows except where demand locational charges are applied to generators where the net station demnad in the half hour of system peak demand is used.

Greece

Unit transmission tariff

Transmission losses are paid by those who inject energy in the transmission system (generators and importers), however, an estimation for this cost has been included here for comparison purposes. In the non-TSO related costs, costs related to RES payments that are completely irrelevant to IPTO are also included.

Components (First connection charges)

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 diffrentiate according to the installation location characteristics (e.g. ground morphology) or any other special project requirements

Other Regulatory Changes

Regulatory Authority Support cost.

Hungary

Unit transmission tariff

The base cost has increased based on reserve cost increasing. The TSO tariff has increased significantly from previous year. The tariff is slightly different to 132 kV and above. 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 item of the non-TSO component has decreased. The new tariff came in force not on January 1, but only on July 1. 2022. The NRA has set the tariff starting in July in such a way as to provide sufficient coverage for the entire year.

Components (First connection charges)

Charging is based on actual costs.

Other Regulatory Changes

1. The RES support scheme has two component parts (paid by competitive market consumers).
2. Separate for Aid linked to the stranded costs of conversion of the cogeneration process. Paid by competitive market consumers.
3. 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. Paid by competitive market consumers.

Iceland

Unit transmission tariff

There are no transmission lines in Iceland that are operated at higher voltage level than 220 kV so the price for voltage level 380 – 400 kV was set to zero.

In April 2022 a capacity charge for producers was implemented and consequently the transmission tariffs for consumers decreased. However the transmission tariffs for power intensive users increased, the exchange rate was higher and the average charge for

Components (First connection charges)

Charges are based on the actual cost and borne by the producer (G) or a power intensive user (L).

Ireland

Components (First connection charges)

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.

Other Regulatory Changes

Public Service Obligation (PSO) levy to support renewable energy.

Italy

Locational differentiation

Losses on the Italian transmission network are purchased by load service entities based on 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 2022 (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

From 2016 transmission tariff is binomial. Distributors pay Terna “CTR component” (infrastructure component of Transmission Tariff) that is split into 2 subcomponents:

- CTRE: energy (volume) component (ct €/kW)
- CTRP: power (capacity) component (ct €/kW per year)

Energy component is applied on monthly basis to the net energy withdrawn from DSOs connected to the NTG. Transmission fee is applied only if the resulting balance is a withdrawal. The energy injected in the distribution grid at HV level (virtual interconnection points) is also considered as energy withdrawn from the NTG.

Components (First connection charges)

Production pay Terna a fixed amount of 2.5k€ to get a general appraisal of the possible connection solution ("STMG"). Once obtained the authorisation applicants pay upfront Terna an amount of 2.5k€ + 0.5€/kW (max 50,000€) for a detailed technical connection solution ("STMD").

Reduced fees apply in case of connection of renewable and for high-performance co-generation plants and on transitory basis for storage.

Consumption units 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.

Netting of flows for the application of transmission tariffs

From 2016 transmission tariff is binomial. Distributors pay Terna "CTR component" (infrastructure component of Transmission Tariff) that is split into 2 subcomponents:

- CTRE: energy (volume) component (ct€/kW)
- CTRP: power (capacity) component (ct€/kW per year)

Energy component is applied on a monthly basis to the net energy withdrawn from DSOs connected to the NTG. Transmission fee is applied only if the resulting balance is a withdrawal. The energy injected in the distribution grid at HV level (virtual interconnection points) is also considered as energy withdrawn from the NTG.

Latvia

Components (First connection charges)

Includes both the direct costs of building the connection equipment as well as the necessary reinforcements in the grid, if applicable.

Lithuania

Unit transmission tariff

Tariff increased due to higher costs of system services. The tariff increased due to increased costs for ensuring the operation of the isolated system (component of system services)

Components (First connection charges)

100% of all actual connection costs.

Luxembourg

Unit Transmission Tariffs

Tariff increase from 2021 to 2022 mainly due to 59% increase in losses purchase and 40% increase in System Services purchase.

Components (First connection charges)

Grid users (L G DSO) pay the actual costs for their own connection line and substation. General reinforcements of the grid are socialised in the tariffs.

Other Regulatory Changes

RES support mechanism: 0.75€/MWh: The tax "Mécansime de compensation" (0.75€/MWh for customers ≥ 65kW) serves to encourage and subsidise national energy production projects based on renewable sources or cogeneration.

Non-RES support mechnism: 0.1€/MWh: Tax "Taxe Electricité" 0.50€/MWh (consumers cat. B)* 0.10 €/MWh (consumers cat. C)**

* Cat. B: consumers > 25MWh except belonging to cat. C

** Cat. C: consumers > 25MWh electricity mainly used for chemical reduction electrolysis or in metallurgical processes.

Montenegro

Components (First connection charges)

There is no difference in cost for L G and DSO

Other Regulatory Changes

Cost of Renewable energy Support mechanism aren't recovered through TSO charges already recovered through Fid-in tariff. NRA institutions cost isn't recovered through TSO charges too. NRA is the government body and belongs public administration.

Netherlands

Unit Transmission Tariffs

220 kV is considered part of the extra high voltage grid in the Netherlands. 150 kV is part of the high voltage grid. Tariff included here is assumed to be the tariff of the high voltage grid.

Components (First connection charges)

Grid users pay a connection fee for connecting to the grid. Other costs are included in the tariff.

North Macedonia

Components (First connection charges)

Grid user has to pay for its own connection line and substation to meet security criteria.

Northern Ireland

Unit Transmission Tariff

Significant rise in SMP from € 92.37 to € 225.

Components (First connection charges)

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.

Norway

Main Characteristics

The loss element has a localisation signal in the “marginal loss factor” (MLF). MLF is the same for Generation (G) and Consumption (L). MLF is calculated for every connection point in the grid on a weekly basis. Differentiation Day and Night/Weekend.

The fix element for G has no locational signals. The fix element for L has an element of localisation signal. It is constructed so that consumption in same connection point as production gets a lower tariff.

Components (First connection charges)

Connection fees are established based on the need for new capasity. Max connection fee is 50 % of investment cost.

Poland

Unit Transmission Tariff

The CHP charge in 2021 was 0 in 2022 – 0.6190 €/MWh;

capacity charge in 2021 was 1.7490 €/MWh in 2022 – 2.4723 €/MWh (44 % growth).

Components (First connection charges)

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:

Final customers (load) pay 25 %;

RES units of installed capacity ≤ 5 MW, CHP units of installed capacity ≤ 1 MW and grid energy storages pay 50 % of total investments expenditures.

Other generators and distribution companies pay 100 % of total investment expenditures.

Other Regulatory Changes

For UTT calculation non-TSO charges were calculated as the average for PSE end-consumers (their payments depend on electricity intensity ratio of PSE end-consumers). TSO charges final consumers connected to transmission network and DSOs at any voltage level (then DSO charge their final consumers).

RES charge is set annually by the NRA (in 2022: 0.90 PLN/MWh).

Stranded costs in transition charge rates are set in the law.

CHP charge rate is set annually by the Minister responsible for energy affairs (in 2022: 4.06 PLN/MWh).

Capacity charge is set annually by the NRA (in 2022: 102.60 PLN/MWh).

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

Unit Transmission Tariff

TSO costs: Losses (+0.58 €/MWh) and System Services (+0.70 €/MWh).

The Total variation for non-TSO costs is manly explained by surplus of the remainigremaining PPA (−6.79 €/MWh), Islands' tariff convergence costs (−2.29 €/MWh) and interruptibility interpretability costs (−1.24 €/MWh).

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.

Components (First connection charges)

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 and a grid co-payment to the system according to Ordinance ERSE 10/2019 published by the Regulator.

In case of not enough reception capacity and new grid reinforcements are not included in the NDP G must pay the needed grid reinforcements.

Internal reinforcement/expansion of the grid is endorsed to TSO's responsibility.

DSO reinforcement needs all the costs are socialised via the tariff.

Main Characteristics

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.

Other Regulatory Changes

Regulator costs (0.05389 €).

Capacity payments Islands' tariff convergence costs Interruptibility (3.710693 €).

Surplus costs for the remaining Power Purchase Agreements (PPAs) (−0.537102 €).

Hydro power station land (0.326131 €).

Romania

Main Characteristics

G and L are treated separately in the settlement.

Components (First connection charges)

The connecting entity (generator/load) fully covers the cost of the equipment that connects their installation to the transmission grid.

Costs associated to upstream grid reinforcements required to safely connect new users (generators/loads) are:

- shared between the TSO and generators connecting to the grid.
- fully paid by the TSO (and therefore socialised across all transmission users) 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.

Other Regulatory Changes

Mechanism designed to provide financial support to cogeneration plants.

Serbia

Components (First connection charges)

Shallow: Generators and DSOs have to pay fee for connection lines to match grid security criteria 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 €/MW at 110 kV and 20,360 €/MW at 220 kV.

Other Regulatory Changes

Tax for the financing of NRA (0.68 % of Transmission tariff).

Slovak Republic

Unit Transmission Tariff

The average price increased mainly due to the increase in the prices of electricity purchased to cover transmission losses on the PXE exchange and the decrease in the volume of invoiced end-use electricity of large electricity consumers in 2022 who met the conditions for a reduced tariff for system services and during the high increase in electricity prices in 2022 they have slowed down or ended their production. G share: 0.08588, L share: 14.630525.

Components (First connection charges)

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 a generators connected on the TSO pay 100 % of actual costs for the infrastructure connecting its installation to the transmission grid (100 % shallow).

Slovenia

Unit Transmission Tariff

Regarding high energy prices in the year 2022 Slovenian Government had decided with Intervention Act for ELES as TSO (as well DSO) that tariffs for network fee for billing power and for network fee for billing energy were reduced to 0 for three months (from 1st February 2022 till 30th April 2022).

Main Characteristics

Nuclear and Thermo power plants.

Components (First connection charges)

Shallow: Generators and DSOs have to pay fee for connection lines to match grid security criteria and for substation. Deep: Industrial customers have to pay the fee for the further network development if such is required. Connection fees are: 43,970 €/MW.

Other Regulatory Changes

Tax for the financing of NRA (3 % of Transmission tariff).

Spain

Unit transmission tariff

Cost of system services increased 3.1 €/MWh in 2022 vs 2021 (+74 %). Cost of losses also increased due to the increase of energy costs (3.4 €/MWh in 2022 vs 0.59 €/MWh in 2021).

Components (First connection charges)

All network users are subject to connection charges and pay for the infrastructure connecting its installation to the transmission grid valued as standard costs and the reinforcement of the grid.

Sweden

Unit transmission tariff

Due to much higher spot price and larger variation in price between the bidding zones. The spot price effects the energy charge.

Components (First connection charges)

Generators or consumers connecting to the grid will pay costs related to this (lines sub stations …).

Switzerland

Components (First connection charges)

No first connection charge for assets which can be used by other grid users.

Other Regulatory Changes

There is no non-TSO charge.

Ukraine

Components (First connection charges)

Shallow: Generators and DSOs have to pay fee for connection lines to match grid security criteria and for substation. Deep: Industrial customers have to pay the fee for the further network development if such is required.

Other Regulatory Changes

Payers are load customers except for “green” electrometallurgists.

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	18.5%	46.4%	35.1%
Bosnia & Herzegovina	14.1%	28.6%	57.3%
Bulgaria	19.0%	17.0%	64.0%
Croatia	16.0%	16.3%	67.8%
Cyprus	0.0%	0.0%	100.0%
Czech Republic	68.0%	31.0%	1.0%
Denmark	25.0%	50.0%	25.0%
Estonia	31.4%	2.9%	65.7%
Finland	38.6%	7.7%	53.8%
France	21.0%	27.0%	52.0%
Germany	66.0%	34.0%	0.0%
Great Britain	53.8%	26.9%	19.3%
Greece	23.7%	76.0%	0.3%
Hungary	67.1%	28.5%	4.4%
Iceland	0.0%	30.8%	69.2%
Ireland	5.6%	25.6%	68.8%
Italy	17.3%	39.0%	43.8%
Latvia	31.1%	0.0%	68.9%
Lithuania	30.0%	0.0%	70.0%
Luxembourg	0.0%	100.0%	0.0%
Montenegro	23.0%	28.0%	47.0%
Netherlands	24.3%	51.3%	24.3%
North Macedonia	25.7%	0.0%	74.3%
Northern Ireland	0.0%	38.2%	61.9%
Norway	79.9%	4.9%	15.2%
Poland	54.2%	45.3%	0.4%
Portugal	33.0%	67.0%	0.0%
Romania	56.0%	43.5%	0.5%
Serbia	18.3%	17.7%	64.0%
Slovakia	75.4%	22.0%	2.6%
Slovenia	26.6%	10.5%	62.9%
Spain	48.9%	44.7%	6.4%
Sweden	74.0%	26.0%	0.0%
Switzerland	27.7%	71.6%	0.7%
Ukraine	22.0%	58.0%	20.0%

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.

Table A.2. Voltage levels operated by TSOs

Appendix 3: Comparison of network losses prices

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

Remarks:

– The base case is taken (see Section 3).

Table A.3. Comparison of network losses prices

Appendix 4: Comparison of system services prices

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

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: Areas in countries with different Generation/ Consumption locational tariffs

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).

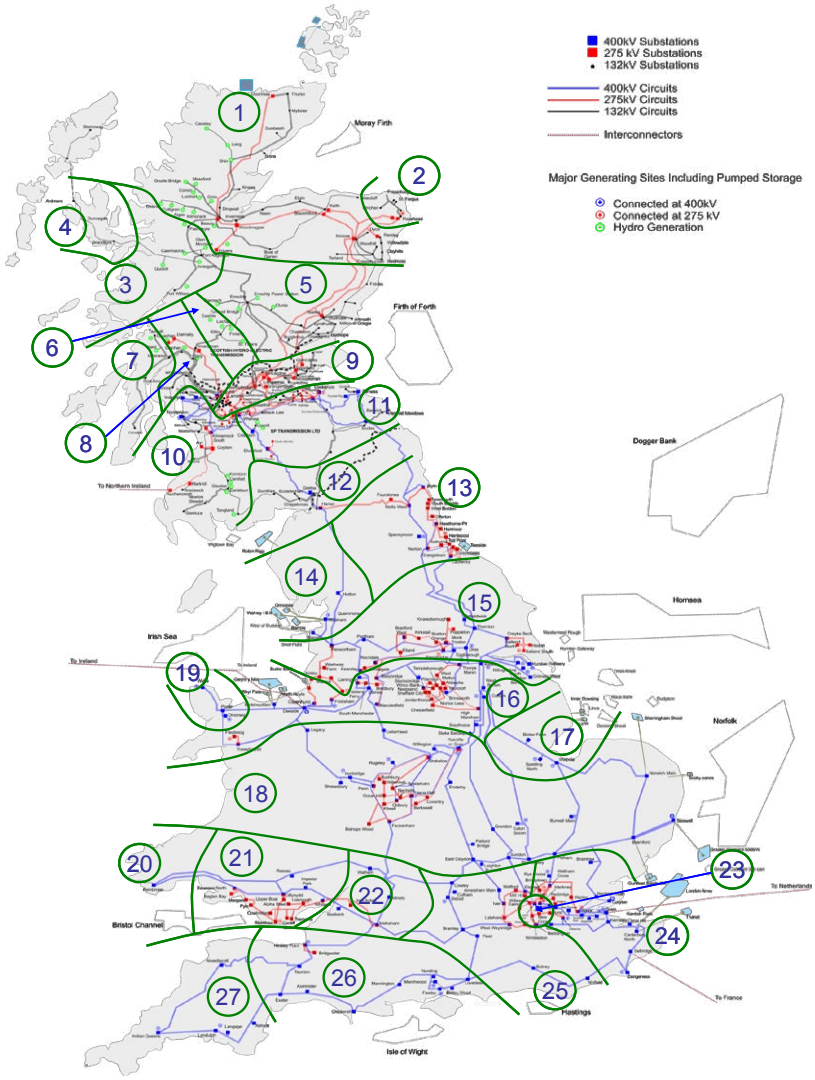


Chart A5.1 Great Britain

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.

The locational elements are:

1. Generator Transmission Use of System (GTUOs)
   GTUoS is made up of a postage stamp and locational component. The postage stamp portion is intended to recover a minimum of 70% of the total GTUoS revenue and is applied evenly across all generators, while the locational element is intended to provide for recovery of a maximum of 30%.
   2024-Approved-GTUoS-Tariffs-Accompanying-Note-SONI-v2.0.pdf
2. Transmission Loss Adjustment Factors
   Transmission Loss Adjustment Factors (TLAFs) are calculated by the TSOs, based on the Regulatory Approved approved TLAF methodology (SEM-12-049),
   2022-23-Approved-Transmission-Loss-Adjustment-Factors-(TLAFs)-Accompanying-Note-v1.0.pdf

Publication of graph to highlight where they change year on year as shown below:

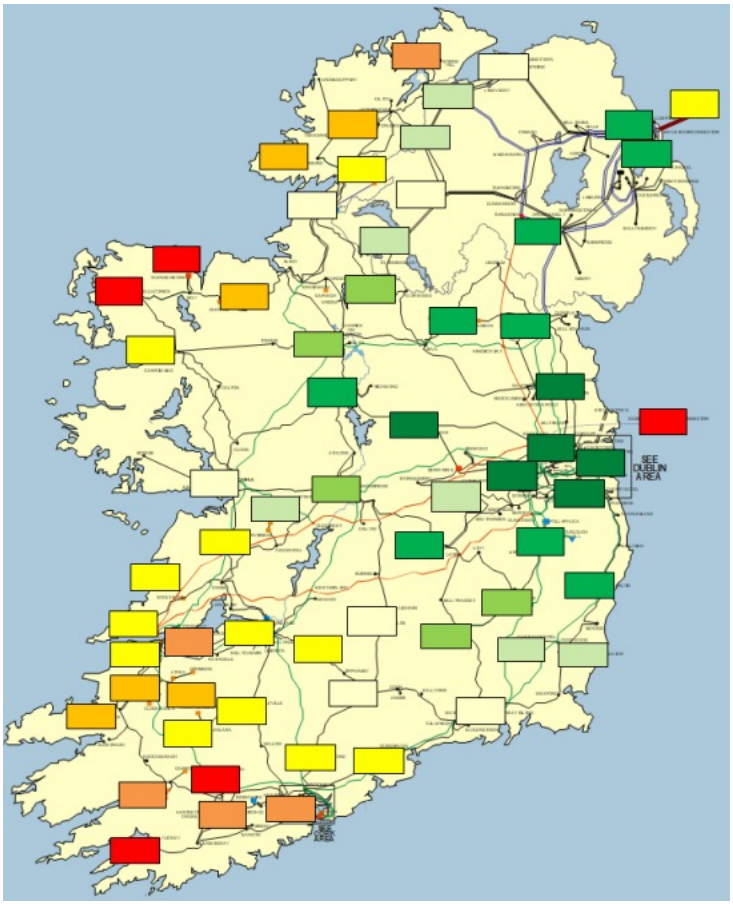


Chart A5.1 Locational breakdown of 2022/2023 TLAFs

There is also a location specific file:

https://cms.soni.ltd.uk/sites/default/files/2024-09/2022-23-Approved-TLAFs-v1.0.pdf

It should be noted that these tariffs are "all island" in that EirGrid and SONI as TSOs coordinate their calculations using the same approved methodology. Therefore, the same report is published by both TSOs. Other tariffs (demand side tariffs) are calculated differently in each jurisdiction.

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: Marked price (€/MWh) × marginal loss factor (%) × energy consumption (L) or production (G) (MWh). MLF is calculated for every connection point 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 calculated in such a way that consumption at the same connection point as production pays a lower tariff than consumption behind connection points where there is less or no production. The k-factor is between 0.6 and 1. K-factor = 1 gives no tariff reduction. K-factor = 0.6 gives 40 % tariff reduction.

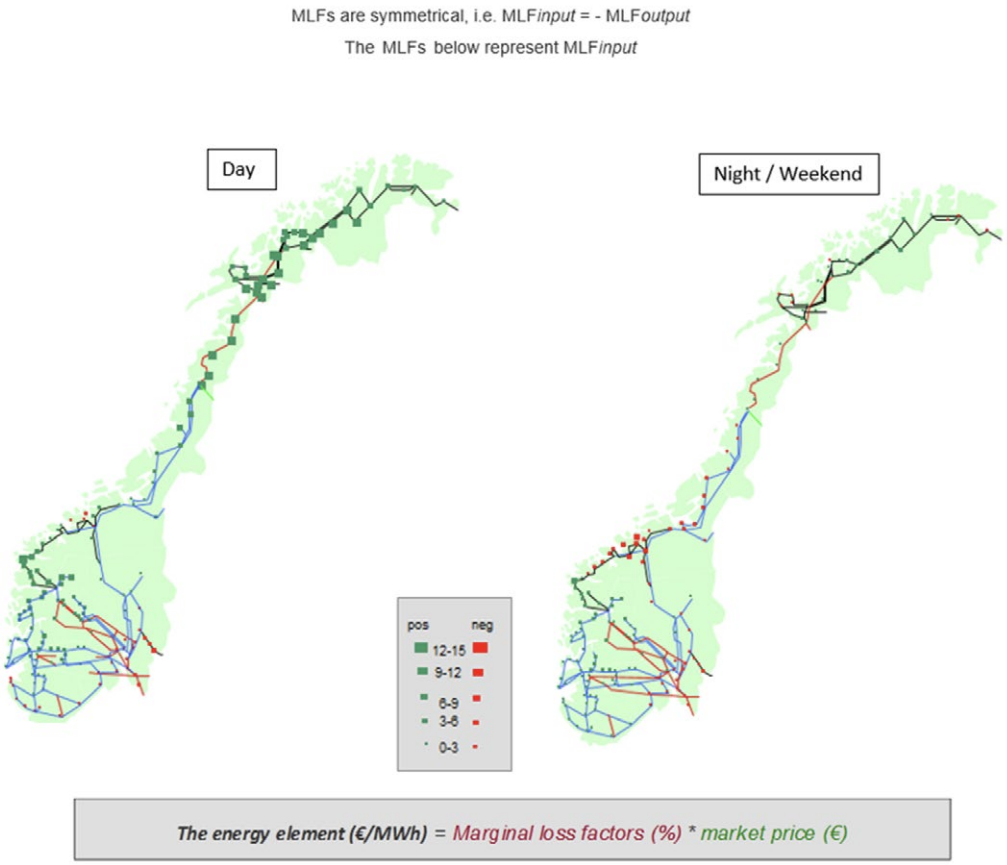


Chart A5.1 Norway. Marginal Loss Factors (MLF) Average 2014–15

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.

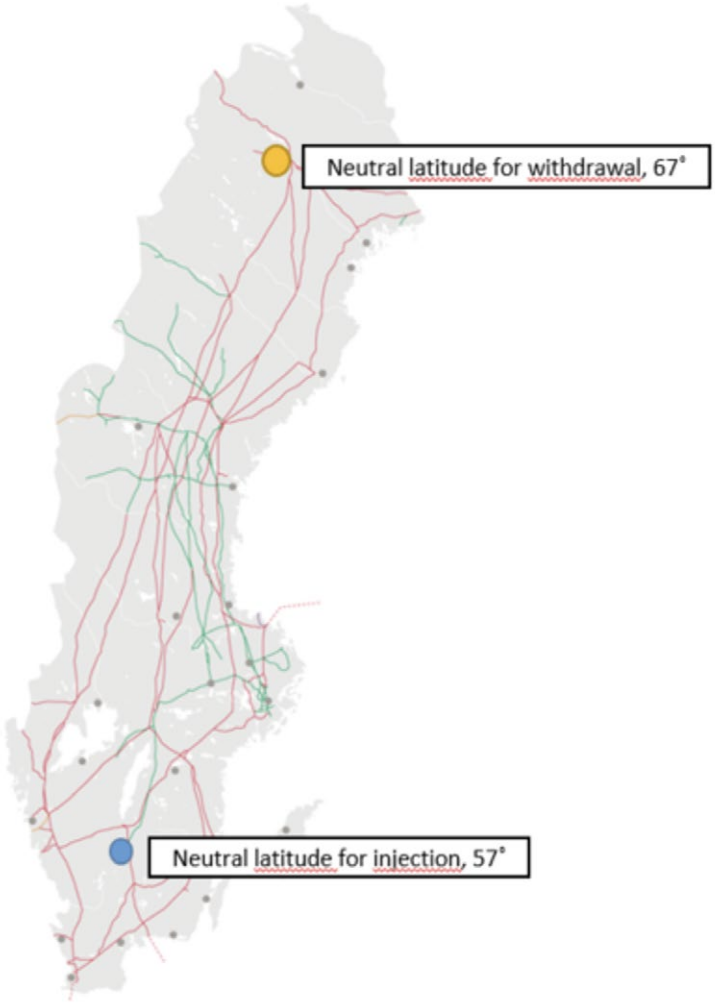


Chart A5.1 Sweden.

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	0.62	L	APG collects and passes tariffs for RES support from directly connected customers through. In the customer bills, these rariffs are not recorded in the network cost section but in the taxes & levies section. "NRAs/Other Institutions" are paid by "L" and included in the infrastructure tariff.
Belgium	RES support mechanism	0.18	L	Cost coverage for regional taxes for towers and cables
Bulgaria	RES support mechanism	1.83	L	
Croatia	NRAs/Other Institutions	0.01	L	All energy operator 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 NRA – HERAs budget
Cyprus	RES support mechanism	5.00	L	This levy is administered by the Ministry of Energy to support the growth of RES production and energy savings.
Denmark	NRAs/Other Institutions	0.10	L	
Estonia	RES support mechanism	11.30	All	
Finland	Others	0.07	All	Peak load capacity fee
France	Others	0.23	L	For the base case it is 0.228 €/MWh in 2022 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 20/07/2021 decreased this percentage to 10.11 % from 01/08/2021.

Country	Other regulatory charges not directly related to TSO activities			
	Cost item	Charge level (€/MWh)	Paid by	Description
Germany	RES support mechanism	2.25	L	• 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 consumers 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. 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/en/Renewable-energies-and-levies/EEG/EEG-financing/EEG-levies** • For the second half of 2022, the „EEG Umlage" was set to 0 ct/kWh. For the whole of 2022, a calculated value in the form of an imputed total annual levy is therefore used as a basis. This results from the arithmetic mean between the „EEG Umlage" rate for the first half of 2022 and the statutory „EEG Umlage" rate for the second half of 2022.
	non-RES support mechanism	0.83	L	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.) + costs according to the German Grid Tariff Regulation Ordinance + extra charge related to the Ordinance on Interruptible Load Agreements
Great Britain	non-RES support mechanism	0.52	L	non-RES support mechanism: Assisstance 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. (0.456825 paid by L). NRAs: (0.059557 paid by All). NRA Licence Fees G 13.2% / L 86.8%
Greece	RES support mechanism	0.07	L	Regulatory Authority Support cost
Hungary	RES support mechanism	0.00	L	1. The RES support scheme has two component parts (paid by competitive market consumers)
	non-RES support mechanism	3.62	L	2. Separate for Aid linked to the stranded costs of conversion of the cogeneration process. Paid by competitive market consumers
	Others	0.20	L	3. 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. Paid by competitive market consumers
Ireland	RES support mechanism	3.72	L	Public Service Obligation (PSO) levy to support renewable energy

Country	Other regulatory charges not directly related to TSO activities			
	Cost item	Charge level (€/MWh)	Paid by	Description
Luxembourg	RES support mechanism	0.75	L	• The tax "Mécansime de compensation" (0.75 €/MWh for customers ≥ 65 kW) serves to encourage and subsidise national energy production projects based on renewable sources or cogeneration
	non-RES support mechanism	0.10	L	• The tax "Taxe Electricité" – Cat A: 1 €/MWh / consumption < 25 MWh – Cat B: 0.50 €/MWh / consumption > 25 MWh – Cat C: 0.10 €/MWh / consumption > 25 MWh, electricity mainly used for chemical reduction, electrolysis or in metallurgical processes – TSO customers are normally classified in cat C. This is why I put 0,1 €/MWh
Montenegro		0.00		Cost of Renewable energy Support mechanism aren't recovered through TSO charges, already recovered through Fid-in tariff. NRA institutions cost aren't recovered through TSO charges, too. NRA is the government body and belongs public administration.
Poland	RES support mechanism	0.14	L	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 2022 the RES charge is 0.90 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).
	Stranded costs	0.10	L	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 modernise their production units, adjusting them to environmental standards. Those costs are recovered by a transition charge in the Tariff. Charge rates are set in the law. TSO charges final consumers connected to transmission network and DSOs at any voltage level (then DSO charge their final consumers).
	non-RES support mechanism	3.09	L	Connected with settlements with (i) CHP producers and (ii) capacity mechanism settlements recovered by respectively (i) CHP charge and (ii) capacity charge in the Tariff. TSO charges final consumers connected to transmission network and DSOs at any voltage level. For UTT calculation, both charges were calculated as the average for PSE end—consumers. Their payment of CHP charge depends on electricity intensity ratio of PSE end--consumers. Their payments of capacity charge depend on difference between average hourly electricity consumption in peak and off-peak periods in working days. CHP Charge rate is set annually by the Minister responsible for energy affairs. For 2022 the cogeneration charge is 4.06 PLN/MWh. Capacity charge rate is set annually by the NRA. For 2022 the capacity charge is 102.60 PLN/MWh.
Portugal	Others	3.55	L	Regulator costs (0.05389) Capacity payments Islands' tariff convergence costs, Interruptibility (3.710693) Surplus costs for the remaining Power Purchase Agreements (PPAs) (–0.537102) Hydro power station land (0.326131)
Romania	non-RES support mechanism	3.66	L	Mechanism designed to provide financial support to cogeneration plants
Serbia	NRAs/Other Institutions	0.03	L	Tax for the financing of NRA (0.68 % of Transmission tariff)
Slovenia	NRAs/Other Institutions	3.71	L	Tax for the financing of NRA (3 % of Transmission tariff)
Switzerland		0.00		no non-TSO charge
Ukraine	RES support mechanism	2.62	L	Payers are load customers except for "green" electrometallurgists

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 charge 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, paid by consumers and generators. Consumers pay a second charge for past and future system developments (system provision) based on load: • Network Level 1 – 8.70 €/kW • Network Level 2 – 9.80 €/kW
Belgium	Shallow	The tariff for using the first connection bay encompasses: • an annual fee for the installation substantial modification dismantling or renovation of the connection bay; and • an annual fee for managing the connection bay.
Bosnia and Herzegovina	Deep	Grid users pay for the infrastructure connecting its installation to the transmission grid plus all other reinforcements in existing network.
Bulgaria	Shallow	The price for connection is paid by the grid 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/Shallow	The connection power for calculating the fee for connection to the network is determined from the formula: P = max (P12..P22) where is P12 – connection power in the direction of download from the network (kW) and P22 – connection power in the direction of transmission to the grid (kW).
Cyprus	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.
Czech Republic	Shallow	25,710 €/MW for power (2022 and 2023 charge were the same, difference due to the exchange rate)
Denmark	Shallow	L: Pays for the actual costs for connection to the substation. G: No initial charge. All are paid over the general tariffs.
Estonia	Shallow	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.

Country	Charge Type	Description
France	Shallow	* 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. * 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/ 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	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.
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	Production pay Terna a fixed amount of 2.5 k€ to get a general appraisal of the possible connection solution (“STMG”). Once obtained the authorisation applicants pay upfront Terna an amount of 2.5 k€ + 0.5 €/kW (max 50,000 €) for a detailed technical connection solution (“STMD”). Reduced fees apply in case of connection of renewable and for high-performance co-generation plants and on transitory basis for storage. Consumption units 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.
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.
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	Grid users pay a connection fee for connecting to the grid. Other costs are included in the tariff.
Northern 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.
Norway	Shallow/Deep	Connection fees are established based on the need for new capasity. Max connection fee is 50 % of investment cost.
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: • Final customers (load) pay 25 % • RES units of installed capacity ≤ 5 MW, CHP units of installed capacity ≤ 1 MW, and grid energy Storages pay 50 % of investment expenditures. Other generators and distribution companies pay 100 % of total investment expenditures.

Country	Charge Type	Description
Portugal	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 and a grid co-payment to the system according to Ordinance ERSE 10/2019 published by the Regulator In case of not enough reception capacity and new grid reinforcements are not included in the NDP G must pay the needed grid reinforcements. Internal reinforcement/expansion of the grid is endorsed to TSO's responsibility. DSO reinforcement needs all the costs are socialised via the tariff.
Romania	Shallow/Deep	The connecting entity (generator/load) fully covers the cost of the equipment that connects their installation to the transmission grid. Costs associated to upstream grid reinforcements required to safely connect new users (generators/loads) are: • shared between the TSO and generators connecting to the grid; • fully paid by the TSO (and therefore socialised across all transmission users) 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. No locational differentiation.
Serbia	Shallow/Deep	Shallow: generators and DSOs have to pay fee for connection lines to match grid security criteria and for substation. Deep: industrial customers have to pay the fee for further network development if such is required. Connection fees are: 16,030 €/MW for 110 kV, and 20,360 €/ MW for 220 kV.
Slovakia	Super Shallow /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/Deep	Shallow: Generators and DSOs have to pay fee for connection lines to match grid security criteria and for substation. Deep: Industrial customers have to pay the fee for the further network development if such is required. Connection fees are: 43,970 €/MW.
Spain	Deep	All network users are subject to connection charges and pay for the infrastructure connecting its installation to the transmission grid valued as standard costs and the reinforcement of the grid.
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.
Ukraine	Shallow/Deep	Shallow: Generators and DSOs have to pay fee for connection lines to match grid security criteria and for substation. Deep: Industrial customers have to pay the fee for further network development if such is required.

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	No
Austria	1) For pump storage: the grid usage charge for pumped storage plants for all network levels is: – energy: 0.215800 ct €/kWh; – power: 100.00 ct €/kW. 2) Reduced infrastructure tariff for negative Ancillary Services called energy: 0.085 ct €/kWh additional power: 100.00 ct €/kW.
Belgium	No
Bosnia and Herzegovina	No
Bulgaria	No
Croatia	No
Cyprus	No
Czech Republic	No
Denmark	No
Estonia	No
Finland	No
France	* Specific tariff for a second connection used for emergency situations. * Specific tariff for multi-locations customers * A DSO directly connected to the lowest voltage level of a TSO transformer * A DSO owning lines of the same voltage level as the lines of the TSO it is connected to benefits from a discount. * If cold temperatures, DSOs may benefit from a discount on their capacity overrun. * A customer can benefit from a discount on its tariff during 2 weeks, provided it informs the TSO in advance. * Some industrial customers can benefit from discount from 50 % to 90 % .

Country	Special Tariff Conditions
Germany	• **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 tari**ff.** • **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	No
Greece	No
Hungary	No
Iceland	**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.
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 charging mode for storage (1 MW). Zero tariff for system services component for DSO grid losses.
Luxembourg	No
North Macedonia	No

Country	Special Tariff Conditions
Montenegro	No
Netherlands	There is a special tariff for users with a maximum of 600 hours (or less).
Northern Ireland	Autoproducers pay capacity based TUoS charges on the greater of either their contracted Maximum Import Capacity or contracted Maximum Export Capacity, not both.
Norway	50 % tariff reduction for large industrial users
Poland	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: • yearly consumption was not less than 400 GWh; • utilisation of 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. 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: • 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. 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. 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.
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 2022, the discount is 0,03 €/kVA at the fixed term of the access tariffs.
Romania	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 2022: • tariff for system services discounted by 95 % if their utilisation of maximum contractual capacity in 2020 were higher than 6 800 hours and perpetual deviation of the subject of settlement was lower than 0.025, • tariffs for access to transmission system and its management: • discounted by 30 % if their maximum contractual capacity in 2021 is higher than 200 MW and their energy supplied over transmission system in 2021 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 2021 was higher than 1.5 TWh, • discounted by 70 % if their maximum contractual capacity in 2021 is higher than 350 MW and their energy supplied over transmission system in 2021 was higher than 2.5 TWh.
Slovenia	No
Spain	No
Sweden	No
Switzerland	No
Ukraine	No

Table A.8. Special tariffs

Appendix 9: Treatment of Final Customers vs Distribution System Operators

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

There might be different tariffs, charges calculation procedures or settlement rules for end customers and distribution system operators. Justification for different treatments 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 end 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	
Austria	No	
Belgium	Yes	The tariffs for DSO are higher (+8.15 €/MWh)
Bosnia and Herzegovina	No	
Bulgaria	No	
Croatia	Yes	HOPS charges only transmission fees for cutomers connected directly to TSO network. For cutomers connected directly to distribution network transmission fee is collected by DSO and transfered to the TSO.
Cyprus	Yes	TSO Cyprus does not charge final customers but load representatives. It is the load representative who charges final customers connected to the transmission network.
Czech Republic	No	
Denmark	Yes	Only end consumers pays tariffs.
Estonia	No	
Finland	No	
France	No	
Germany	No	
Great Britain	Yes	DSOs are not charged charges are levied on end users via their supplier.

Country	Different treatment between final customer and distributor	Difference from the total charge applied to the base case scenario (%)
Greece	Yes	Presently ADMIE does not charge final customers but load representatives. It is the load representative who charges final customers connected to the transmission network.
Hungary	No	
Iceland	No	
Ireland	No	
Italy	Yes	Final users (different from LV domestic users) pay DSOs the "TRAS component" which is split into 2 subcomponents: • TRASE: energy component applied to LT, MT, HV, EHV users • TRASP: power component applied to HV, EHV users. LV domestic users pay DSOs a different tariff component (TD) DSOs pay to the TSO the "CTR components" split into CTRE – energy component – applied to the sum of the energy withdrawn from NTG and injected in "NTG virtual interconnection points" and CTRP – power component – 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	
Netherlands	No	
Northern Ireland	No	
Norway	Yes	Large industrial users get 50 % tariff reduction.
Poland	No	
Portugal	No	
Romania	No	
Serbia	No	
Slovakia	No	
Slovenia	No	
Spain	No	
Sweden	No	
Switzerland	Yes	Bundling of connection points for national railway operator (SBB).
Ukraine	No	

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

Appendix 9A: Treatment of Active Customers vs End Customers

End Customers are seen as Load (L), while Active Customers are seen both as Load (L) and Generation (G) from TSO's perspective.

There might be different tariffs, charges, calculation procedures or settlement rules for Active Customers and End Customers. Justification for different treatments might be the different power flows in the case of Active Customers and some RES incentive charges applied to End Customers which are not applied on Active Customers.

The table below summarises the main features of different treatment /charging mechanisms of Active Customers and End Customers per TSO.

Country	Different treatment between Active Customer and End Customers	Difference from the total charge applied to the base case scenario (%)
Albania	No	
Austria	No	
Belgium	No	
Bosnia and Herzegovina	No	
Bulgaria	No	
Croatia	No	
Cyprus	No	

Country	Different treatment between Active Customer and End Customers	Difference from the total charge applied to the base case scenario (%)
Czech Republic	No	
Denmark	Yes	Prosumers only pay tariffs of the net energy consumption
Estonia	No	
Finland	No	
France	No	
Germany	No	
Great Britain	No	
Greece	No	
Hungary	No	
Iceland	No	
Ireland	No	
Italy	No	
Latvia	No	
Lithuania	No	
Luxembourg	No	
North Macedonia	No	
Montenegro	No	
Netherlands	No	
Northern Ireland	No	
Norway	No	
Poland	Yes	In case of fixed component of the network rate for final PoDs the energy is reduced by the energy storage efficiency factor.
Portugal	Yes	The prosumers that use National Grid don't pay some of non-TSO costs.
Romania	No	
Serbia	No	
Slovakia	Yes	Prosumers are paying tariff for reserved capacity in the form of G-component and only if generation exceeds load.
Slovenia	No	
Spain	No	
Sweden	No	
Switzerland	No	
Ukraine	No	

Table A.9A. Treatment Active Customers vs End Customers

Appendix 9B: Treatment of Storages vs End Customers/Generation

Storage is seen as both Load (L) and Generation (G) from TSO's perspective.

There might be different tariffs, charges calculation procedures or settlement rules for Storages (as Load) and End Customers and Storages (as Generation) and classic Generation. Justification for different treatments of storages might be the important role of storages in the system, thus some special tariff regimes may apply to it.

The table below summarises the main features of different treatment/charging mechanisms of Storages vs End Customers/Generation.

Member State Name	Different treatment between Storages and End Customers/Generation	Difference between Storages and End Customers/ Generation %
Albania	No	
Austria	Yes	For pump storage: The grid usage charge for pumped storage plants for all network levels is: • Energy: 0.2800 ct/kWh • Power: 100.00 ct/kWh
Belgium	Yes	Storage is exonerated from transport tariffs
Bosnia and Herzegovina	No	
Bulgaria	No	
Croatia	Yes	Based on respective law just load self-consumption is a base for load tarrifs
Cyprus	No	
Czech Republic	No	
Denmark	No	
Estonia	No	
Finland	Yes	No fee on consumption for storages only output and input fees
France	No	
Germany	Yes	• Storages do not pay grid charges at all (§ 118 paragraph 6 EnWG) or less grid charges in some cases (§ 19 paragraph 4 StromNEV)

Member State Name	Different treatment between Storages and End Customers/Generation	Difference between Storages and End Customers/ Generation %
Great Britain	Yes	Storage users are considerd to be generation for charging purposes
Greece	No	
Hungary	No	
Iceland	No	
Ireland	No	
Italy	Yes	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	Yes	Storage (only >1 MW) does not pay transmission tarrif for the charged amount if that amount is subsequently returned to the transmission grid
Luxembourg	No	
Montenegro	No	
Netherlands	No	
North Macedonia	No	
Northern Ireland	No	
Norway	No	
Poland	No	
Portugal	Yes	The consumption of storage is not subject to grid tariffs
Romania	No	
Serbia	Yes	Storages don't pay transmission tariff either in Load or Generation regime.
Slovak Republic	Yes	Storages are paying tariff for reserved capacity in the form of G-component
Slovenia	No	
Spain	**No**	
Sweden	**No**	
Switzerland	**No**	
Ukraine	**No**	

Table A.9B. Treatment Active Customers vs End Customers

Appendix 9C: Treatment of Demand Response vs End Customers

Both Demand Response and End Customers are seen as Load (L) from TSO's perspective.

There might be different tariffs, charges calculation procedures or settlement rules for Demand Response and End Customers. Justification for different treatment might be the additional service which Demand Response can provide to the system and market players, by changing its consumption pattern as per external signal.

The table below summarises the main features of different treatment /charging mechanisms of Demand Response and End Customers per TSO.

Country	Different treatment between Demand Response and End Customers	Difference from the total charge applied to the base case scenario (%)
Albania	No	
Austria	Yes	Reduced infrastructure tariff for negative ancillary services: • Called energy: 0.085 ct/kWh • Additional power: 100 ct/kWh
Belgium	No	
Bosnia and Herzegovina	No	
Bulgaria	No	
Croatia	Yes	If demand response participates in ancillary services market tariff costs are reduced in a part caused by ancillary services.
Cyprus	No	
Czech Republic	No	
Denmark	No	
Estonia	No	
Finland	No	
France	Yes	
Germany	No	

Country	Different treatment between Demand Response and End Customers	Difference from the total charge applied to the base case scenario (%)
Great Britain	No	
Greece	Yes	The Demand Response portfolios participate in the Balancing Market as Balancing Service Providers while the load portfolios participate only as Balance Responsible Parties.
Hungary	No	
Iceland	No	
Ireland	No	
Italy	No	
Latvia	No	
Lithuania	No	
Luxembourg	No	
Montenegro	No	
Netherlands	No	
North Macedonia	No	
Northern Ireland	No	
Norway	No	
Poland	No	
Portugal	Yes	The increase in consumption associated with demand response is not subject to grid tariffs
Romania	No	
Serbia	No	
Slovakia	No	
Slovenia	No	
Spain	**No**	
Sweden	**No**	
Switzerland	**No**	
Ukraine	**No**	

Table A.9C. Treatment Active Customers vs End Customers

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 φ or tg φ.

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	Yes	Yes	For each offtake or injection point a tariff for additional reactive energy is applied on a quarter-hourly basis for the offtake or injection of reactive energy should this exceed a certain proportion of the monthly reference peak the latter being the highest active energy peaks injected or withdrawn over the month.
Bosnia and Herzegovina	No	No	
Bulgaria	No	Yes	Different rules for injected and consumed reactive power are imposed to consumers (incl. generators in non-generating mode) and DSOs. The consumed reactive power for which the penalty is imposed is calculated on the basis of a formula: Erp=Erconsumed – 0.49*Eaconsumed The penalty for consumed (transmitted) reactive power is 10 % of the wholesale price of the active power. For consumers (incl. generators in non-generating mode) the penalty for injected reactive power is 100 % from the wholesale price of the active power.
Croatia	Yes	Yes	There is tariff for excess reactive energy. It is paid monthly according to metered consumption. Tariff for excess reactive energy is 0.021236 €/kvarh. It is paid directly connected to the EHV transmission network. The power factor (cos φ) shows how much apparent power is used to obtain active power and is expressed as an amount from 0 to 1. For example a power factor of 0.9 means that only 90 % of the total current entering the user's installation is converted into useful power work the remaining 10 % reduces the capacity of transmission lines and causes losses in the network.
Cyprus	No	No	
Czech Republic	No	No	
Denmark	No	No	

Country	Reactive Tariff Y / N	Penalty Y / N	Quantity / Conditions of application
Estonia	Yes	No	1.54 €/Mvarh.
Finland	No	Yes	
France	Yes	Yes	For loads, hourly billing is applied to calculate unit overruns in each billing zone. • Billing zone for the reactive energy absorbed by the user: 10.99 €/Mvarh • Billing zone for the reactive energy supplied by the user: 0.96 €/Mvarh
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	The tariff assumes a minimum average power factor of cos φ=0.9 at the outfeed for the consumers at each point of delivery. In the event that the average power factor of a single month falls below the limit the energy and capacity charge shall increase by 2 % for each 1 % that the power factor falls below the limit.
Ireland	Yes	Yes	Generator Performance Incentives. Reactive Power Leading/lagging 0.32 €/Mvarh.
Italy	No	Yes	Charge is applied for reactive inductive energy withdrawn from trans./distr. grids where cosφ exceeds a threshold (if there is a HV distr. connection between points cosφ calculated on aggregation of connection points) function of: • ratio of reactive to active energy • relevant time slot It is between 0 – 1.1 ct €/kvarh (energy withdrawn from trans. grid DSOs pay Terna; reactive energy withdrawn from dist. grid Terna pays DSOs) Final consumers pay DSOs for reactive energy withdrawn from the distribution above a set cosφ threshold (between 0 – 1.1 ct €/kvarh for final customers HV/EHV)
Latvia	Yes	No	
Lithuania	Yes	No	Applied to all consumers for each connection point: 0.8 €/Mvarh for consumption and 1.6 €/Mvarh for generation of reactive energy.
Luxembourg	No	No	
Montenegro	Yes	Yes	All grid users except generators pay reactive energy tariff for cosφ < 0.95 – 0.010484 €/kvarh for LT and 0.005242 for HT. These tariffs are applied both to capacitive and inductive reactive energy.
Netherlands	No	No	
North Macedonia	No	Yes	The charges are applied to L and DSO. If consumed reactive energy is below level of cosφ = 0.95 the charge for the exceeding reactive energy is 1.6 €/Mvarh.
Northern Ireland	Yes	Yes	Leading Lagging Charges included in Generator Performance Incentives. Reactive Power Leading 0.328 €/Mvarh. Reactive Power Lagging 0.328 €/Mvarh. See Other System Charges in Statement of Charges.

Country	Reactive Tariff Y / N	Penalty Y / N	Quantity / Conditions of application
Norway	Yes	No	
Poland	No	Yes	PSE S.A. applies 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. The penalty is calculated for each Mvarh of passive energy taken-off the HV and EHV network when phase factor tgφ is above 0.4 and for each Mvarh of passive energy fed into the transmission network regardless the value of phase factor. The charge for excess take-off passive energy (above tgφ =0.4) is calculated according to the following formula: $O_b = k \times C_{rk} \times \left(\sqrt{\frac{1+tg^2 \varphi}{1+tg^2 \varphi_0}} - 1 \right) \times A$ where: k – coefficient equal 0.5, C_{rk} – unit price of active energy, tgφ – measured value of phase factor in period used for settlement of the charges for excess take-off of passive energy, $tg\varphi_0$ – 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. 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.
Portugal	Yes	Yes	**Penalty:** The Inductive reactive energy supplied by the transmission network outside the off-peak hours, is charged as follows: 0.462 €/Mvarh, if 0.3 ≤ tgφ < 0.4 1.4 €/Mvarh, if 0.4 ≤ tgφ < 0.5 4.2 €/Mvarh, if tgφ > =0.5 **Tariff:** The reactive energy received by the transmission network in the off-peak hours, is charged to 1.4 €/Mvarh.
Romania	Yes	Yes	Rate applied is 18.33 €/Mvarh (calculated as 30 % of the estimated price of electricity purchased by the TSO to offset network losses). Charged to both G and L. Both capacitive and inductive. If cos φ < 0.65 the penalty applied is three times the reactive tariff for: • Recorded capacitive energy • Inductive energy with the difference between the consumed reactive energy and the related reactive energy for cos φ = 0.9.
Serbia	Yes	Yes	All grid users except generators, PSPP and auxiliary power for power plants are charged for reactive energy. If consumed reactive energy exceeds level of cosφ = 0.95 the charge for the exceeding reactive energy is double. The base reactive energy tariff is 2.4403 €/Mvarh. The reactive energy tariff for cosφ < 0.95 is 4.8806 €/Mvarh. These tariffs are applied both to capacitive and inductive reactive energy.
Slovakia	No	No	
Slovenia	No	No	
Spain	No	Yes	
Sweden	No	No	
Switzerland	Yes	Yes	This value is not included in the UTT calculation.
Ukraine	No	No	

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			
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

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
Iceland			X			
Ireland						X
Italy						X
Latvia		X				
Lithuania				X	60 Min	
Luxembourg		X				
North Macedonia		X				
Montenegro		X				
Netherlands				X	15 Min	
Northern Ireland						X
Norway			X			
Poland				X	60 min	
Portugal				X	15 Min	
Romania			X			
Serbia		X				
Slovakia			X			
Slovenia				X	15 Min	
Spain						X
Sweden				X	60 Min	
Switzerland		X				
Ukraine			X			

Country remarks regarding Great Britain, Italy and Poland 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 31st December 2022.

The table below summarises exchange rates applied.

Country	Exchange rate
Albania	1ALL = 0.008754 €
Bosnia and Herzegovina	1BAM = 0.511292 €
Bulgaria	1BGN = 0.510204 €
Croatia	1HRK = 0.132802 €
Czech Republic	1CZK = 0.041468 €
Denmark	1DKK = 0.134409 €
Great Britain	1GBP = 1.1275 €
Hungary	1HUF = 0.002498 €
Iceland	1ISK = 0.006601 €

Country	Exchange rate
North Macedonia	1MKD = 0.016262 €
Northern Ireland	1GBP = 1.1275 €
Norway	1NOK = 0.095147 €
Poland	1PLN = 0.213224 €
Romania	1RON = 0.202020 €
Serbia	1RSD = 0.008523 €
Sweden	1SEK = 0.098039 €
Switzerland	1CHF = 1.010101 €
Ukraine	1UAH = 0.025673 €

Table A.12. Exchange rates

Appendix 12A: Consumer Price Index

The table below summarises Consumer Price Index (CPI) for 2022 per each country, used for the calculation of evolution of UTT prices in 2022 constant Euros.

Country	CPI
Albania	6.56
Austria	8.62
Belgium	10.34
Bosnia and Herzegovina	14.00
Bulgaria	9.50
Croatia	10.67
Cyprus	8.10
Czech Republic	14.77
Denmark	8.48
Estonia	19.40
Finland	7.18
France	4.90
Germany	8.70
Great Britain	7.90
Greece	9.30
Hungary	15.27
Iceland	5.73
Ireland	8.11
Italy	8.70

Country	CPI
Latvia	17.24
Lithuania	18.90
Luxembourg	8.16
Montenegro	11.93
Netherlands	4.10
North Macedonia	14.02
Northern Ireland	9.20
Norway	6.23
Poland	13.21
Portugal	8.11
Romania	12.02
Serbia	11.72
Slovakia	12.12
Slovenia	9.32
Spain	8.32
Sweden	8.00
Switzerland	2.67
Ukraine	15.09

Table A.12A. Consumer Price Index

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	Public Service Obligations (PSOs) are compulsory services that regulators or governments may apply to companies in the public interest. 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.
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 notrecoverable. In some jurisdictions, the regulator may allow stranded costs to be charged trough 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 tranmission tariff that is built especifically 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.

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