ENTSO-E Overview of Transmission Tariffs in Europe: Synthesis 2018

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This study was produced by the ENTSO-E Working Group Economic Framework.

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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.

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

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

As in past years, two clarifications to the data submitted by TSOs for the 2018 ENTSO-E Overview of Transmission Tariffs are worth to be reminded. Firstly that, in general, the total UTT includes non-TSO costs charged to "base case" users, even if they do not form part of the TSO tariffs in the participating countries and even if they are not charged directly to base case users. This is because in some countries, non-TSO costs do form part of or are invoiced along with the TSO tariff and therefore, for consistency, it is necessary to include them. However non-TSO costs can still be disaggregated and are shown separately in this document in order to be transparent about the different elements charged to base case users. This partly explains the increase in the non-TSO costs compared to years up to 2015. 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.

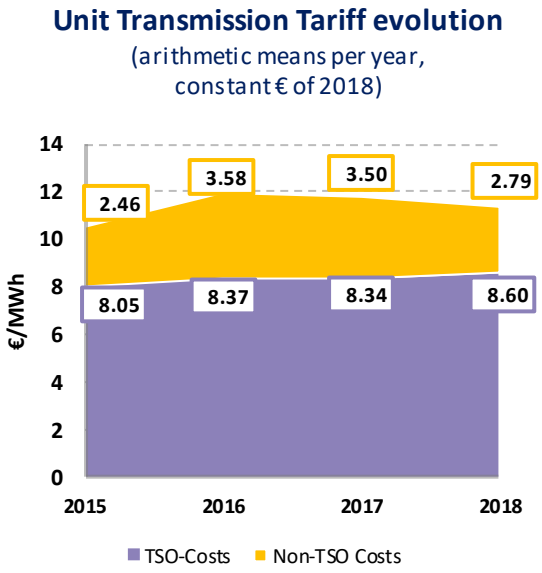
The 2018 edition of the ENTSO-E Overview of Transmission Tariffs in Europe introduces one major enhancements compared with previous versions – we welcome Albania as a new participating country in the overview.

In terms of the main findings, the table below summarises the annual change in the average UTT components and their values for 2018:

	2018	**2018/2017**
Average European UTT	**11.38** €/MWh	-3.92%
• Due to TSO Costs	8.60 €/MWh	+3.04%
• Due to Non-TSO Costs	2.79 €/MWh	-25.42 %*

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

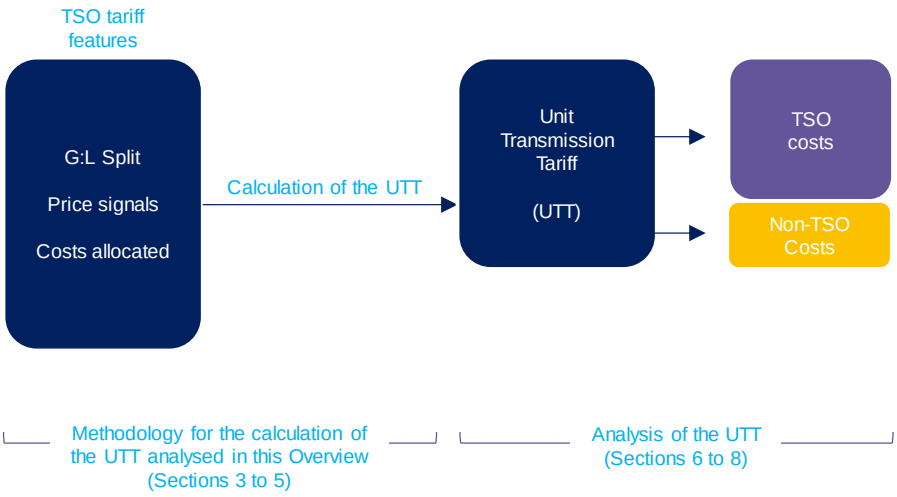
* The decrease of average non-TSO part of UTT in Europe in 2018 is largely caused by the change of supporting system for renewable energy and energy research in Denmark. Since 1 January 2018, the special payment for financing above support has not been charged by Danish TSO.



On average, in 2018 the TSO cost component of the UTT is divided 59.0% for infrastructure, 30.9% for system services and 10.1% for losses. On average, 60.2% of the TSO cost component is invoiced based on energy (i.e. on a volume, or MWh basis), while 39.8% is invoiced based on power (i.e. a capacity, or MW basis). The TSO part of the UTT is applied to generation and load in 15 countries whereas in 21 countries only load is charged. The average level of the TSO part of the UTT is 8.08 €/MWh for load and 0.51 €/MWh for generators. The TSO part of the UTT is charged by using locational signals in 5 countries.

2. Introduction

- Transmission tariffs are one of the key elements of the Internal Electricity Market. It should be noted that this Overview is not a direct comparison of transmission tariffs and if used in this way, any conclusions drawn are likely to be misleading. Based on different national contexts and national policies, which transmission tariffs have to meet, there are numerous approaches which implies a considerable complexity throughout Europe. It is outside the scope of this report to analyse all influences that shape the tariffs in each system. As there is no single "correct solution" for the allocation of costs to transmission users, different tariff schemes exist in Europe. Differences might include whether market mechanisms are used as part of the regulatory regime, the treatment of transmission losses and of ancillary services, and the level of first connection costs to which transmission grid users are exposed. This Overview does not take into account the differences among countries in areas such as quality of service, market arrangements, technical characteristics, environmental aspects, consumption density, and generation location – all factors that influence the level of such tariffs.
- With the above in mind, in order to make the tariffs more comparable across the ENTSO-E countries participating in this report, a "Unit Transmission Tariff" (UTT) is calculated for a pre-defined "base case", discussed further in Section 3. Thus, this overview does not compare individual transmission tariffs, but calculated Unit Transmission Tariffs expressed in €/MWh which may significantly differ from country specific TSO tariffs. **It is this "Unit Transmission Tariff" that is discussed throughout this document.**



- The above diagram 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 2018. 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.

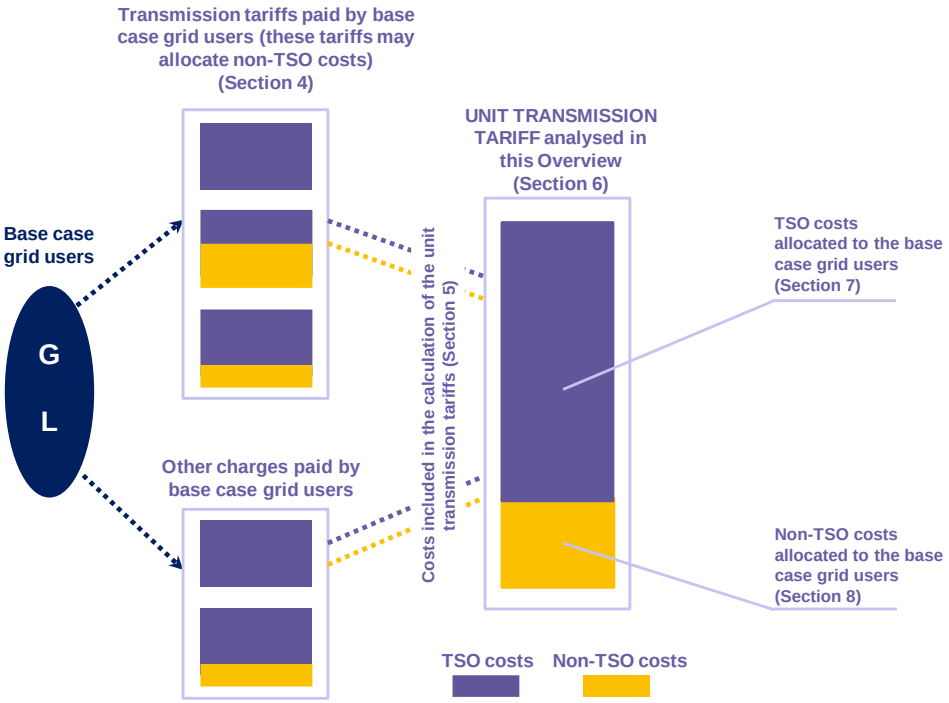
3. Methodology

- The main purpose of this ENTSO-E overview is to present a comparison of calculated 2018 Unit Transmission Tariffs expressed in €/MWh for a pre-defined "base case".
- The "base case" is characterized by (i) a pre-defined voltage level to which load and generation are connected; and (ii) a power demand and utilization time, as follows:
  - Voltage level: Since voltage levels of transmission networks vary across Europe, (see Appendix 2), in order to facilitate comparison an assumption has been made that both producers and consumers are connected to the EHV (Extra High Voltage) network (400 kV- 330 kV). For countries with no EHV network, load or representative load connected to the EHV network, tariffs for lower voltages have been considered.
  - Power demand and utilization 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 000h of utilization time has been assumed.

  "Base case users" are users with the characteristics of connection, power demand and utilization time specified above.
- The Unit Transmission Tariff is calculated under the hypothesis of the "base case" by adding the charges applied to load (L) and generation (G) (in cases where G is charged). For countries with different tariff rates per location, an average value has been taken.
- In order to make the overview as comparable as possible, the calculation of the Unit Transmission Tariff covers tariffs and charges invoiced to the base case users (even if those charges are not recovered through TSO tariffs) in order to allocate the following costs:
  - "TSO costs", i.e. costs related to TSO activities: Infrastructure costs (OPEX, depreciation and return on capital), costs of purchasing system services and losses compensation costs;
  - "Non-TSO costs", i.e. costs not directly related to TSOs' activities. For example: stranded costs, costs of renewable or cogeneration support schemes, regulatory levies, costs of diversification and security of supply, etc. Taxes for funding non-TSO Costs are not included in the calculation of the UTT.

    The above is particularly relevant when considering the graphs in this document.
- In addition, some examples are calculated by varying the "base case" assumptions:
  - The voltage level (See Section 6);
  - The load's utilization 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 2018 have been used to calculate the Unit Transmission Tariff expressed in € (see Appendix 12: Exchange rates).

- The diagram below summarizes the methodology of this Overview:



4. Main characteristics of TSO tariffs in Europe

Table 4.1 summarizes 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.

Table 4.1. Main characteristics of TSO tariffs in Europe

	Sharing of network operator charges		Price signal		Are losses included in the tariffs charged by TSO?	Are system services included in tariffs charged by TSO?
	Generation	Load	Seasonal	Location		
Albania	0.0 %	100.0 %	No	No	Yes	Yes
Austria	14.0 %	86.0 %	No	No	Yes	Yes
Belgium	6.0 %	94.0 %	X	No	No	Yes
Bosnia and Herzegovina	0.0 %	100.0 %	No	No	Yes	Yes
Bulgaria	0.0 %	100.0 %	No	No	Yes	Yes
Croatia	0.0 %	100.0 %	X	No	Yes	Yes
Cyprus	0.0 %	100.0 %	No	No	Yes	Yes
Czech Republic	0.0 %	100.0 %	No	No	Yes	Yes
Denmark	3.1 %	96.9 %	No	No	Yes	Yes
Estonia	0.0 %	100.0 %	X	No	Yes	Yes
Finland	19.2 %	80.8 %	X	No	Yes	Yes
France	3.0 %	97.0 %	XXX	No	Yes	Yes
Germany	0.0 %	100.0 %	No	No	Yes	Yes
Great Britain	14.8 %	85.2 %	No	Yes	No	Yes
Greece	0.0 %	100.0 %	X	No	No	Yes
Hungary	0.0 %	100.0 %	No	No	Yes	Yes
Iceland	0.0 %	100.0 %	No	No	Yes	Yes
Ireland	25.0 %	75.0 %	No	Yes	No	Yes
Italy	0.0 %	100.0 %	No	No	Yes	Yes
Latvia	0.0 %	100.0 %	No	No	Yes	Yes
Lithuania	0.0 %	100.0 %	No	No	Yes	Yes
Luxembourg	0.0 %	100.0 %	No	No	Yes	Yes
North Macedonia	0.0 %	100.0 %	No	No	Yes	Yes
Montenegro	35.2 %	64.8 %	X	No	Yes	Yes
Netherlands	0.0 %	100.0 %	No	No	Yes	Yes
Northern Ireland	25.0 %	75.0 %	XXX	Yes	No	No
Norway	33.0 %	67.0 %	X	Yes	Yes	Yes
Poland	0.0 %	100.0 %	No	No	Yes	Yes
Portugal	7.9 %	92.1 %	XX	No	No	No
Romania	2.9 %	97.1 %	No	No	Yes	Yes
Serbia	0.0 %	100.0 %	X	No	Yes	Yes
Slovakia	2.6 %	97.5 %	No	No	Yes	Yes
Slovenia	0.0 %	100.0 %	XXX	No	Yes	Yes
Spain	10.0 %	90.0 %	XXX	No	No	No
Sweden	36.0 %	64.0 %	No	Yes	Yes	Yes
Switzerland	0.0 %	100.0 %	No	No	No	No

Remarks:

(1) The % shares of network charges between G and L are provided for the base case charge.

(2) The "X" indicates time differentiation. With one "X", there is only one time differentiation (for example,"day-night", "summer-winter"). With two "X" (or more), there are two (or more) time differentiations.

A country remark regarding Austria, France, Greece, Italy, Netherlands, Northern Ireland, Norway, Portugal, Spain and Switzerland can be found in Appendix 1.

5. 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.

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

	Infrastructure				System services									
	OPEX (except system-services,losses and ITC)	Depre-ciation	Return on capital invested	ITC	Primary reserve	Secondary reserve	Tertiary reserve	Congestion management (internal)	Congestion management (cross border)	Black -Start	Voltage Control Reactive Power	System Balancing	Losses	Other
Albania	C (estimated)	C (estimated)	C (estimated)	C (estimated)	N	C (estimated)	C (estimated)	N	B/C (estimated)	N	N	B/C (estimated)	C (estimated)	N
Austria	C	C	C	B/C	N	C	N	C	B/C	C	C	N	C	C
Belgium	C	C	C	B/C	C	C/B	C/B	C	C/B	C	C	N	C (estimated)	C
Bosnia & Herzegovina	C	C	C	B/C	C	C	C	N	B/C	C	N	C	C	N
Bulgaria	C	C	C	C/B	C	C	N	N	B/C	C	C	N	C	C
Croatia	C	C	C	B/C (estimated)	N	C	C	N	C	C	C	C/B	C	C
Cyprus	C	C	C	N	C	C	C	N	N	C	C	N	C	N
Czech Rep.	C	C	C	C/B	C	C	C	C	C	C	C	C/B	C	N
Denmark	C (estimated)	C (estimated)	C (estimated)	B/C (estimated)	C (estimated)	C (estimated)	C (estimated)	C/B (estimated)	B/C (estimated)	C (estimated)	C (estimated)	B/C (estimated)	C (estimated)	C (estimated)
Estonia	C	C	C	B/C	N	N	C	N	C	C	C	N	C	C
Finland	C	C	C	C/B	N	N	C	C	C	C	C	C	C	C
France	C	C	C	C	C	C	C	C	C	C	C	N	C	C
Germany	C/B	C	C	C/B	C	C	C	C	C	C	C	N	C	C
Great Britain	C	C	C	C/B	C	C	C	C	C	C	C	C	N	C
Greece	C	C	C	C/B	C	C	N	N	B/C	C	N	N	C (estimated)	C
Hungary	C	C	C	C/B	C	C	C	C	B/C	C	C	B/C	C	B/C (estimated)
Iceland	C	C	C	N	C	C	C	N	N	C	C	C	C	N
Ireland	C	C	C	C	C	C	C	C	C	C	C	N	C	N
Italy	C	C	C	N	C	C	C	B/C	B/C	C	C	C	C (estimated)	C (estimated)
Latvia	C	C	C	C/B	C	C	C	N	N	C	C	C/B	C	N
Lithuania	C/B	C	C	B/C	N	C	C	N	N	C	C/B	N	C	N
Luxembourg	C	C	C	C	C	C	C	C	C	C	C	C	C	C
North Macedonia	C	C	C	B/C	N	C	C	N	B/C	C	C	C/B	C	N
Montenegro	C	C	C	B/C	N	C	C	N	B/C	N	N	C	C	C
Netherlands	C	C	C	B/C	C	C	C	C	B/C	C	C	B/C	C	N
Northern Ireland	C	C	C	C	C	C	C	C	C	C	C	C	C	N
Norway	C	C	C	C	C	C	C	B/C	B/C	C	C	N	C	N
Poland	C	C	C	N	C	C	C	C	N	C	C	C	C	C
Portugal	C	C	C	C/B	N	C/B (estimated)	N	N	B/C	N	N	N	C (estimated)	C
Romania	C	C	C	C/B	N	C	C	C	N	N	C	N	C	C
Serbia	C	C	C	B/C	C	C	C	C	C/B	C	C	C	C	C
Slovak Rep	C	C	C	B/C	C	C	C	C	N	C	C	N	C	N
Slovenia	C/B	C/B	C/B	C/B	N	C	C	C	C/B	C	C	N	N	C
Spain	C	C	C	C	C (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)	C
Sweden	C	C	C	B/C	C	N	N	N	N	C	C	N	C	N
Switzerland	C (estimated)	C (estimated)	C (estimated)	B/C (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)	B/C (estimated)	C (estimated)	C (estimated)	C (estimated)	C (estimated)	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.
- 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.

Remark:

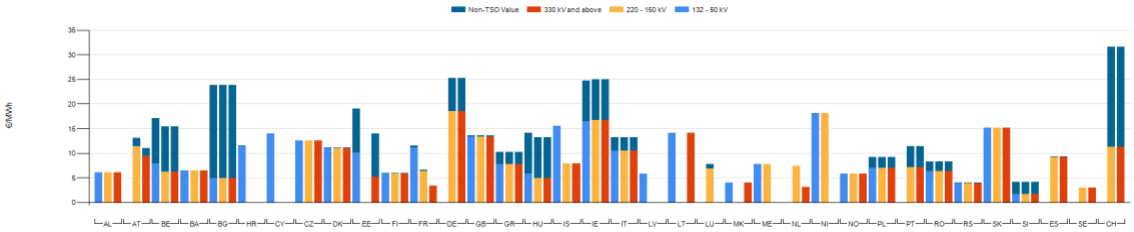
This chapter is referring to total costs (TSO costs and non-TSO costs) included in the calculation of the Unit Transmission Tariff.

Country remarks regarding Denmark, France, Greece, Hungary, Italy, Luxembourg, Netherlands, Portugal, and Spain to be found in Appendix 1.

6. Unit Transmission Tariffs in 2018

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 whereas other regulatory charges not directly related to TSOs´ activities are marked in dark blue.

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



		AL	AT	BE	BA	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS	IE	IT	LV	LT	LU	MK	ME	NL	NI	NO	PL	PT	RO	RS	SK	SI	ES	SE	CH
Total	330 kV and above	6.08	11.06	15.36	6.48	23.79	0.00	0.00	12.52	11.14	14.02	5.97	3.34	25.30	13.64	10.27	13.24	7.89	25.04	13.23	0.00	14.09	0.00	4.04	0.00	3.12	0.00	5.84	9.19	11.40	8.33	4.04	15.16	4.20	9.36	2.93	31.64
	220 - 150 kV	6.08	13.06	15.36	6.48	23.79	0.00	0.00	12.52	11.14	0.00	5.97	6.59	25.30	13.64	10.27	13.24	7.89	25.04	13.24	0.00	0.00	7.71	0.00	7.74	7.33	18.14	5.84	9.19	11.40	8.33	4.04	15.16	4.20	9.36	2.93	31.64
	132 - 50 kV	6.08	0.00	17.03	6.48	23.79	11.46	14.00	12.52	11.14	18.97	5.97	11.55	0.00	13.64	10.27	14.11	15.52	24.68	13.24	5.85	14.09	0.00	4.04	7.74	0.00	18.14	5.84	9.19	0.00	8.33	4.04	15.16	4.20	0.00	0.00	0.00
TSO	330 kV and above	6.08	9.43	6.17	6.48	4.87	0.00	0.00	12.52	11.05	5.12	5.78	3.34	18.49	13.34	7.73	4.93	7.89	16.74	10.54	0.00	14.09	0.00	4.04	0.00	3.12	0.00	5.84	7.00	7.15	6.40	4.01	15.16	1.72	9.25	2.93	11.26
	220 - 150 kV	6.08	11.43	6.17	6.48	4.87	0.00	0.00	12.52	11.05	0.00	5.78	6.34	18.49	13.34	7.73	4.93	7.89	16.74	10.55	0.00	0.00	6.86	0.00	7.74	7.33	18.14	5.84	7.00	7.15	6.40	4.01	15.16	1.72	9.25	2.93	11.26
	132 - 50 kV	6.08	0.00	7.84	6.48	4.87	11.45	14.00	12.52	11.05	10.07	5.78	11.19	0.00	13.34	7.73	5.80	15.52	16.38	10.55	5.85	14.09	0.00	4.04	7.74	0.00	18.14	5.84	7.00	0.00	6.40	4.01	15.16	1.72	0.00	0.00	0.00

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.

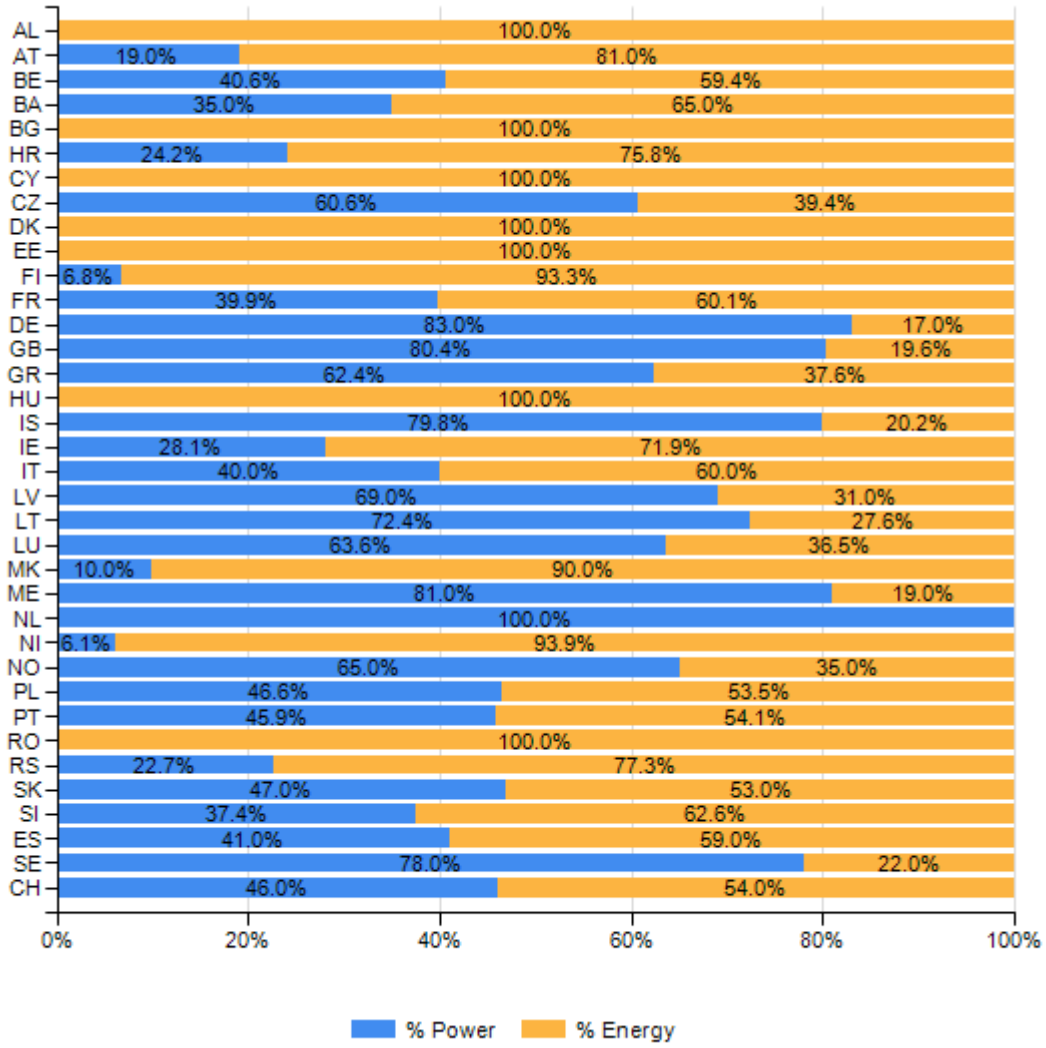
Country remarks regarding Austria, Denmark, Estonia, Germany, Greece, Hungary, Iceland, Italy, Latvia, Lithuania, Luxembourg, Norway, Slovakia, Spain and Switzerland are to be found in Appendix 1.

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.

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



Remarks:

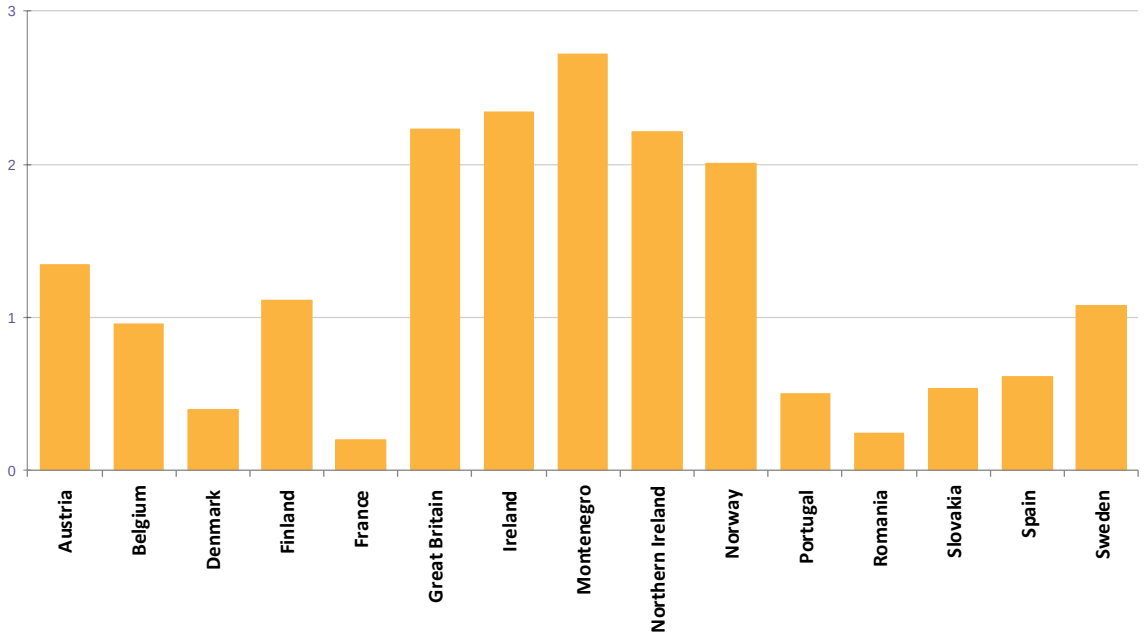
- The example taken for this comparison is the base case (see Section 3).
- Other charges not directly related to TSO activities (i.e. non TSO costs) **are not included** in the above graph.
- Values have been rounded.

Country remarks regarding France, Greece, Iceland, Italy and Spain are to be found in Appendix 1.

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.

Chart 7.2. G components of the TSO components of the Unit Transmission Tariffs in 2018 (€/MWh)



Remarks:

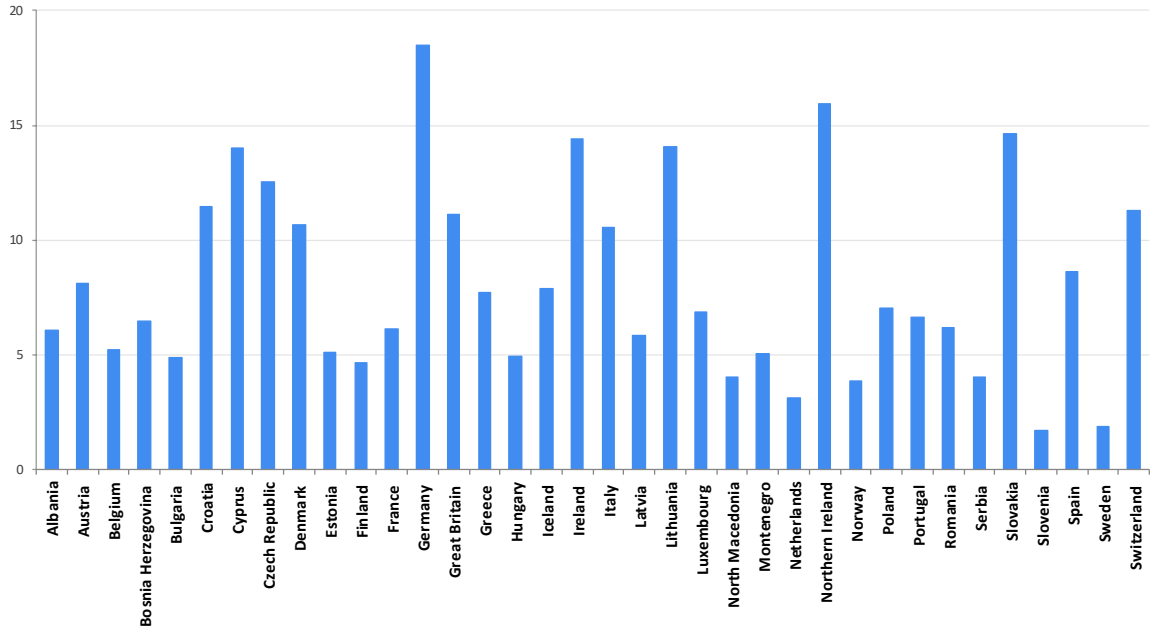
- The example taken for this comparison is the base case (see Section 3).
- Other charges not directly related to TSO activities (i.e. Non-TSO costs) **are not included** in the above graph.
- Commission Regulation (EU) no 838/2010 places limits on annual average transmission charges paid by producers 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 Greece and Spain to be found in Appendix 1.

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.

Chart 7.3. L components of the TSO components of the Unit Transmission Tariffs in 2018 (€/MWh)



Remarks:

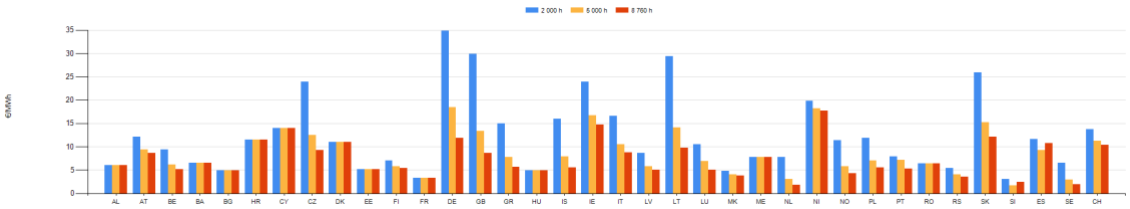
- The example taken for this comparison is the base case (see Section 3).
- Other charges not directly related to TSO activities (Non-TSO costs) **are not included** in the above graph.

Country remarks regarding Austria, France and Greece to be found in Appendix 1.

7.4 Impact of utilization time

Transmission charges paid by network users, and subsequently Unit Transmission Tariffs, change due to the utilization time if the applied tariffs have power (capacity) as a revenue driver. Chart 7.4 shows the impact of the utilization time on the TSO components of the Unit Transmission Tariff.

Chart 7.4. Impact of utilization time on the TSO components of the Unit Transmission Tariffs



Remarks:

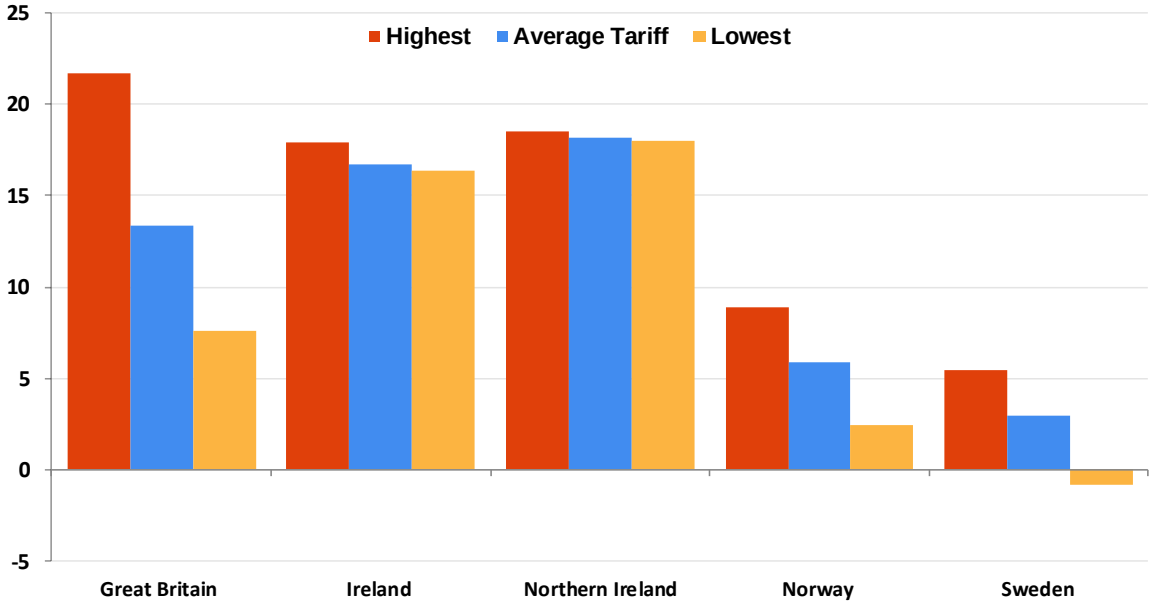
- The example taken for this comparison is the base case (see Section 3) modified by considering different utilization times.
- Other charges not directly related to TSO activities (i.e. Non-TSO costs) **are not included** in the above graph.
- For most TSOs, a typical customer is a DSO with a seasonal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

Country remarks regarding France are to be found in Appendix 1.

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.

Chart 7.5. Impact of location on the Unit Transmission Tariffs (€/MWh)



Remarks:

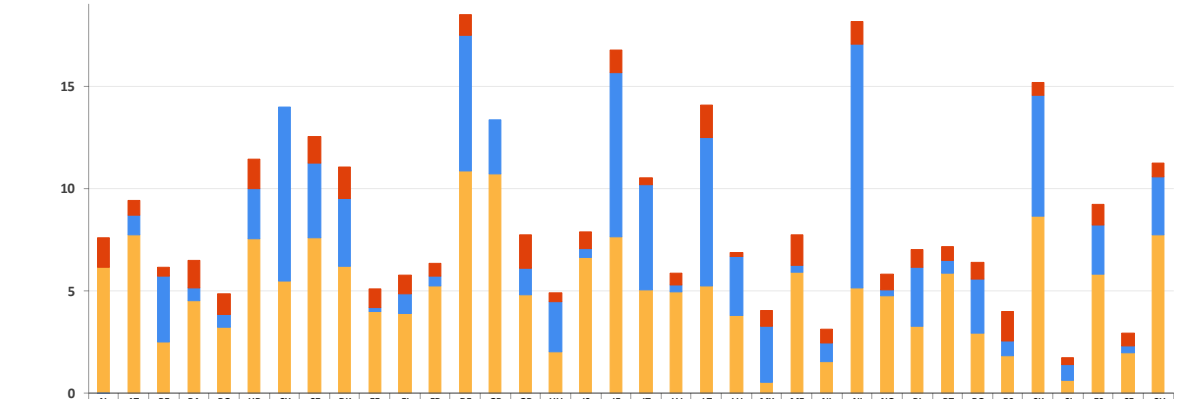
- The example taken for this comparison is the base case (see Section 3) modified by considering different locations.
- Other charges not directly related to TSO activities (i.e. non-TSO costs) **are not included** in the above graph.
- For more details about locational differentiation of transmission 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.

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.

Chart 7.6. Components of TSO costs of the Unit Transmission Tariffs (€/MWh)



	AL	AT	BE	BA	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS	IE	IT	LV	LT	LU	MK	ME	NL	NI	NO	PL	PT	RO	RS	SK	SI	ES	SE	CH
Losses	1.44	0.72	0.44	1.36	1.00	1.48	0.00	1.29	1.52	0.94	0.94	0.63	0.99	0.00	1.61	0.44	0.84	1.10	0.36	0.55	1.61	0.18	0.78	1.47	0.65	1.10	0.77	0.83	0.66	0.82	1.42	0.59	0.30	1.02	0.61	0.71
System Services	-1.51	0.98	3.22	0.58	0.63	2.45	8.50	3.64	3.34	0.19	0.92	0.45	6.62	2.61	1.30	2.48	0.41	8.00	5.13	0.33	7.23	2.86	2.72	0.37	0.92	11.89	0.31	2.91	0.62	2.65	0.73	5.93	0.79	2.42	0.35	2.83
Infrastructure	6.14	7.73	2.51	4.55	3.24	7.53	5.50	7.59	6.19	3.99	3.92	5.27	10.88	10.73	4.82	2.01	6.64	7.64	5.05	4.97	5.26	3.82	0.54	5.90	1.55	5.15	4.76	3.26	5.87	2.93	1.85	8.64	0.64	5.81	1.97	7.72

Remarks:

The example taken for this comparison is the base case (see Section 3).

- Other charges not directly related to TSO activities (i.e. non TSO costs) **are not included** in the above graph.
- The figures in the chart are estimations of the value of each final price component.
- For countries where it is not possible to split the tariff as it is done in this chart, some assumptions and estimations have been made. System services include system balancing if applicable.

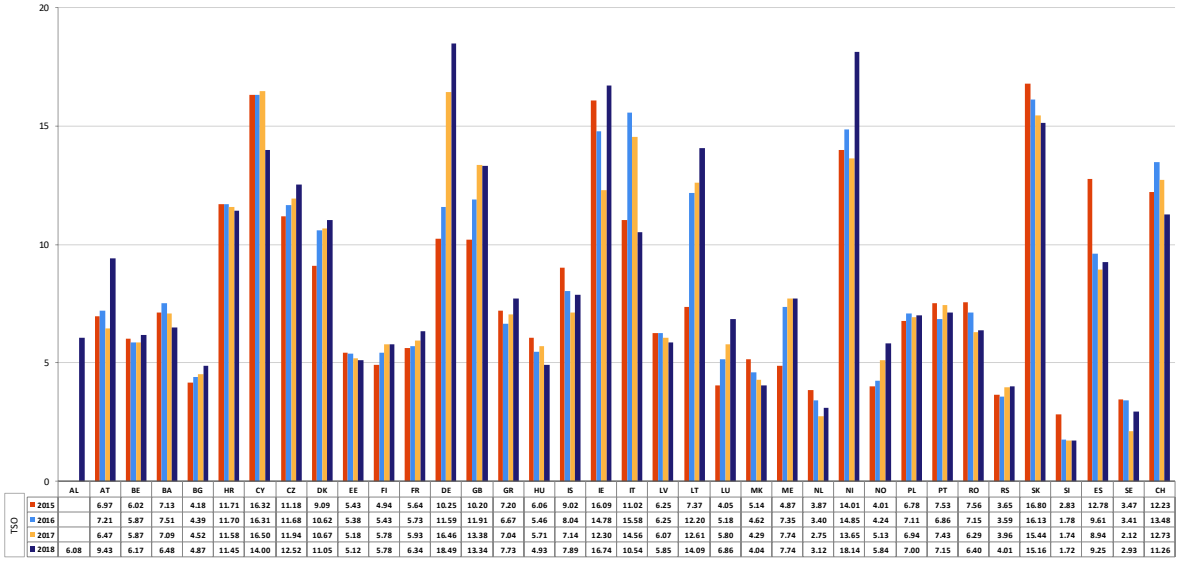
A country remark regarding Austria, France, Greece, Italy, Netherlands and Spain can be found in Appendix 1.

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 2015-2018 in € using exchange rates on 31st of December 2018.

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

Euro per MWh - Constant Euros of 2018



TSO	AL	AT	BE	BA	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS	IE	IT	LV	LT	LU	MK	ME	NL	NI	NO	PL	PT	RO	RS	SK	SI	ES	SE	CH
2015		6.97	6.02	7.13	4.18	11.71	16.32	11.18	9.09	5.43	4.94	5.64	10.25	10.20	7.20	6.06	9.02	16.09	11.02	6.25	7.37	4.05	5.14	4.87	3.87	14.01	4.01	6.78	7.53	7.56	3.65	16.80	2.83	12.78	3.47	12.23
2016		7.21	5.87	7.51	4.39	11.70	16.31	11.68	10.62	5.38	5.43	5.73	11.59	11.91	6.67	5.46	8.04	14.78	15.58	6.25	12.20	5.18	4.62	7.35	3.40	14.85	4.24	7.11	6.86	7.15	3.59	16.13	1.78	9.61	3.41	13.48
2017		6.47	5.87	7.09	4.52	11.58	16.50	11.94	10.67	5.18	5.78	5.93	16.46	13.38	7.04	5.71	7.14	12.30	14.56	6.07	12.61	5.80	4.29	7.74	2.75	13.65	5.13	6.94	7.43	6.29	3.96	15.44	1.74	8.94	2.12	12.73
2018	6.08	9.43	6.17	6.48	4.87	11.45	14.00	12.52	11.05	5.12	5.78	6.34	18.49	13.34	7.73	4.93	7.89	16.74	10.54	5.85	14.09	6.86	4.04	7.74	3.12	18.14	5.84	7.00	7.15	6.40	4.01	15.16	1.72	9.25	2.93	11.26

Remarks:

- The example taken for this comparison is the base case (see Section 3).
- Other charges not directly related to TSO activities (i.e. non-TSO costs) **are not included** in the above graph.
- Prices have been updated to 2018 by using the annual average rate of change in the Harmonised Index of Consumer Prices (HICP) as provided by Eurostat. If it is not available, the official CPI data from the country is taken.
- For countries not in the Euro zone the exchange rate as for 31 December 2018 is used.
- See Country remarks for details. When annual changes exceed 10% or 0.5 €/MWh compared to last year, reasons are provided.

Country remarks regarding Austria, Czech Republic, Cyprus, Germany, Great Britain, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Netherlands, Northern Ireland, Norway, Portugal, Slovakia, Spain, Sweden and Switzerland are to be found in Appendix 1.

8. Analysis of non-TSO components of Unit Transmission Tariffs

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

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

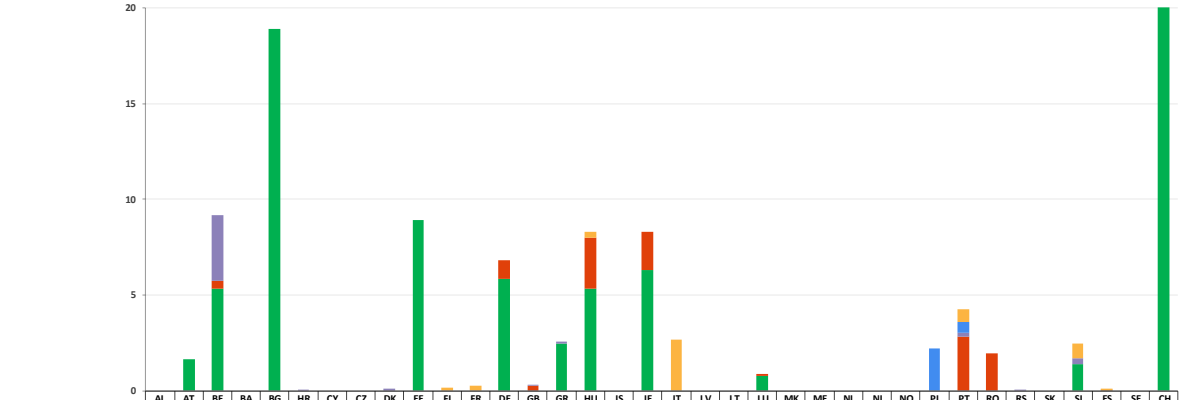
8.1 Non-TSO Costs

Non-TSO costs broadly fall into five main categories:

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

Also refer to Appendix 6 for additional information.

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



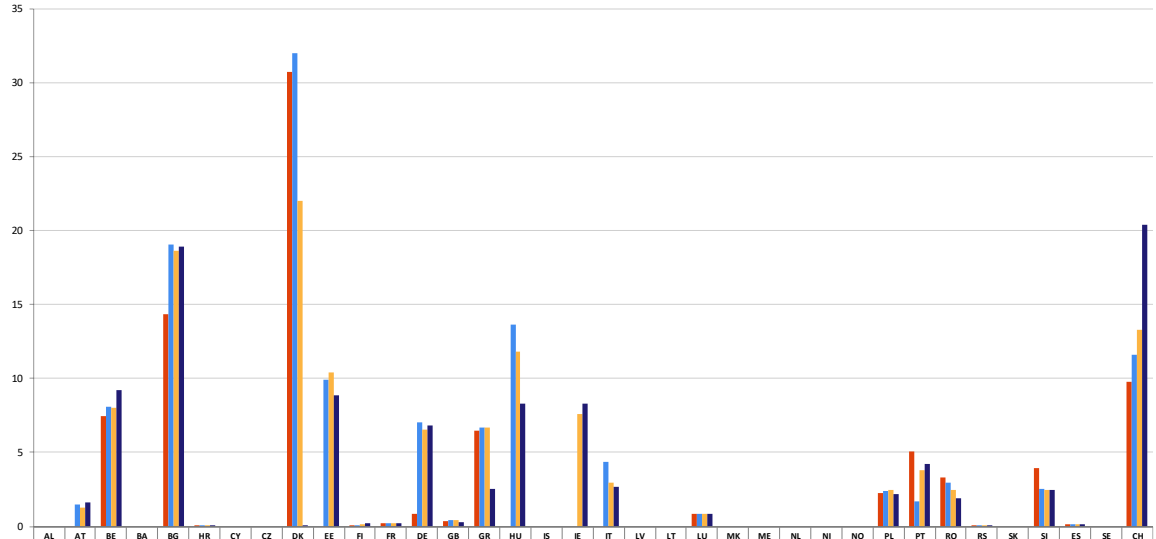
	AL	AT	BE	BA	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS	IE	IT	LV	LT	LU	MK	ME	NL	NI	NO	PL	PT	RO	RS	SK	SI	ES	SE	CH
Others											0.18	0.24				0.28			2.69										0.67				0.80	0.11		
Stranded costs																												2.19	0.58							
NRAs/Other Institutions			3.44			0.01			0.09					0.04	0.07														0.19		0.03		0.29	0.01		
non-RES support mechanism			0.43										0.97	0.26	0.00	2.67		1.98				0.10							2.81	1.93				0.00		
RES support mechanism		1.63	5.31		18.92				0.00	8.90			5.84		2.47	5.35		6.32				0.75						0.00					1.39			20.38

8.2 Evolution of non-TSO costs

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

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

Euro per MWh - Constant Euros of 2018



non-TSO	AL	AT	BE	BA	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS	IE	IT	LV	LT	LU	MK	ME	NL	NI	NO	PL	PT	RO	RS	SK	SI	ES	SE	CH
2015		0.00	7.49	0.00	14.38	0.01	0.00	0.00	30.77	0.00	0.10	0.23	0.83	0.37	6.51	0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.00	0.00	0.00	0.00	2.28	5.05	3.32	0.03	0.00	3.96	0.14	0.00	9.76
2016		1.46	8.06	0.00	19.06	0.01	0.00	0.00	32.03	9.96	0.09	0.23	7.07	0.41	6.69	13.64	0.00	0.00	4.36	0.00	0.00	0.87	0.00	0.00	0.00	0.00	0.00	2.40	1.71	2.92	0.02	0.00	2.53	0.11	0.00	11.59
2017		1.28	8.02	0.00	18.66	0.01	0.00	0.00	22.06	10.40	0.11	0.24	6.56	0.46	6.72	11.80	0.00	7.60	2.94	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00	2.45	3.77	2.50	0.03	0.00	2.48	0.12	0.00	13.29
2018	0.00	1.63	9.19	0.00	18.92	0.01	0.00	0.00	0.09	8.90	0.19	0.24	6.81	0.30	2.54	8.31	0.00	8.30	2.69	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00	2.19	4.25	1.93	0.03	0.00	2.48	0.11	0.00	20.38

Remarks:

- The example taken for this comparison is the base case (see Section 3).
- Prices have been updated to 2018 by using the annual average rate of change in the Harmonised Index of Consumer Prices (HICP) as provided by Eurostat. If it is not available, the official CPI data from the country is taken.
- For countries not in the Euro zone the exchange rate as for 31 December 2018 is used.

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

Country remarks regarding Denmark, Estonia, Greece, Hungary, Netherlands, Slovakia, Spain and Switzerland are to be found in Appendix 1.

9. Appendices

1. Country specific details
2. Voltage levels operated by TSOs
3. Comparison of network losses prices
4. Comparison of system services prices
5. Tariff areas in countries with generation/consumption tariffs with locational differentiation
6. Other regulatory charges not directly related to TSO activities
7. First connection charges
8. Special Tariffs
9. Treatment of Final Customers versus Distribution System Operators
10. Reactive Energy
11. Netting of flows for the application of transmission tariffs
12. Exchange rates
13. Glossary of terms

Appendix 1: Country specific details

Austria

Main Characteristics

Only tariffs according to regulation are included in the report.

Unit transmission tariff

Network level 2 in Austria is only a transformer level, transforming from 220/380kV to 100kV. Therefore the tariff of network level 2 only applies if transformer is owned by TSO (irrespective if transformed 380kV to 110kV or 220kV to 110kV). If transformer is owned by connected party then tariff from network level 1 applies. Changes due to increased redispatch demand and cost.

Range of components paid by generators and consumers

Base case inlcudes following tariff components: Infrastructure, Losses, Secondary Reserve.
Generation pays: Secondary Reserve, Losses.
Load pays: Infrastructure, Losses.
Losses is the only component which is paid by both (G+L).

Cyprus

Components of the calculated unit transmission tariff

In Cyprus, the step-down power transformers are part of the Transmission System Owner's Regulated Asset Base (RAB). This entails that TUOS rates have traditionally reflected equipment costs that serve customers connected at lower voltages (i.e. MV and LV level). The latter led into HV customers (which use their privately-owned transformers) being charged for network equipment that is designated to serve lower voltage customers. CERA rectified this issue in 2017 by developing a more appropriate methodology for the derivation of the TUOS rate. Therefore, the charge rate for using the Transmission System has been reduced to 0.55 €cents/kWh in 2018.

Czech Republic

Components of the calculated unit transmission tariff

The increase of the unit transmission tariff between 2017 and 2018 reflects higher allowed revenues (higher RAB and depreciations due to investments).

Denmark

Unit transmission tariff

RES support (PSO-tariff) is no longer handled by the TSO. As of January 1, 2018 it is handled by the State and financed by the Finance Act
TSO includes cost covered by both generators and consumers

Voltage levels operated by TSOs

Numbers above does not include DC-interconnections - if included the numbers will be 29%/47%/24%.
Last year should be changed as well to same figures as this year, cause it seems that last years data include DC-connections.

Estonia

Unit transmission tariff

Non-TSO component consists of RES support tariff. It is calculated each year based on the prognosis for the next year's produced RES energy, consumed electrical energy and the difference between actually charged and paid RES support amounts in the previous year.

Other regulatory charges not directly related to TSO activities

Non-TSO component consists of RES support tariff. It is calculated each year based on the prognosis for the next year's produced RES energy, consumed electrical

energy and the difference between actually charged and paid RES support amounts in the previous year.

Finland

Other regulatory charges not related to TSO activities

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

France

Main Characteristics

There is a G-component only for generators connected at the 150-400 kV levels. For L, time differentiation with 5 temporal classes for voltages lower than 350 kV. Three kinds of differentiation exist: summer/winter, mid-peak/off-peak, and peak hours only in January, February and December.

Unit transmission tariff

Non-TSO charges apply on the power part of the tariff and only to industrial customers. Tariffs for the highest voltage have no power part, therefore no non-TSO charges. Among RTE customers with a utilization time between 4500 h and 5500 h, very few are industrial customers, the overwhelming majority are distribution loads which don't pay those non-TSO charges. The invoice here is calculated for industrials customers.

Energy and Power related components

Non-TSO charges apply on the power part of the tariff and only to industrial customers.

Range of components paid by generators and consumers

There is a G component only for generators connected at the 150 - 400 kV levels. (€0.20 /MWh). The example above represents the costs of a generator and a industrial customer both connected at the 220-150 kV level (highest voltage level with statistically representative data).

Components of the calculated unit transmission tariff

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

Cost items included in calculation of the unit transmission tariff

Since 01/08/2017 (new tariff "TURPE 5"), the cost of contracting fast reserve and industrial load-shedding capacities is included in the tariff. "Other" includes the remuneration of interruptible customers.

Voltage levels operated by TSOs

As of 31/12/2018

Germany

Unit transmission tariff

The grid fees 2018 compared with the grid fees 2017 are mainly increased due to the following facts:
1. Increased costs for the grid security i.e. Redispatch, RES curtailment, provision of reserve capacity and costs for stand-by of decommissioned conventional power

plants for grid security reasons
2. Increased costs for offshore and onshore investments

Great Britain

Main Characteristics

Losses are recovered in the energy market.
System services included in BSUoS tariff.

Unit transmission tariff

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

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

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

Greece

Main Characteristics

Transmission Losses are recovered in the energy market. They are paid by those who inject energy in the transmission system (generators and importers).
System services are included in Uplift charges.

Unit transmission tariff

Transmission losses are paid by those who inject energy in the transmission system (generators and importers), however, an estimation of 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 ADMIE are also included.
In the non TSO related costs, costs related to RES payments that are completely irrelevant to ADMIE are also included.
In the non TSO related costs, costs related to Public Services obligations payments used to be included because they were collected by ADMIE (as a pass through item) but since 2018 they are completely irrlevant to ADMIE while DSO is responsible for collecting these amounts.

Energy and Power related components

Transmission losses are paid by those who inject energy in the transmission system (generators and importers), however, an estimation of 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 ADMIE are also included.
In the non TSO related costs, costs related to RES payments that are completely irrelevant to ADMIE are also included.
In the non TSO related costs, costs related to Public Services obligations payments used to be included because they were collected by ADMIE (as a pass through item) but since 2018 they are completely irrlevant to ADMIE while DSO is responsible for collecting these amounts.

Range of components paid by generators and consumers

Producers pay for transmission losses, however, this is done through the energy market and not through tariffs and uplift accounts.
Transmission losses are paid by those who inject energy in the transmission system (generators and importers), however, an estimation of 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 ADMIE are also included.
In the non TSO related costs, costs related to RES payments that are completely irrelevant to ADMIE are also included.
In the non TSO related costs, costs related to Public Services obligations payments used to be included because they were collected by ADMIE (as a pass through item)

but since 2018 they are completely irrlevant to ADMIE while DSO is responsible for collecting these amounts.

Components of the calculated unit transmission tariff

In the non TSO related costs, costs related to RES payments that are completely irrelevant to ADMIE are also included. In the non TSO related costs, costs related to RES payments that are completely irrelevant to ADMIE are also included.
In the non TSO related costs, costs related to Public Services obligations payments used to be included because they were collected by ADMIE (as a pass through item) but since 2018 they are completely irrlevant to ADMIE while DSO is responsible for collecting these amounts.

Cost items included in calculation of the unit transmission tariff

Transmission losses are paid by those who inject energy in the transmission system (generators and importers), however, an estimation of this cost has been included here for comparison purposes.
In the non TSO related costs, costs related to RES payments that are are completely irrelevant to ADMIE are also included. In the non TSO related costs, costs related to RES payments that are completely irrelevant to ADMIE are also included.
In the non TSO related costs, costs related to Public Services obligations payments used to be included because they were collected by ADMIE (as a pass through item) but since 2018 they are completely irrlevant to ADMIE while DSO is responsible for collecting these amounts.
Concerning Tertiary Reserve item, it is not included in the calculation, since according to the applied market model in the case that there is a need of this service, a constraint is added and one extra unit is required in the day ahead market. This of course increases the system marginal price but in a way that is impossible to be calculated.

Other regulatory charges not directly related to TSO activities

In the non TSO related costs, costs related to RES payments that are completely irrelevant to ADMIE are also included. In the non TSO related costs, costs related to RES payments that are completely irrelevant to ADMIE are also included.
In the non TSO related costs, costs related to Public Services obligations payments used to be included because they were collected by ADMIE (as a pass through item) but since 2018 they are completely irrlevant to ADMIE while DSO is responsible for collecting these amounts.

Hungary

Unit transmission tariff

The tariff is slightly different to 132 kV and above 132 kV.
The lower tariff is valid for distributors and consumption of some generators.
The Non-TSO part is significantly lower than data from previous year caused by the lower unit price for Non-RES support mechanism fixed in the Electricity Act for this year mainly. The other elements of the Non-TSO component are reduced non-significantly.

Components of the calculated unit transmission tariff

The components "Infrastructure", "System services" and "Losses" are determined by the Hungarian Regulatory Authority year by year:
- The component "Infrastructure" was reduced by the amount of the complete congestion income with some corrections from previous years.
- The component "System services" was increased by the correction amounts from previous years.
- The component "Losses" was increased by the higher basis of calculation and some corrections from the previous year additionally.
The Non-TSO part is significantly lower than data from previous year caused by the lower unit price for Non-RES support mechanism fixed in the Electricity Act for this year mainly. The other elements of the Non-TSO component are reduced non-significantly.

Cost items included in calculation of the unit transmission tariff

Congestion management (cross border): since 2018 the CM revenue is part of the tariff again.

Voltage levels operated by TSOs

The total reported value "330 kV and above" includes 61.37% of 400 kV circuits and 5.52% of 750 kV circuits. Other voltages are 220 kV (28.67%) and 132 kV (4.44%).

Iceland

Unit transmission tariff

Landsnet's tariff is prepared in accordance with the revenue cap determined by the National Energy Authority of Iceland. The tariff applies to Distribution System Operators (DSOs) on the one hand and power-intensive industries on the other hand. Transmission fees are independent of the distance travelled by the power through the grid as well as the distance between the sites where the power is injected into and drawn from it.
A special charge is applied for ancillary services and transmission losses, at a fixed amount per each kWh drawn from the grid.
The tariff for consumption by power-intensive industries is denominated in US dollars while the tariff for DSOs, as well as for other items, is denominated in Icelandic kronur (ISK).
Only changes between the 2017 final report and 2018 final report is a 5% increase in ancillary services and -3,9% decrease in the transmission losses.

Energy and Power related components

The calculated ratio according to the Tariffs methodology is 70% power / 30% energy for Landsnet.
Non-TSO costs are not applicable in Iceland.

Ireland

Components of the calculated unit transmission tariff

Main reason for increase between years: It is within the System Services area that has given rise to the larger part of the increase. Part of the calculation of System Services is the 'Cost of Constrains' (from SEMO), and this has risen from €2.05 /MWh to €5.00 /MWh between 2017 and 2018.

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

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

Italy

Main Characteristics

- Losses on the Italian transmission network are purchased by load service entities on the basis of standard losses factors. Purely for comparison purposes, in this overview the value of losses has been estimated by applying an average losses factor related to 2017 (estimated on the total value of losses, including those on the grids lower than EHV).
- system services costs are a passthrough component for the TSO

Energy and Power related components

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

Components of the calculated unit transmission tariff

- Losses: losses on the Italian transmission network are purchased by load service entities on the basis of standard losses factors. Purely for comparison purposes, in this overview the value of losses has been estimated by applying an average losses factor related to 2017 (estimated on the total value of losses, including those on the grids lower than EHV).
- System services: it is a passthrough component for the TSO. The value provided is a preliminary estimated value of the system services/ancillary services unitary cost, based on an estimated average of the UPLIFT component.
- infrastructure component: it has been estimated considering the sum of the unitary fees related to transmission (based on the "TRAS" tariff, which is applied by distributors to final users) and dispatching (DIS tariff)

Cost items included in calculation of the unit transmission tariff

- In 2018, the ITC component has not been considered in order to estimate the Unit Transmission Tariff
- "Non-TSO component": a 2018 estimated value has been reported. It includes other items that are not directly related to the Transmission activity (mainly aimed at providing system security)

Netting of flows for the application of transmission tariffs

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

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

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

Latvia

Unit transmission tariff

Transmission tariff to users, the proprietary border of electrical installations of which is on the 06-20 kV side of 110/6-20 kV transformer. Taking into account that transmission networks of 110 kV and 330 kV operate in parallel in order to ensure the safety of the transmission system activity, in accordance with tariff calculation methodology, tariffs of transmission services for electricity user, which are connected to a 110 kV or 330 kV voltage level, have not been determined as different.

Lithuania

Unit transmission tariff

In Lithuania TSO voltage levels are 110 kV, 330kV and just one line 400 kV.
In 2018 due to higher regulated prices of reserve service providers the tariff for the for system services increased by 38% or 2 €/MWh.

Luxembourg

Unit transmission tariff

The tariff increase mainly comes from System Services tariff increase (service delivered by Amprion for Luxembourg).

Netherlands

Main Characteristics

As of 2015 the transmission and system services are charged based on a combination of contracted peak capacity and monthly measured peak load. Therefore the system services are also recovered through the transmission tariffs. The income of the offshore transmission network is not included in the transmission tariffs, as the allowed revenue is primarily recovered by means of a subsidy.

Components of the calculated unit transmission tariff

There is not separate tariff for losses. The costs of energy and power related to the TO consist of losses, reactive power and congestion management (internal).

Cost items included in calculation of the unit transmission tariff

The net benefit of ITC in the tariffs of 2018 amounts to EUR 15 (net benefit of EUR 41 mio in 2017).
The net benefit of system balancing in the tariffs of 2018 amounts to EUR 21 mio (net benefit of EUR 23 mio in 2017).
The net benefit of cross border congestion management amounts to EUR 145 mio in 2018 (net benefit of EUR 173 mio in 2017).

Voltage levels operated by TSOs

In the Netherlands the EHV charge is for 220 / 380 kV networks and the HV charge is for 110/150 kV networks. So the combination 220-150 kV is not common in the Netherlands. Hence there is a mismatch between the breakdown of the assets classes and the tariffs. The EHV (NL definition) assets are 32% of the total kilometers operated, whereas HV represents 68% (NL definition).

Other regulatory charges not directly related to TSO activities

TenneT TSO B.V. does not report any non-TSO costs, as TenneT is not involved with the collection of RES support / energy taxes. In the Netherlands the supplier model is applied, which implies that the Consumers receive one bill, for electricity, transport and taxes, which is provided by the Supplier of electricity. The TSO invoices the transmission expenses to the DSOs and to industrial parties directly connected the TenneT network, without consideration of taxes or other costs. The large industrial consumers whom are directly invoiced by TenneT are required to submit a declaration for energy taxes by themselves.

Netting of flows for the application of transmission tariffs

In NL the G charge does not apply, there could however be infeed from existing load clients on the EHV and HV networks. The tariff is based on the measured peak volume in any month. The peak is assessed by using the sum of the peak values (measured periods of 15 min in the month). In practice this means that infeed and outflows within the connection point, which occurs simultaneously are netted against one and other.

Northern Ireland

Main Characteristics

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

Components of the calculated unit transmission tariff

Main reason for increase between years: It is within the System Services area that has given rise to the larger part of the increase. Part of the calculation of System Services is the ‘Cost of Constrains’ (from SEMO), and this has risen from €2.05 /MWh to €5.00 /MWh between 2017 and 2018.

Cost items included in the calculation of the unit transmission tariff

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

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

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

Norway

Main Characteristics

Price signals:
Norwegian Transmission tariffs consists of the following components:
Energy component (Loss element) and Fixed component.

- The energy component has an element of localization 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 til grid on a weekly basis.
Differentiation Day and Night/Weekend (See map attached).
- Fixed components shall cover the remaining costs within the income cap.
The fix element for G has no locational signals.
The fix element for L has an element of localization signal in the so called "k-factor".
The k-factor is constructed so that consumption in same connection point as production become a lower tariff than other consumption.

Unit transmission tariff

The Transmission Grid i Norway consists of about 11 000 km of high-voltage power lines and about 200 connection points (stations). The voltage level in the Transmission Grid is mainly 420-300 kV, but in some parts of Norway - particularly in the North, the voltage level of the transmission grid is 132 kV.
Norwegian Transmission Tariffs are independent of voltage level and utilization time.

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

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 localization 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 in til grid on a weekly basis. (See map attached)

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

Poland

Voltage levels operated by TSOs

The total reported value "330 kV and above" include 44.82 of circuits 400 kV and 0.79% of circuits 750 kV.
The other voltages are 220 kV (53.87%) and 110 kV (0.51%).

Netting of flows for the application of transmission tariffs

Trasmission tariff system doesn't provide settelements 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 then total energy taken-off transmission grid in this point, monthly charge for DSO/final consumer is zero.

Portugal

Main Characteristics

Losses and system services are included in energy price.

Unit transmission tariff

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

Range of components paid by generators and consumers

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 of the calculated unit transmission tariff

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

Cost items included in calculation of the unit transmission tariff

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

Slovakia

Unit transmission tariff

In the conditions of the Slovak TSO, the calculated average price of the entities connected to the transmission system fails to correspond to the real average prices applied with the entities connected to the transmission system. The real price is lower by approx. 1.39 €/MWh in the year 2017 and by approx. 1.34 €/MWh in the year 2018. It is a consequence of the applied methodology based on which the average prices in this report are being calculated.

Other regulatory charges not directly related to TSO activities

Slovak TSO doesn't collect any tax or additional fee for the RES support.

Slovenia

Voltage levels operated by TSOs

400 kV: 669 km
220 kV: 328 km
110 kV: 1 896 km

Spain

Main Characteristics

Only access tariffs and system operator charges for generation and demand are considered in Table 4.1. Losses and system services are not included in this calculation, as they are recovered through the energy market.

Unit transmission tariff

Apart from some non-TSO costs detailed in Appendix 6, it is not possible to split the Spanish UTT into TSO and non-TSO related charges. The reason is that according to the Spanish legislation some non-TSO costs (e.g. those due to renewable support schemes) are allocated through the access tariffs without any specific differentiation per tariff. Therefore, the TSO cost part of the Spanish UTT shown in Sections 6 and 7 of this Overview also includes regulatory charges not directly related with TSO activities (i.e. non-TSO costs).

Until 2014, interruptibility costs in Spain were charged to demand through the corresponding access tariff. Thus, interruptibility costs were one of the abovementioned non-TSO costs which were not explicitly shown in the access tariff. Since 2015 interruptibility costs have been charged through the energy market. For consistency with past data, interruptibility costs continued to be included in the UTT within the system services category in 2015 and preliminary data of 2016. After careful review, consistency with charges included by other countries and with the TTO methodology itself has been thought to be a preferable approach. Consequently, interruptibility costs have been removed from the calculation of the Spanish UTT.

Energy and Power related components

Unlike Table 4.1, data in Chart 7.1 is computed on the basis of the Spanish UTT.

Range of components paid by generators and consumers

Data in Chart 7.2 reflect two charges applied to generators:
- The charge corresponding to the access tariff for generators (0.5 €/MWh);
- A fee paid by generators above 1 MW of installed capacity in order to finance system operator´s activities. The fee depends on their available capacity. An availability of 94% has been assumed in the calculations.

Components of the calculated unit transmission tariff

In Chart 7.6 the “Losses” and “System services” components show 2018 prices for these cost categories (as an estimation of 2019 prices). Both figures are provided only for comparison purposes, despite the fact that they are not included in the Spanish transmission tariff (they are recovered through the energy market). The share of the Spanish UTT marked as “Infrastructure” includes both TSO and non-TSO related charges. The reason is that according to the Spanish legislation some non-TSO costs (e.g. those due to renewable support schemes) are allocated through the access tariffs without any specific differentiation.

Cost items included in calculation of the unit transmission tariff

System services and losses are not included in the Spanish transmission tariff because they are recovered through the energy market. As an estimation of 2019 prices, 2018 final prices for system services and losses in Spain have been included in the overview only for comparison purposes. This is indicated in Table 5.1 through the legend “estimated”.

Other regulatory charges not directly related to TSO activities

It is not possible to split the Spanish unit transmission tariff into non-TSO related charges as detailed in Table A.6. The reason is that according to the Spanish legislation some non-TSO costs (e.g. those due to renewable support schemes) are allocated through the access tariffs without any specific differentiation. Therefore only non-TSO costs specifically differentiated in the Spanish legislation can be classified.

Sweden

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

Locational signal is from north to south. Due to that most production is situated in the north and most of the consumtion is in the south of Sweden it is more expensive to be a producer in the north and less expensive in the south and vise verse is applicable to consumption.

Switzerland

Main Characteristics

There is a separate tariff for losses as well as for system services.

Unit transmission tariff

In Switzerland there is no individual consumer connected to the EHV grid (only generators, DSOs and the national railway operator SBB). Thus the figures shown are for a virtual consumer connected to the EHV grid with no underlying network or connected generation.

Other regulatory charges not directly related to TSO activities

RES charges shown as Non-TSO costs are collected by the TSO in a separate invoice. These charges represent the full RES-surcharge in Switzerland. A reduction of this surcharge is available for energy intensive consumers. The base user for the TTO is not deemed to be such an energy intensive consumer. Costs billed to TSO by NRA and energy ministry are included in transmission tariff.

Netting of flows for the application of transmission tariffs

Monthly netting between G and L is performed only with regards to calculation of fixed basic charge. If for the last 12 months sum of G is larger than 4 times the sum of L no fixed basic charge needs to be paid in the actual month.

Appendix 2: Voltage levels operated by TSOs

Table A.2. Voltage levels operated by TSOs

Country	330 kV and above	220 - 150 kV	132 - 50 kV
Albania	13.4%	38.5%	48.1%
Austria	34.0%	47.0%	19.0%
Belgium	16.3%	46.7%	37.1%
Bosnia and Herzegovina	13.7%	24.1%	62.3%
Bulgaria	16.7%	19.9%	63.4%
Croatia	16.0%	16.0%	68.0%
Cyprus	0.0%	0.0%	100.0%
Czech Republic	63.8%	34.7%	1.5%
Denmark	25.0%	47.0%	28.0%
Estonia	32.0%	4.0%	64.0%
Finland	36.8%	11.2%	52.0%
France	20.8%	26.6%	52.6%
Germany	62.0%	38.0%	0.0%
Great Britain	53.5%	26.8%	19.6%
Greece	24.5%	74.5%	1.0%
Hungary	66.9%	28.7%	4.4%
Iceland	0.0%	27.5%	72.5%
Ireland	6.0%	26.0%	68.0%
Italy	17.1%	39.1%	43.8%
Latvia	26.0%	0.0%	74.0%
Lithuania	28.5%	0.0%	71.5%
Luxembourg	0.0%	100.0%	0.0%
North Macedonia	27.2%	0.0%	72.8%
Montenegro	23.0%	28.0%	49.0%
Netherlands	24.0%	51.6%	24.4%
Northern Ireland	0.0%	38.2%	61.9%
Norway	72.6%	3.6%	23.8%
Poland	45.6%	53.9%	0.5%
Portugal	30.5%	69.5%	0.0%
Romania	56.0%	43.6%	0.5%
Serbia	18.3%	19.1%	62.5%
Slovakia	70.3%	27.1%	2.6%
Slovenia	23.1%	11.3%	65.5%
Spain	49.2%	44.8%	6.1%
Sweden	74.0%	26.0%	0.0%
Switzerland	27.0%	73.0%	0.0%

Remarks:

- Percentages are calculated as the ratio between the kilometers of circuits for each voltage level and total kilometers of circuits operated by each TSO.
- Values have been rounded.

Country remarks regarding France, Hungary, Italy, Luxembourg, Netherlands, Poland and Slovenia are to be found in Appendix 1.

Appendix 3: Comparison of network tariff elements losses prices

Table A.3. Comparison of network losses prices

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

Remarks:

- The base case is taken (see Section 3)

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

Appendix 4: Comparison of system services prices

Table A.4. Comparison of system services prices

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

Remarks:

- The base case is taken (see Section 3).
- These figures cover the system services listed in Table 4.1

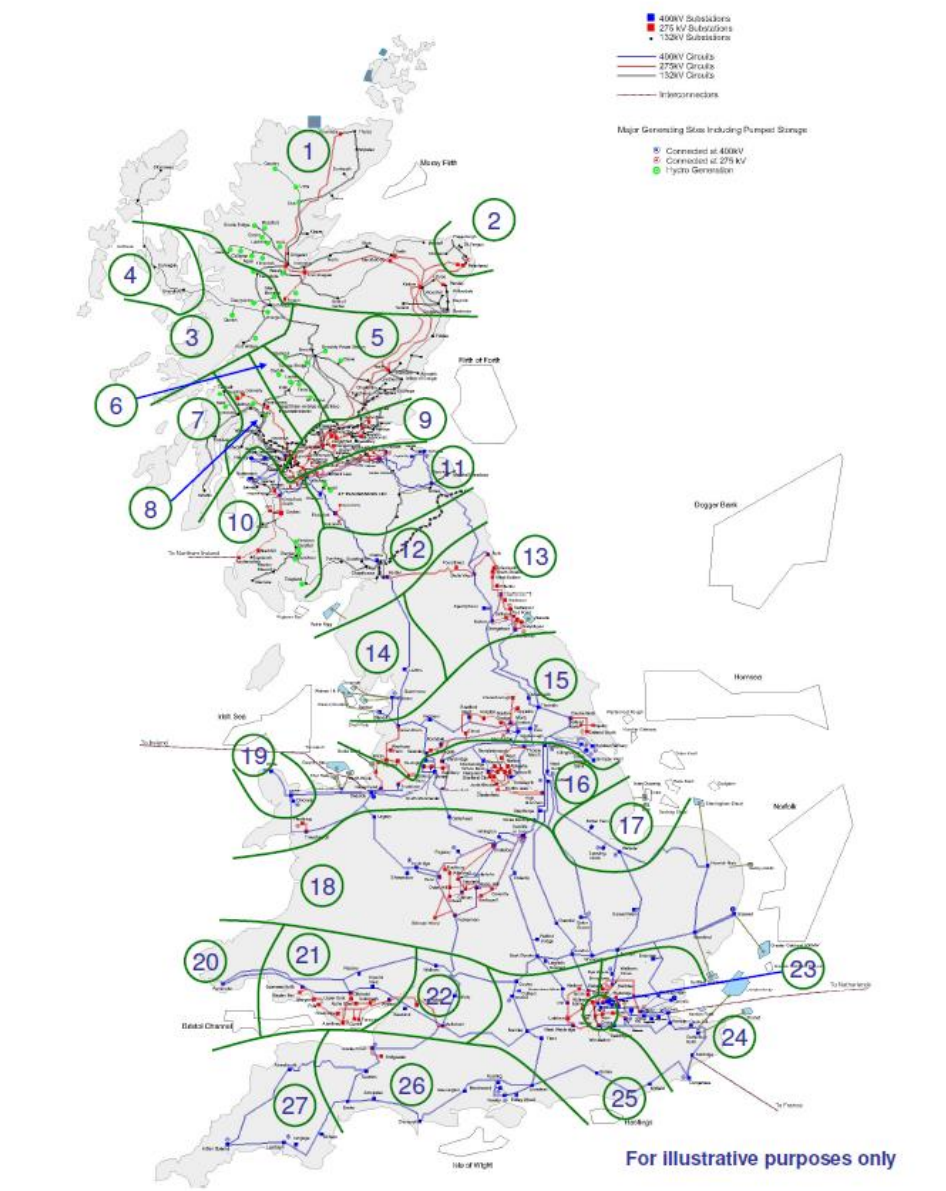
A country remark regarding France, Germany, Great Britain, Italy, Netherlands and Spain can be found in Appendix 1.

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

Great Britain

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

Chart A5.1 Great Britain



Ireland:

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

Northern Ireland:

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

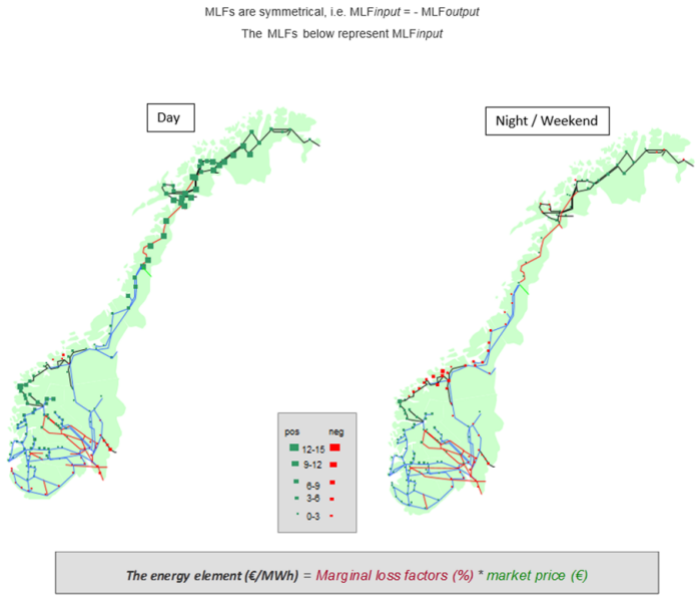
Norway:

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

The energy component has an element of localization 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 in til grid on a weekly basis. (See map attached)

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

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



Sweden:

Power based charge is based on the latitude. For injection the charges is highest in most northern location. For outtake it is highest in most southern location.

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 summarizes 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:

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

Country	Other regulatory charges not directly related to TSO activities			
	Cost item	Charge level (€/MWh)	Paid By	Description
Austria	**RES support mechanism**	1.63	L	APG collects and passes through tariffs for RES support from its directly connected customers. In the customer bill these tariffs are not recorded in the network cost section but in the taxes and levies section
	NRAs/Other Institutions	0.00	L	Included in infrastructure tariff
Belgium	**RES support mechanism**	5.31	L	PSO for financing connection of offshore windturbine parks & PSO for financing green certificates
	non-RES support mechanism	0.43	L	PSO for strategic reserves (installed for adequacy purposes)
	NRAs/Other Institutions	3.44	L	Federal contribution
Bosnia and Herzegovina	**RES support mechanism**	0.00	L	RES support mechanism is not included in the calculation of the Transmission tariff in B&H
	non-RES support mechanism	0.00	L	No other support mechanism cost in the calculation of the Transmission tariff in B&H
	NRAs/Other Institutions	0.00	L	No such cost in given calculation of the Transmission tariff in B&H
	Stranded costs	0.00	L	No Stranded cost in the calculation of the Transmission tariff in B&H
	Others	0.00	L	No
Bulgaria	**RES support mechanism**	18.92	L	The charge is paid by industrial consumers as a separate fee and by tariff customers as a component in a tariff price
Croatia	**NRAs/Other Institutions**	0.01	L	All energy operators that carry out one or more energy activities, based on the licence for carrying out energy activities issued by HERA, pay 0.05% of their total income for previous year into HERA s budget
Denmark	**NRAs/Other Institutions**	0.09	L	Payment to the Danish Energy Regulatory Authority and to the

				Danish Energy Agency to cover their administrations costs
Estonia	**RES support mechanism**	8.90	L/DSO	RES support mechanism, charged separately from TSO invoice. Not considered as a part of TSO tariffs
Finland	**Others**	0.18	L/DSO	Peak Load Capacity Fee.
France	**Others**	0.24	L	For the base case it is 0.242 €/MWh in 2018 for industrial customers only (0 for distributors). In 2005, the pensions system of people working in the gas and electricity industry was globally reformed. For the transmission tariff, it implied the creation of what is called in French, CTA, Contribution Tarifaire d'Acheminement - Transmission Tariff Contribution). It is calculated on the fixed part of the tariff (power part of the transmission tariff). All the customers pay the "CTA" which does not cover any RTE cost. The order of 29/12/2005 set the percentage applied to the fixed part at 8.20% for the transmission activity. The order of 26/04/2013 increased this percentage to 10.14 % from 01/05/2013
Germany	**RES support mechanism**	5.84	L	• Extra charge related to the connection of Offshore Windfarms to the grid • 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/de/EEG-Umlage.htm
	non-RES support mechanism	0.97	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**	0.26	L	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.
	NRAs/Other Institutions	0.04	L/G	G 14.8% / L 85.2% NRA Licence Fees
Greece	**RES support mechanism**	2.47	L	In the non-TSO related costs, costs related to RES payments that are completely irrelevant to ADMIE are also included.
	non-RES support mechanism	0.00	L	In the non TSO related costs, costs related to Public Services obligations payments used to be included because they were collected by ADMIE (as a pass through item) but since 2018 they are completely irrlevant to ADMIE while DSO is responsible for collecting these amounts.
	NRAs/Other Institutions	0.07	L	Regulatory Authority Support Cost.
Hungary	**RES support mechanism**	5.35	L	The renewable energy support scheme has two component parts: 1.) Feed-in Tariff (FIT): generated electricity shall be purchased from FIT Blance Group Members at the regulated price. Total generated electricity volumes of the FIT Balance Group are auctioned on the Hungarian Power Exchange 2.) Feed-in Premium (FIP): Generated electricity is sold by the power plants themselves on the electricity market. Monthly ex-post market reference price (average price of HUPX) will be supplemented with the subsidised price.
	non-RES support mechanism	2.67	L	Separate for Aid for restructuring the coal industry and Aid linked to the stranded costs of conversion of the cogeneration process.

	Others	0.28	L	Financial support for the provision of discount-rate electricity to personnel described in specific other legislation based on their previous or existing employment in the electricity industry
Ireland	**RES support mechanism**	6.32	L	Portion of Public Service Obligation (PSO) levy to support renewable energy.
	non-RES support mechanism	1.98	L	Portion of Public Service Obligation (PSO) levy to support peak generation plants.
Italy	**Others**	2.69	L	This estimate includes other items that are not directly related to the Transmission activity (mainly aimed at providing system security), are paid by dispatching users (i.e. not directly invoiced to the final consumers) and are passthrough for the TSO
Luxembourg	**RES support mechanism**	0.75	L	The tax “Fonds de compensation“ (0.75 €/MWh for customers ≥ 65kW) serves to encourage and subsidize national energy production projects based on renewable sources or cogeneration
	non-RES support mechanism	0.10	L	The tax “Taxe Electricité” is used to finance the “Assurance dependence”. 0.50 €/MWh (consumers cat. B)* 0.10 €/MWh (consumers cat. C)** * Cat. B: consumers > 25 MWh, except belonging to cat. C ** Cat. C: consumers > 25 MWh, electricity mainly used for chemical reduction, electrolysis or in metallurgical processes.
Netherlands	**NRAs/Other Institutions**	0.00	L	The costs of the NRA are included in the total costs and not separately recognised as a tariff. The costs amount to EUR 3 mio in 2017
Norway	**None**			No RES support mechanism in tariff
Poland	**RES support mechanism**	0.00	L/DSO	RES charge i.e. cost 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 2018 the RES charge is 0.00 PLN/MWh
	Stranded costs	2.19	L/DSO	Stranded costs i.e. cost resulting from compensations paid to energy producers for dissolving (early termination) long term energy sales contracts concluded in the past with a single buyer company. The long term contracts obliged energy producers to modernize their production units, adjusting them to environmental standards. Those costs are

				recovered by a transition charge in the Tariff. Charge rates are calculated by NRA. TSO charges final consumers connected to transmission network and DSOs at any voltage level (then DSO charge their final consumers).
Portugal	**non-RES support mechanism**	2.81	L	Capacity payments, Islands' tariff convergence costs, Interruptibility
	NRAs/Other Institutions	0.19	L	Regulator costs
	Stranded costs	0.58	L	Surplus costs for the remaining Power Purchase Agreements (PPAs)
	Others	0.67	L	Hydro power station land
Romania	**non-RES support mechanism**	1.93	L	Cogeneration
Serbia	**NRAs/Other Institutions**	0.03	L	Tax for the financing of NRA (0.68% of Transmission tariff)
Slovenia	**RES support mechanism**	1.39	L	mechanism applied
	NRAs/Other Institutions	0.29	L	component
	Others	0.80	L	component
Spain	**non-RES support mechanism**	0.00	L	Established as 0.001% of the access tariff for demand, which results in a charge of 0.000052 €/MWh for the base case users
	NRAs/Other Institutions	0.01	L	Established as a 0.15% of the access tariff for demand, which results in a charge of 0.0079 €/MWh for the base case users
	Others	0.11	L	Charge for the financing of the tariff deficit. It is established as a 2.039% of the access tariff for demand, which results in a charge of 0.1059 €/MWh for the base case users
Switzerland	**RES support mechanism**	20.38	L	Surcharges for Feed-in remuneration (KEV) and water conservation measures.
	NRAs/Other Institutions	0.00	L	Costs billed to TSO by NRA and energy ministry are included in transmission tariff

Country remarks regarding Czech Republic, Greece, Hungary, Netherlands, Slovakia, Spain and Switzerland are to be found in Appendix 1

Appendix 7: First connection charges

The connection charges types are characterized 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 socialized 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 summarizes the main features of charging mechanisms in force for first connection to transmission grid.

Table A.7. First connection charges

Country	Charge Type	Description
Albania	Shallow/Deep	Charges are based on the actual costs. No differentiation of charges for L, G, and DSO. No locational differentiation.
Austria	Shallow	In form of building-cost contribution for generation or tariff for load. Tariff for load: - Network Level 1 - 8.70 €/kW - Network Level 2 - 9.80 €/kW
Belgium	Mainly Shallow	- Onshore: Everything is socialized, except all installations between the grid user and the substation and the connection bay at the substation. - Offshore: idem. However, a support mechanism foresees in an additional subsidy for the cable connection up to 25 M€.
Bosnia and Herzegovina	Shallow	Charges are based on the actual costs. No differentiation of charges for L, G and DSO. No locational differentiation.
Bulgaria	Shallow	The price for connection is paid by the user, for installations up to the point of connection. The price for reinforcement of the grid is paid by the operator. There is no any different treatment of users.
Croatia	Deep	G – pays for the infrastructure connecting its installation to the transmission grid and extensions in existing network L – pays according to formula NVN = cVN . P (capacity kW * 1 350.00 HRK=182.00 €/kW or actual costs if difference between formula and real costs is more/less than 20%
Cyprus	Mainly Shallow	The connection cost includes all new infrastructure that will need to be built, up to the point of connection, e.g. a new substation and transmission line. No other costs are charged, e.g for upgrading existing equipment further into the transmission network.
Czech Republic	Shallow	No locational differentiation. Connection fees:

		7 775 €/MW for energy withdrawal (load) 19 436 €/MW for energy injection (generation)
Denmark	Super Shallow to partially Shallow	In some cases charges are calculated to a fictitious point that can be closer than the physical connection point. Charges are not differentiated for L, G or DSO's and there is no locational differentation. In most cases the costs are socialized in the tariffs – if not the charges to the grid user are based on actual costs.
Estonia	Deep	Necessary reinforcements in the grid are included in the connection fee
Finland	Shallow	Standard fee based on average costs of connection infrastructure. No differentiation of charges for L, G, DSO. No locational differentiation.
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: network development costs due to RES integration are mutualized on a regional basis. No locational differentiation, charges based on actual costs.
Germany	Shallow to Super shallow	Charging is generally based on actual costs. Grid users pay for their own connection line and substation. General reinforcements of the grid are socialized via tariffs. No differentiation of charges for L, G or DSO.
Great Britain	Shallow	This applies to both generation and load and means that connection charges relate only to the costs of assets installed solely for, and only capable of use by, an individual user. All other assets are assumed to be shared and their costs are included in the wider locational transmission tariff.
Greece	Shallow	Grid users pay for the infrastructure connecting its installation to the transmission grid. The charge includes studies, materials check, construction, supervision and delivery costs. The costs depend on distance or voltage level and they differentiate according to the installation location characteristics (e.g. ground morphology) or any other special project requirements.
Hungary	Shallow/Deep	Charging is based on actual costs. Establishing a new connection for a generator incurs a maximum 100% of investment costs charged, same for a single customer is a maximum 70% or 1 million HUF/MVA (3 110 €/MVA, exchange rate: 321.51 HUF/€), whichever larger. If the generator used at least annual average 70 % of renewable energy sources for its production per 5 years, it pays only 70 % of the investment costs, and if this value is at least 90 %, it pays only 50 % of the investment costs. Multiple generators and/or customers on the new connection are charged proportionally. No locational differentiation.
Iceland	Shallow/Deep	Charges are based on the actual costs and borne by the Producer (G) or a power intensive user (L).
Ireland	Shallow	All connecting parties pay for the connection to the system (using a Least Cost Chargeable methodology).

		Demand customers only pay 50% while generators pay 100% of connection charges.
Italy	Shallow	Connection of production plants - G: When first requesting the connection, applicants pay upfront Terna a fixed amount of 2 500 € to get a general appraisal of the possible connection solution ("STMG"). Once obtained the authorization, applicants pay upfront Terna an amount of 2 500 €+ 0.5 €/kW (max 50 000 €) for a more detailed project plan ("STMD"). Grid user bears costs for building the grid connection plant. Enhancements of the NTG are socialized in tariff. Reduced fees apply in case of connection of production plants powered by renewable sources and for high-performance co-generation plants. Connection of consumption units – L: Applicants pay Terna the same foreseen for "STMG" and "STMD" of production plant and a connection fee equal to 50% of the expenditure for building grid connection plant including cost of the materials and labour costs as well as overheads, assumed equal to 20% of these amounts. Connection of DSO: The DSO/TSO that implements the connection plant recovers the incurred costs through tariff.
Latvia	Deep	Grid users builds own connection line. All connection equipment and reinforcement are included in the connection fee. Producer (G) always has to compensate 100% from new connection charge. DSO must compensate 100% from new connection charge. For load increasing of existing connection DSO must compensate connection fee pro-rata with load increasing. Consumer (L) must compensate 100% of new connection charge and must compensate existing connection load increasing by pro-rata with load increasing, except consumers, who have special connection status issued by National Authority (Regulations on the Special Connection to the Electricity Transmission System). The Special Connection to the Electricity transmission system is allocated by Cabinet of Ministers. If the Consumer has the special connection case, then compensation costs from consumer side are: • 66% with load ≥50MW and consumption ≥100000MWh in the nearest two years; • 33% with load ≥75MW and consumption ≥150000MWh in the nearest two years; • 0% with load ≥100MW and consumption ≥200000MWh in the nearest two years. Other charges are compensated from TSO side. No locational differentiation. Charging is based only on actual costs.
Lithuania	Deep	100% of all actual connection costs, exception for the renewable generators - 40% 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 socialized in the tariffs.

North Macedonia	Shallow	Grid user has to pay for its own connection line and substation, to meet security criteria.
Montenegro	Shallow	There is no difference in cost for L, G and DSO.
Netherlands	Shallow	The connection charge consists of the costs to connect the client's installation to the client's circuit end connecting to the TenneT station.
Northern Ireland	Shallow	Load and generation over 1MW pay 100% shallow connection costs. Connection costs will be based on out turn cost or a fixed quotation.
Norway	Shallow	Cost related customer-specific network facilities must be borne by the customer.
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% of total investment expenditures. • RES units of installed capacity <=5MW pay 50% of total investment expenditures. • Co-generation units of installed capacity <=1MW pay 50% of investment expenditures. Other generators and distribution companies pay 100% of total investment expenditures. RES units of installed capacity <=40 kW don't pay connection charges.
Portugal	Super Shallow to partially 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 but the internal reinforcement/expansion of the grid is endorsed to TSO's responsibility, in the case of G. The connection is made to the nearest substation where it is technically possible and where available capacity exists. For G, the available network capacities are defined in the NDP (National Development Plan) and in the annual document "Network Characterization", according to Decree Law nº 215A and 215B/2012 from October 8th. For L, there is the obligation to connect, according to the Commercial Relationship Code and if internal grid development is needed, it is paid by L. After built, the connection facilities (lines, cables, equipment at substations, etc.) will be integrated in TSO asset; thus TSO is in charge of their O&M costs. Concerning the DSO reinforcement needs (there is just one in Portugal) all the costs are socialized via the tariff. The charges are based on the actual costs and no locational differentiation is applied.
Romania	Shallow/Deep	Connection equipment: the connecting entity (generator/load) fully covers the cost of the equipment that connects their installation to the transmission grid. Upstream grid reinforcement: costs associated to upstream grid reinforcements required to safely connect new users (generators/loads) are: • shared between the TSO and generators connecting to the grid; • fully paid by the TSO (and therefore socialized across all transmission users through the transmission tariff) in case of loads connecting to the grid

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

Appendix 8: Special tariffs

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

- Special tariff conditions for low utilization (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 summarizes different charging rules/tariff conditions or exemptions from rules defined as “standard” and applied by TSO’s for specific groups of network users.

Table A.8. Special tariffs

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: 0.233 c€ /kWh; - power: 100.00 c€/kW. 2) Reduced infrastructure tariff for negative ancillary services called energy: 0.085 c€/kWh additional power: 100.00 c€/kW.
Belgium	Two kind of special tariffs exist: (1) For an "additional" access point for the same electrical facilities of a grid user, there is a special tariff for the term "power put at disposal". The additional access point can be on an ongoing basis (standard operations) or on an occasional basis (as a reserve), with no time limit. (2) For the mobile charges of the railway company, the power terms are reduced by 7%.
Bosnia and Herzegovina	No.
Bulgaria	No.
Croatia	No.
Cyprus	No.
Czech Republic	No.
Denmark	1) For grid companies with autoproducers with net settlement, an adjusted settlement basis is applied that takes into account that the autoproducers shall not pay a grid tariff or a system tariff for the part of their consumption that they cover by their own production. 2) Customers with their own 132 kV transformers with settlement on the 132 kV side pay a reduced grid tariff.
Estonia	No.
Finland	No.
France	* Specific tariff for a second connection used for emergency situations. * Specific tariff for multi-locations customers.This tariff considers a unique virtual site, summing all load of the concerned sites, and calculating an annual fee proportional of the necessary length of network to connect these sites. * A DSO directly connected to the lowest voltage level of a transformer that

	belongs to the TSO can use the tariff of the highest voltage level of this transformer. * A DSO owning lines of the same voltage level as the lines of the TSO it is connected to benefits from a discount. * When the actual temperatures are very low compared to average temperatures, DSOs may benefit from a discount on their capacity overrun. * Occasional planned overrun of contracted capacity: a customer can benefit from a discount on its tariff during 2 weeks, provided it informs the TSO in advance. * Industrial customers connected to the transmission grid can benefit from a reduction of their transmission invoice from 5% to 90% depending on their demand (annual consumption, annual usage duration, usage duration during peak period vs. usage duration during off-peak period) and on the importance of electricity in their process, the degree of international competition or whether they have storage capabilities or not.
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 tariff. - Grid fee reduction: for Energy intensive customers (typically heavy industry customers) with energy consumption that exceeds 7 000 full load hours per year and 10 GWh there is a fee reduction. Depending on full load hours, the grid fee has to be at least 10, 15 or 20 % of the normal grid fee. - Grid fee exemption: for pump-storage power stations a grid fee exemption is possible for 10 years if the amount of storage-energy has increased by 5% minimum. The agreement on both for individual tariffs and grid fee reduction and exemption requires the approval of the regulator. -Grid fee reduction for customer with an exclusive usage of storage (not less than 20% of yearly power price).
Great Britain	Small Generators' Discount: 2.53121 €/MWh (11.35 GBP/kW based on 5 000 hours utilisation) paid to <100MW generators connected to the transmission network at 132kV (primarily Scotland). Recovered through a charge on demand 0.12314 €/MWh (0.55 GBP/kW based on 5 000 hours utilisation).
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. Supply voltage discount A discount of 5% is granted on the capacity charge and energy charge pursuant to where electricity is delivered to distributors at a nominal voltage over 66 kV. Delivery charge discount A discount is granted on the out-feed delivery charge if the maximum power out-feed is as follows: In the range of 3.0 – 6.0 MW the discount is 40%. In the range of 1.0 - 3.0 MW the discount is 70%. DSO Delivery charge discount Distribution system operators shall pay out-feed charges for electricity produced in power plants connected to Landsnet through a distribution system, as follows: 1. For energy produced in power plants under 1.42 MW, no out-feed charge is paid.

	2. For electricity produced in power plants in the size range of 1.42-3.1 MW, no out-feed charge is paid at the lower limit of the range, but the charge then increases proportionally up to 60% of the full out-feed charge at the upper limit. 3. For energy from power plants of 3.1 – 10 MW, 60% of the full out-feed charge is paid.
Ireland	Autoproducers pay capacity based TUoS charges on the greater of either their contracted Maximum Import Capacity or contracted Maximum Export Capacity, not both.
Italy	Energy withdrawals for generation plants auxiliary services and for hydro pumping storage plants are exempt (if specific predetermined conditions are met) from transmission and distribution fees.
Latvia	No.
Lithuania	Zero transmission tariff in pumping mode for hydro pump power plant. Zero tariff for system services component for DSO grid losses.
Luxembourg	No.
North Macedonia	No.
Montenegro	No.
Netherlands	There is a special tariff for users with maximum 600 hours. Furthermore there is a volume discount for users with a stable base load profile in the off peak hours.
Northern Ireland	No.
Norway	Special tariffs is offered for interrupible load according to agreements. The tariffs are 5%-75% of the regular L-tariff level depending on the kind of agreement. Power intensive load: Customers with load> 15MW for more than 5 000 hours per year is offered a lower tariff based on defined criteria. The average reduction is approximate 70% compared to regular load.
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; • utilization of the contractual power was not less than 50%; • overall costs related to electric energy (purchase and transportation) constitute not less than 15% of the total production costs. A final consumer is entitled to pay 28% 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; • utilization 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 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.
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 2018, the discount is 1.23 €/kVA at the fixed term of the access tariffs.

Romania	No. Small-sized generators (generators with installed capacity of up to 5MW) 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 2018: - tariff for system services discounted by 95% if their utilization of maximum contractual capacity in 2016 were higher than 6 800 hours (average utilization of the contractual capacity was not less than 77.63%) and perpetual deviation of the subject of settlement was lower than 0.025, - tariffs for access to transmission system and its management: • discounted by 30% if their maximum contractual capacity in 2018 is higher than 200 MW and their energy supplied over transmission system in 2016 was higher than 1 TWh, • discounted by 50% if their maximum contractual capacity in 2018 is higher than 250 MW and their energy supplied over transmission system in 2016 was higher than 2 TWh, • discounted by 70% if their maximum contractual capacity in 2018 is higher than 350 MW and their energy supplied over transmission system in 2016 was higher than 2.5 TWh.
Slovenia	No.
Spain	There is a special access tariff (€) for pumped hydro electricity storage facilities. This tariff equals the normal access tariff for generation (0.5 €/MWh) multiplied by a correction factor (MWh) that takes into account both the electricity production and the energy consumed during the pumping process, as follows: AccessTariff_forPumpedHydroStorage = AccessTariff_forGenerators * [Ept+(Eb*(1-r))] Where Ept is the total energy production which is fed into the system; Eb is the energy consumed during the pumping process for exclusive use of the generation of electricity; and r is the efficiency of the storage facility, which has been established at a value of 0.7. [Disp. Adicional Segunda, Real Decreto 1544/2011].
Sweden	No.
Switzerland	Bundling of connection point for national railway operator (SBB).

Appendix 9: Treatment of Final Customers vs Distribution System Operators

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

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

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

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

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 limit value for capacitive reactive power for DSOs is 5Mvar for the voltage levels 132-50kV, whereas for final customers the limit value is 2.5Mvar for the same voltage levels.
Bosnia and Herzegovina	No	
Bulgaria	No	
Croatia	Yes	TSO charges only transmission fees for customers connected directly to TSO network. For customers connected directly to distribution network, transmission fee is collected by DSO and transferred to the TSO.
Cyprus	No	
Czech Republic	No	
Denmark	No	The TSO does not charge the customer directly. It is the electricity supplier that charge the customers.
Estonia	No	
Finland	No	
France	Yes	* A DSO directly connected to the lowest voltage level of a transformer that belongs to the TSO can use the tariff of the highest voltage level of this transformer. * A DSO owning lines of the same voltage level as the lines of the TSO it is connected to benefits from a discount. * When the actual temperatures are very low compared to average temperatures, DSOs may benefit from a discount on their capacity overrun.
Germany	No	
Great Britain	No	

Greece	No	
Hungary	Yes	The transmission tariff is regulated by the type of customers as well. Distributors pay a higher tariff to MAVIR. The TSO's income of the additional part is repaid in another sum - which is calculated with a predetermined percentage by Regulator's decision (HEA) - for the distributors. Thus: Transmission charge for eligible customer: 4.929862 €/MWh Transmission charge for distributor: 10.351155 €/MWh Income of the positive difference of Transmission charge for the distributors is paid back for the distributors in percentage as a rebate. Calculation: [(injection /kWh/ * 542.13 c€) * (n1+n2+n3+… %)], where Σ n = 100 % Difference from the charge applied to the base case scenario: 109.97 % before rebate
Iceland	No	
Ireland	No	
Italy	Yes	LV, MV, HV, EHV final users (different from LV domestic users) pay Distributors the "TRAS component" covering transmission costs. The TRAS component is split into two different subcomponents: - TRASE: energy (volume) component, in "cent. €/kWh"--> it is applied to LV, MV, HV, EHV users; - TRASP: power (capacity) component, in "cent. €/kW" --> it is applied to HV, EHV users. LV domestic users pay Distributors a different tariff component (TD) structured in three different subcomponents (a.k.a. "sigma" components). Distributors pay to the TSO the "CTR components" (infrastructure component of Transmission Tariff) for power and energy withdrawal from NTG. The CTR component is split into two different subcomponents: - CTRE: energy (volume) component, in "cent. €/kWh"--> it is applied to the sum of the energy withdrawn from NTG and the energy injected in the "NTG virtual interconnection points" (i.e. the energy injected in the distribution grid at HV level); - CTRP: power (capacity) component, in "cent. €/kW per year" --> it is applied to the interconnection capacity between

		NTG and distribution grid withdrawn from the NTG.
Latvia	No	
Lithuania	No	
Luxembourg	No	
North Macedonia	No	
Montenegro	No	TSO charges only transmission fees for customers connected directly to TSO network. Customers who are not directly connected to TSO network, transmission fee is collected by DSO.
Netherlands	No	
Northern Ireland	No	
Norway	No	
Poland	No	There is no differentiation between final consumers and distributors but between kinds of points of delivery (PoD). There are two different rates for access to the transmission network: one called “final” PoD (where end consumption is connected) and other called “network” PoD (which are PoD of DSOs having more than two PoDs, and these PoDs are nodes of meshed distribution network 110 kV). In final PoD contractual capacity is reserved by and extra charges applied in case of exceeding, in network PoD contractual capacity is determined based on actual energy flows, no extra charges in case of exceeding. The total charge (without non-TSO charges) for users connected in “final PoDs” amounts to 70% of the charge paid by DSO in “network PoDs”.
Portugal	No	
Romania	No	
Serbia	No	
Slovakia	No	
Slovenia	No	
Spain	Yes	DSOs do not pay access tariffs. Instead, access tariffs paid by users include network costs not only at their voltage level but also costs of networks at higher voltages, including transmission networks.
Sweden	No	
Switzerland	No	

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 summarizes main features of charging mechanisms applied by TSO's for reactive energy for users connected to transmission network.

Table A.10. Reactive Energy

Country	Reactive Tariff Y/N	Penalty Y/N	Quantity/Conditions of application
Albania	No	No	
Austria	No	No	
Belgium	No	Yes	In case the offtaken active energy does not exceed, on a quarterly basis, 10% of the yearly peak in a given offtake point, the offtake of additional reactive energy is defined in respect of 32.9% of the 10% of the yearly peak in this offtake point. The tariff for the offtake of additional reactive energy is function of the exceeding level. Zone 1 starts for the quarter-hourly deliveries of reactive energy exceeding tg φ =0.329 for each offtake point. Zone 2 starts for the quarter-hourly deliveries of reactive energy exceeding tg φ =0.767 for each offtake point. In case the capacitive reactive power of the customer being in offtake regime doesn't exceed the following limit values, penalty for supplementary deliveries of reactive energy equals 0 €/Mvarh. Voltage level (kV) // Limit values capacitive reactive power (Mvar): 400-380 // 9 220-150 // 9 132-50 // 2.5
Bosnia and Herzegovina	No	No	
Bulgaria	No	Yes	Different rules for injected and consumed reactive power are imposed to consumers and DSOs. The consumed reactive power for which the penalty is imposed to consumer is calculated on the basis of a formula: Erp=Erconsumed – 0.49*Eaconsumed

			where Erp is the quantity of reactive power for which penalty is imposed, Erconsumed is the consumed reactive power for an 15 min interval, 0,49 is a coefficient, adequate to a power factor 0.9, Eaconsumed is a quantity of active power consumed for a 15 min interval. The formula for DSOs is the same, but Erconsumed and Eaconsumed are replaced by Ertransmitted and Eatransmitted (transmitted energy from transmission to distribution network). The penalty for consumed (transmitted) reactive power is 10% of the wholesale price of the active power. The penalty for injected reactive power is 100% from the wholesale price of the active power.
Croatia	No	Yes	There is tariff for excess reactive energy. It is paid monthly according to metered consumption. Tariff for excess reactive energy is 0.0215 €/kvarh. It is paid by L directly connected to the 110 kV transmission network.
Cyprus	No	No	
Czech Republic	No	No	
Denmark	No	No	
Estonia	Yes	No	1.54 €/Mvarh.
Finland	Yes	Yes	The new reactive power tariff was introduced in the beginning of 2017. There is no tariff for reactive power, provided that the hourly reactive power stays within limits defined for each conection point. The limit for inductive reactive power is defined as 16% of the average active power and the limit for capacitive reactive power is defined as 4% of the average active power. The tariff for reactive power exceeding the aforementioned limits is 1 000 €/Mvar for the highest hourly value each month. The tariff for reactive energy exceeding the limits is 5 €/Mvarh. The reactive power tariff will be introduced gradually. In 2017 and 2018, one third and two thirds respectively of the reactive power tariff will be charged.
France	No	Yes	For an industrial customer, if reactive energy/active energy (tg φ) >0.4 for each connection point from 01/11 to 31/03 (from Mondays to Saturdays from 6h to 22h): * 1.43 c€/kvarh is invoiced for 500-350 kV customers. * 1.53 c€/kvarh is invoiced for 350-130 kV customers. * 1.72 c€/kvarh is invoiced for 130-50 kV customers (these values apply from 01/08/2017 to 31/07/2018). Customers having tariffs with time differentiation (i.e. connection voltage lower than 350 kV) have to pay only if their tg φ is higher than 0.4 during peak and winter mid-peak hours.

			A DSO shall pay a penalty depending on its injection or withdrawal of active power: if it is withdrawing active power, the DSO shall pay if it also withdraws reactive power above a certain level, if it is injecting active power, the DSO shall pay if it injects reactive power.
Germany	Yes	Yes	Charging schemes for reactive energy are not equally applied due to different contractual arrangements between TSOs and customers. In particular circumstances customers are charged for reactive power usage (charge up to 9.20 €/Mvarh). Power Plants are reimbursed for the provision of reactive power.
Great Britain	No	No	
Greece	No	No	
Hungary	No	No	
Iceland	No	Yes	Landsnet's tariff scheme assumes a minimum average power factor of cos φ 0.9 at the out-feed for distribution system operators and for power intensive users, at each point of delivery.
Ireland	Yes	Yes	Generator Performance Incentives. Reactive Power Leading/lagging 0.31 €/Mvarh.
Italy	No	Yes	A charge in c€/kvarh is applied for reactive energy (inductive) withdrawn from the transmission/distribution grids where cos φ exceeds a set threshold. Cos φ is calculated for each connection point unless there is a HV distribution connection between points; in such a case cos φ is calculated on the aggregation of connection points. In both cases a charge is applied as a function of: - the ratio of reactive to active energy, - the relevant time slot (F1, F2 or F3) and it is between 0 and 1.1 c€/kvarh. Then DSOs pay Terna for reactive energy withdrawn from the transmission grid and Terna pays DSOs for reactive energy withdrawn from the distribution grid. The difference paid/received by Terna increases/decreases the amount of the ancillary services. There is also a charge paid to DSOs by final consumers for reactive energy withdrawn from the distribution above a set cos φ threshold (charge is between 0 and 1.1 c€/kvarh for final customers HV/EHV).
Latvia	Yes	No	Reactive power tariffication between TSO and DSO not applied in Latvia.
Lithuania	Yes	No	Applied to all consumers for each connection point: 0.71 €/Mvarh for consumption and 1.42 €/Mvarh for generation of reactive energy.
Luxembourg	No	No	
North Macedonia	Yes	Yes	Allowed cos φ = 0.95. Price Q=1.2 €/Mvarh
Montenegro	Yes	No	Direct users on 110kV transmission grid are charged for reactive energy. Excessive take-on of reactive power will be collected from direct

			users, at different prices depending on the technological procedure that the user is conducted, and it is 20% of the cost of active energy.
Netherlands	No	No	
Northern Ireland	Yes	Yes	Leading Lagging Charges included in Generator Performance Incentives. Reactive Power Leading 0.31 €/Mvarh. Reactive Power Lagging 0.31 €/Mvarh. See Other System Charges in Statement of Charges.
Norway	Yes	No	Reactive power that is detrimental to the system will be invoiced to the customer.
Poland	No	Yes	PSE S.A. apply penalties for excess reactive power by final consumers connected to transmission network in nodes where end consumption is connected and DSOs having only one connection point. The penalty is calculated for each MVahr of passive energy taken-off the HV and EHV network when phase factor tgφ is above 0.4 and for each MVahr 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: $O_b = k \times C_{rk} \times \left(\sqrt{\frac{1+\mathrm{tg}^2\,\varphi}{1+\mathrm{tg}^2\,\varphi_0}} - 1 \right) \times A$ 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: 8.415 €/Mvarh, if 0.3<= tgφ <0.4 25.5 €/Mvarh, if 0.4<= tgφ <0.5 76.5 €/Mvarh, if tgφ >=0.5 Tariff: The reactive energy received by the transmission network in the off-peak hours, is charged to 19.1 €/Mvarh.

Romania	Yes	Yes	Rate applied is 12.57 €/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 users on transmission grid except generators, PSPP and auxiliary power for power plants are charged for reactive energy. If consumed reactive energy exceeds level of cosφ=0.95 the charge for the exceeding reactive energy is double. The base reactive energy tariff is 1.5085 €/Mvarh. The reactive energy tariff for cosφ<0.95 is 3.017 €/Mvarh. These tariffs are applied both to capacitive and inductive reactive energy.
Slovakia	No	No	
Slovenia	No	Yes	1: The charges are applied to L and DSO. In case of cos φ<0.95 inductive and capacitive. 2: There is no differentiation about voltage levels, time/period (15min) and location. 3: The charges are applied for all connection points of given user. 4: The rate applied is 3.26 €/Mvarh.
Spain	Yes	Yes	A charge in €/Mvarh is applied to the reactive energy consumption exceeding 33% of the active energy consumption. Applicable to consumers connected above 1 kV. With few exceptions, this charge is the following for all tariff periods: (i) for 0.80≤cos φ <0.95, 0.041554 €/kvarh; (ii) for cos φ <0.80, 0.062332 €/kvarh. (Orden IET/3586/2011).
Sweden	No	No	
Switzerland	Yes	Yes	13.38 €/Mvarh to be paid for individual use of reactive energy, 2.66 €/Mvarh premium for delivery of 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:

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

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

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

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

Appendix 12: Exchange rates

For countries for which currency is not €, the tariff figures in this report were converted into € by using the exchange rate dated 31 December 2018.

The table below summarizes exchange rates applied.

Table A.12. Exchange rates

Country	Exchange rate
Albania	1ALL=0.008102€
Bosnia and Herzegovina	1BAM= 0.511292€
Bulgaria	1BGN=0.510000€
Croatia	1HRK=0.134815€
Czech Republic	1CZK=0.038873€
Denmark	1DKK=0.133423€
Great Britain	1GBP=1.1149€
Hungary	1HUF=0.00311€
Iceland	1ISK=0.007506€
North Macedonia	1MKD=0.016261€
Northern Ireland	1GBP=1.1149€
Norway	1NOK=0.101000€
Poland	1PLN=0.232558€
Romania	1RON=0.214413€
Serbia	1RSD=0.0085€
Sweden	1SEK=0.09758€
Switzerland	1CHF=0.88625€

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 not recoverable. 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.