ENTSO-E Overview of transmission tariffs in Europe: Synthesis 2009

July 2010

This study was achieved by the ENTSO-E Working Group Economic Framework:

Fonck Pascale (Convenor, Belgium), Bruno De Wachter (Secretary, Belgium), Andrzej Bartosik (Poland), Pavel Šolc (Czech Republic), Oliver John (Germany), Nadja Ballauf (Germany), Peter Scheerer (Germany), Steffen Hofer (Germany), Lucian Balea (France), Steffen Østermark (Denmark), Daniela Dembech (Italy), Mirela Dutoiu (Romania), Maria José Clara (Portugal), Efthimia Chassioti (Greece), Zsuzsanna Hodi (Hungary), Mark Needham (Ireland), Roberts Hedd (Great Britain), Andreas Schreiber (Switzerland), Alexander Meinhart (Austria), Jukka Metsala (Finland), Vincenc Kozar (Slovenia), Roger Kearsley (Sweden), Antons Kutjuns (Latvia), Giedrius Radvila (Lithuania), Mauricio Remacha (Spain), Peep Soone (Estonia), Tore Granli (Norway), Oscar Tessensohn (Netherlands), Hristo Boyadzhiev (Bulgaria), Jan Orac (Slovak Republic), Roby Gengler (Luxemburg), Igor Jurisevic (Serbia), Aleksandar Milisa (Bosnia and Herzegovina), Izabela Netkova (FYROM), Kristina Mravak (Croatia).

Table of contents

Background **4**

Methods and hypotheses chosen for ENTSO-E overview **5**

Main characteristics of the TSO tariffs in Europe **6**

Comparison of transmission tariffs: sum of generation and load fees **7**

Costs included in the comparison transmission tariffs **9**

Comparison of transmission tariffs: split between components related to TSO activities and other regulatory charges **11**

Energy-related components and power-related components in the transmission tariff **12**

Range of G components paid in 2009 by producers across Europe **13**

Range of L components paid in 2009 by load across Europe **14**

Comparison of transmission tariffs G+ L: impact of utilisation time **15**

Comparison of transmission tariffs G+ L: impact of location **16**

Components of transmission tariffs **17**

Transmission tariffs evolution only TSO costs **19**

Transmission tariffs evolution including non TSO costs **20**

Appendices **21**

Appendix 1: Voltage level operated by TSO 22

Appendix 2: Comparison of network losses 23

Appendix 3: Comparison of system services 24

Appendix 4: Definition of the tariff areas in countries with generation/consumption geographic zonal differentiation (i) 25

Appendix 5: Other regulatory charges not directly related to TSO activities 27

Appendix 6: First connection charges 29

Appendix 7: Special tariffs 31

Appendix 8: Treatment Final Customers vs Distribution System Operators 33

Appendix 9: Reactive Energy 36

Glossary of terms **39**

Background

- Transmission tariff is very important for the International Electricity Market. There is no single “right solution”, except for recovering costs. Different methods work side-by-side for the time being. Experience will then determine the possible degree of harmonization of the underlining principles for setting transmission charges to be achieved in the future.
- This report contains the comparative overview of 2009 transmission tariffs for 31 European countries as a contribution to understand the components in the transmission tariffs and other regulatory charges recovered or invoiced by TSOs, but not directly related to TSOs’ activities.
- In order to be as comparable as possible, the tariffs taken into account have to cover all of the energy transmission charges, meaning that it includes not only components related to TSO activities but also other regulatory charges not directly related to transmission costs which are covered through different mechanisms in each country. The components taken into account are:
    - infrastructure charges (operation and capital),
    - loss compensation costs,
    - internal congestion costs (but no costs of auctions or market splitting),
    - costs of system services,
    - costs of system balancing,
    - other regulatory charges e.g. stranded costs, incentives for renewable,… if any.
- It must be noted that only one aspect of the regulation (tariff) is covered and this ENTSO-E overview does not take into account the differences among countries such as quality of service, main technical characteristics and environment of the networks (e.g. consumption density, generation location,..).

- Taking into account the «whole» of the tariff: adding, if necessary, both the invoices applied to the load (L) and to the generation (G), assuming they produce and consume the energy they had in their programs (without individual deviations).
- Voltage levels :
    - voltage levels of the transmission networks vary across Europe, in particular the lowest voltage level which is classified as a transmission network varies largely (see Appendix 1: Voltage level operated by TSO)
    - to deal with this circumstance, two main cases are taken:
        - the producer and consumer are both connected to the EHV (Extra High Voltage) network (400 kV- 220 kV)
        - because in some countries transmission tariffs are applied to the HV (High Voltage) voltage range 150-50 kV or because no load is connected to EHV network, tariffs for these voltages have to be compared for these countries too.
- For the comparison of transmission tariffs, the following **base case** is taken into account:
    - 5000 h utilization time that includes day hours of working days
    - the typical load considered is eligible and has a maximum power demand of 40 MW when it is connected at EHV and a maximum power demand of 10 MW when it is connected at HV
    - for countries with location signals, an average value has been taken.
- In addition to the base case, some examples are calculated in order to take into account the variation of tariffs according to:
    - the location of the generation and load (south or north of the country, same area / differentiated area)
    - the load's utilization time (the load is considered to first consume during day hours)

Main characteristics of the 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 the tariffs charged by TSO?
	Generation	Load	Seasonal / time-of-day (1)	Location		
Austria	15%	85%	-	-	Yes	Through a specific component to generators
Belgium	0%	100%	xxx	-	Not included for grid >=150 kV	Tariff for ancillary services
Bosnia and Herzegovina	0%	100%	-	-	No	No
Bulgaria	0%	100%	-	-	Yes	Yes
Croatia	0%	100%	x	-	Yes	Yes
Czech Republic	0%	100%	-	-	Yes	Yes
Denmark	2-5%	95-98%	-	-	Yes	Yes
Estonia	0%	100%	x	-	Yes	Yes
Finland	11%	89%	x	-	Yes	Yes
France	2%	98%	-	-	Yes	Yes
Germany	0%	100%	-	-	Yes	Yes
Great Britain	27% TNUoS Tariff (2) 50% BSUoS Tariff (2)	73% TNUoS Tariff 50% BSUoS Tariff	xx	TNUoS - locational; BSUoS - non-locational	No, recovered in the energy market	Included in BSUoS Tariff
Greece	0 % Use of system 0 % Uplift charges	100 % Use of system 100 % Uplift charges	x	-	No, recovered in the energy market	Included in Uplift charges
Hungary	0%	100%	-	-	Yes	Yes
Ireland	20%	80%	-	Generation only	No, recovered in the energy market	Yes
Italy	3%	97%	-	-	No	Yes
Latvia	0%	100%			Yes	Yes
Lithuania	0%	100%	-	-	Yes	Yes
Luxembourg	0%	100%	-	-	Yes	Yes
FYROM	0%	100%	-	-	Yes	Yes
Netherlands	0%	100%	-	-	Yes	Tariff for ancillary services
Northern Ireland	25%	75%	xxx	-	No	Tariff for ancillary services
Norway	44%	56%	xxx (via losses)	Location	Yes	Yes
Poland	0,60%	99.4%	-	-	Yes	Yes
Portugal	0%	100%	xx	-	No, included in energy price	No, included in energy price
Romania	20,45% use of system	79,55% use of system	-	6 G zones =6 G tariffs values 8 L zones =8 L	Yes	Tariff for ancillary services
	0% system services	100% systems services				
Serbia	0%	100%	x	-	Yes	Yes
Slovak Rep.	0%	100%	-	-	Through a specific fee	Through a specific fee
Slovenia	0%	100%	xx	-	Yes	Tariff for ancillary services
Spain	0%	100%	xxx	-	No, included in energy price	No, included in energy price
Sweden	25%	75%	xx (via losses)	Location	Yes	Yes
Switzerland	0%	100%	-	-	By a separate tariff for losses	By separate tariffs for ancillary services

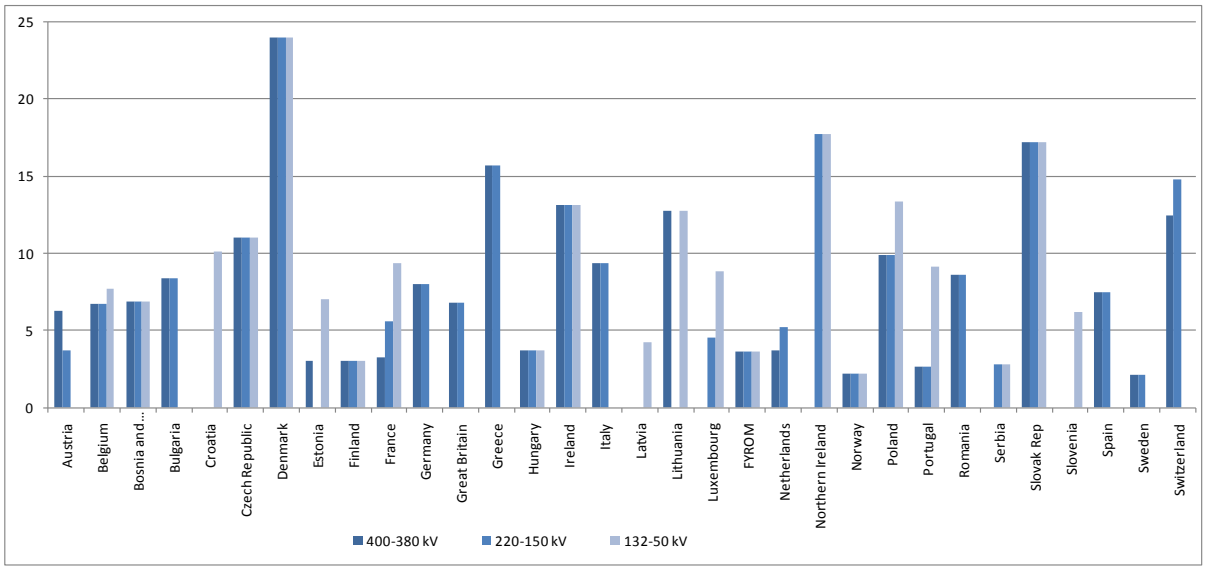
Remarks:

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

(2) TNUoS: Transmission Network Use of System; BSUoS=Balancing Services Use of System

Comparison of transmission tariffs: sum of generation and load fees

Euro per MWh



Remarks:

- In this chart three voltage ranges are taken (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- For those countries where more than one transmission tariff is applied for the different transmission voltage levels, one different bar for each tariff applied to the corresponding voltage level is represented.
- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- The charges taken into consideration for this comparison are included in the table on next page.
- Other regulatory charges are included.

Country remarks:

- Austria: L concerns the usage of the grid. G however concerns secondary control - these are quite different components which should be considered separately.
- Belgium: The cost of losses has been added, but is not included in the TSO-tariffs for users connected at EHV.
- Bosnia and Herzegovina: Currently ISO (Independent System Operator) and TRANSCO are not responsible for the purchase of energy losses, secondary reserves or tertiary reserves... Respective costs are included in the price which consumers pay directly to the service providers. For comparability purposes only the costs in this report were presented as “other regulatory charges not directly related to TSO activities.
- Bulgaria: The Bulgarian TSO is not the owner of the grid and the transmission tariff is divided into two components: tariff 1 for “access to the grid” that has to be paid to ESO and tariff 2 for “transmission” that has to be paid to NEK in its capacity of Transmission Company and owner of the transmission assets. The service “Operation of the Transmission network” is performed by ESO on the basis of a service contract with NEK. The figures comprise both tariffs.
- Denmark: Weighted average between Denmark West and Denmark East.
- Estonia: EHV network is 330 kV. System services are not included.
- Germany: weighted average of the TSOs operating in Germany, KWKG surcharge (combined cycle co-generation) not included.
- Great Britain: Data for losses are not available.

- Greece: Transmission losses are paid by those who inject energy in the transmission system (generators and importers), however an estimated cost has been included here for comparison purposes.
- France: Charge corresponding to the "220-150" voltage level (highest voltage level with statistically representative data).
- Ireland: Transmission losses are accounted for in the market however purely for comparison purposes an estimated charge has been included in these figures.
- Italy: The unitary price of transmission tariff provided by Terna includes within “System services” some pass through components. These are better explained in the remarks section under the “Components of transmission tariffs” table.
- Northern Ireland: Transmission losses are accounted for in the market however purely for comparison purposes an estimated charge has been included in these figures.
- Portugal: 2009’s regulated access tariffs are unusually low because they were deducted from exceptional costs of renewables (tariff deficit), which will be recovered through the next 15 years’ tariffs. In Portugal the interval 132 – 50kV corresponds to the voltage level of 60 kV which is operated by the distribution company. Clients connected to 60 kV also pay to the distribution the use of HV (60 kV) network.
- Spain: System services and losses are not included in the transmission tariff as they are recovered in the energy price in the market. They have been included only for comparative purposes.
- Switzerland: Transmission tariffs in Switzerland are the same on both voltage levels 400kV and 220kV. As in this example the consumption of the end user connected to the 220kV grid is lower than the consumption of the end user connected to the 400kV grid. The fix and the power component of the tariff have more weight.

Costs included in the comparison transmission tariffs

	OPEX except system-services, losses and ITC	Losses cost	ITC cost/revenue	System-services								CAPEX		Other
				Primary reserve	Secondary reserve	Tertiary reserve	Internal Congestion management	Congestion management on interconnections	Black -Start	Voltage Control Reactive Power	System Balancing	Depreciation	Return on capital invested	
Austria	C	C	C/B	N	C	N	C	C/B	C	C	N	C	C	N
Belgium	C	C	C/B	C	C/B	C/B	C	C/B	C	C	N	C	C	Y
Bosnia & Herzegovina	C	C	C/B	C	C	C	N	N	C	C	N	C	C	N
Bulgaria	C	C	C	C (capacity)	C (capacity)	C (capacity)	N	N	C	C	N	C	C	N
Croatia	C	C	N	N	C	C			C	C	N	C	C	C
Czech Rep.	C	C	C/B	C	C	C	C	N	C	C	N	C	C	C
Denmark	C	C	C/B	C	C	C	C/B	C/B	C	C	C/B	C	C	C/B
Estonia	C	C	C	N	N	C	N	N	C	C	N	C	C	N
Finland	C	C	C	N	N	C	C	C	C	C	N	C	C	C
France	C	C	C	C	C	N	C	N	C	C	N	C	C	C
Germany	C	C	C/B	C	C	C	C	C/B	C	C	N	C	C	C
Great Britain	C	N	N	C	C	C	C	C	C	C	C	C	C	N
Greece	C	C	N	C	C	N	N	C	N	N	N	C	C	C
Hungary	C	C	C/B	C	C	C	C	C/B	C	C	C/B	C	C	N
Ireland	C	C	N	C	C	C	N	N	C	C	N	C	C	N
Italy	C	C	C	C	C	C	C	N	C	C	C	C	C	N
Latvia	C	C	C	C	C	C	N	N	N	C	N	C	C	N
Lithuania	C	C	C	N	C	C	N	N	C	C	N	C	C	N
Luxembourg	C	C	C/B	C	C	C	C	C	C	C	C	C	C	N
FYROM	C	C/B	C	N	C	C	N	C	C	N	N	C	C	N
Netherlands	C	C	C/B	N	C/B	C/B	C/B	N	C	C	C	C	C	N
Northern Ireland	C	C	N	C	C	C	N	N	C	C	N	CAPEX	C	N
Norway	C	C	C	C	N	N	C	C	N	N	N	C	C	N
Poland	C	C	C	C	C	C	C	N	C	C	C	C	C	C*
Portugal	C	C	C/B	C/B	C/B	C/B	N	C/B	C/B	C/B	N	C	C	C
Romania	C	C	C/B	N	C	C	C	C/B	C	C	N	C	C	C
Serbia	C	C	C/B	C	C	C	C	C/B	C	C	C	C	C	N
Slovak Rep	C	C	C/B	C	C	C	N	N	C	C	N	C	C	C
Slovenia	C/B	C	C/B	N	C	C	C	C/B	C	C	N	C/B	C/B	C/B
Spain	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sweden	C	C	C/B	N	N	C(1/3)	C	C/B	C	C	N	C	C	N
Switzerland	C	C/B	C	C/B[1]	C/B[1]	C/B[1]	C/B[1]	C/B[1]	C/B[1]	C/B[2]	N	C	C	C[3]

Where:

- C if costs are covered by the transmission invoice
- C/B if costs less benefits are covered by the transmission invoice (C/B indicates whether certain costs covered by the tariff are also compensated by revenues. Intuitive examples are ITC, congestion costs and balancing. For instance if congestion rents are deducted from congestion costs, then the residual amount to be covered by tariffs is obtained. In this case the corresponding entry in the matrix would be C/B and not only C)
- N if the costs are not included in the transmission invoice

Remarks:

- This table contains indication of different costs covered by charges that have been included in the calculation of the price used for the comparison. Some of these charges may not be included in the TSO transmission tariff.

Country remarks:

- Austria:
  - Primary Reserve: According to the Austrian legal framework every generator with a max. capacity > 5 MW has to provide primary reserve.
  - System Balancing and Tertiary Reserve: The border between the two expressions "tertiary reserve" and "balancing energy" is due to the Austrian system blurry. The TSO has nothing to do with the settlement of the system balancing.
- Bosnia and Herzegovina: Currently ISO (Independent System Operator) and TRANSCO are not responsible for purchase energy of losses, secondary reserves, tertiary reserves... Respective costs are included in the price which consumers pay directly to service providers. For comparability purposes only the costs in this report were presented as “other regulatory charges not directly related to TSO activities
- Bulgaria: Primary, Secondary and Tertiary reserves only include cost for capacity.
- Germany: Secondary reserve and Tertiary reserve, covering only costs for capacity.
- Hungary:
  - Total congestion rents on interconnections are taken into account by regulatory authorities when approving the methodology for calculating network tariffs for OPEX

of system operation part - not system-services - similar to ITC. This revenue always reduces the next year tariff.

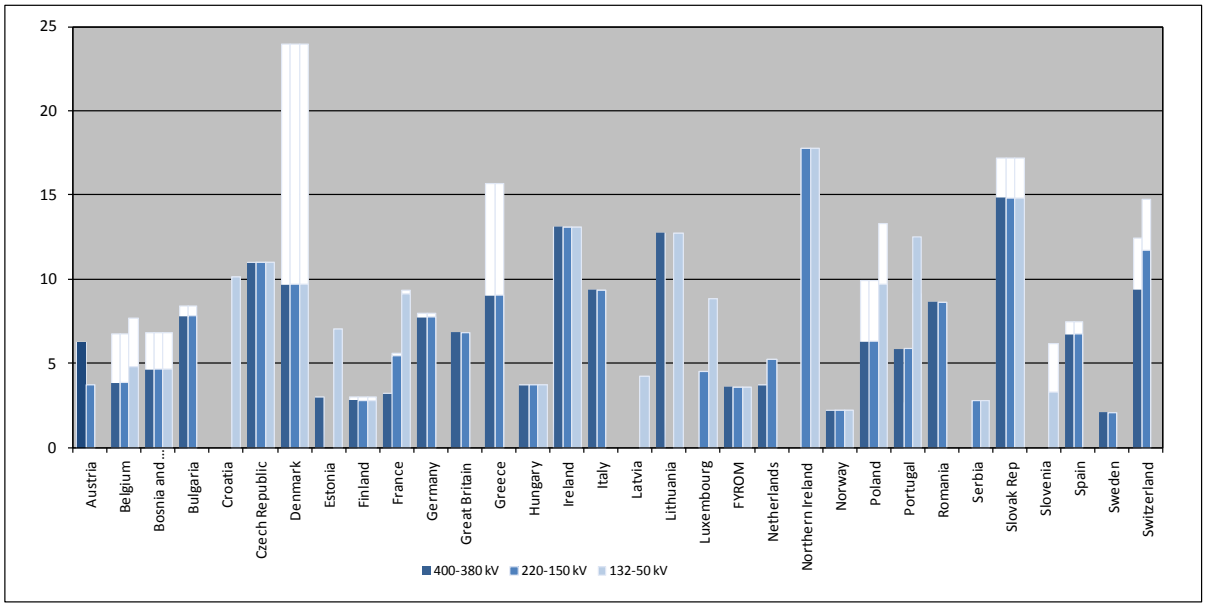
  - The difference of the realized and planned (at the tariff determination) profit of the system balancing reduces/increases the next second year tariff for ancillary services.

- Nordic countries: "Secondary reserve" does not exist in the Nordic countries, with exception of Denmark West, which is connected to the continental system.
- Northern Ireland: Transmission losses are accounted for in the market. However an estimation is calculated purely for comparison purposes.
- Poland: 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 transitory charge in the Tariff.
- Portugal: Losses costs and system-services costs are not recovered by a regulated tariff, they are recovered in the energy.
- Spain: System services and losses are not included in the transmission tariff as they are recovered in the energy price in the market. They have been included only for comparison purposes.
- Switzerland:
  - [1] Partly recovered by power plants with a minimum of 50 MW

    In fact, the cost block general ancillary services (general AS) is charged to all distribution system operators with end consumers in their grids as well as to end consumers that are directly connected to the transmission system. The amount of the general AS costs charged to them is determined based on the tariff of 0.4 Rp./kWh as stipulated by ElCom. In accordance with this and an earlier ElCom ruling, Swissgrid charges power plants with an electricity output of at least 50 MW for the costs for general ancillary services which exceed the abovementioned 0.4 Rp./kWh, according to their share of gross energy production. ElCom ordered a billing rate of 0.45 Rp./kWh (on-account billing rate for power plants with an electricity output of at least 50 MW).
  - [2] No tariff component in 2009
  - [3] Cost-covering feed-in remuneration fee

Comparison of transmission tariffs: split between components related to TSO activities and other regulatory charges

Euro per MWh



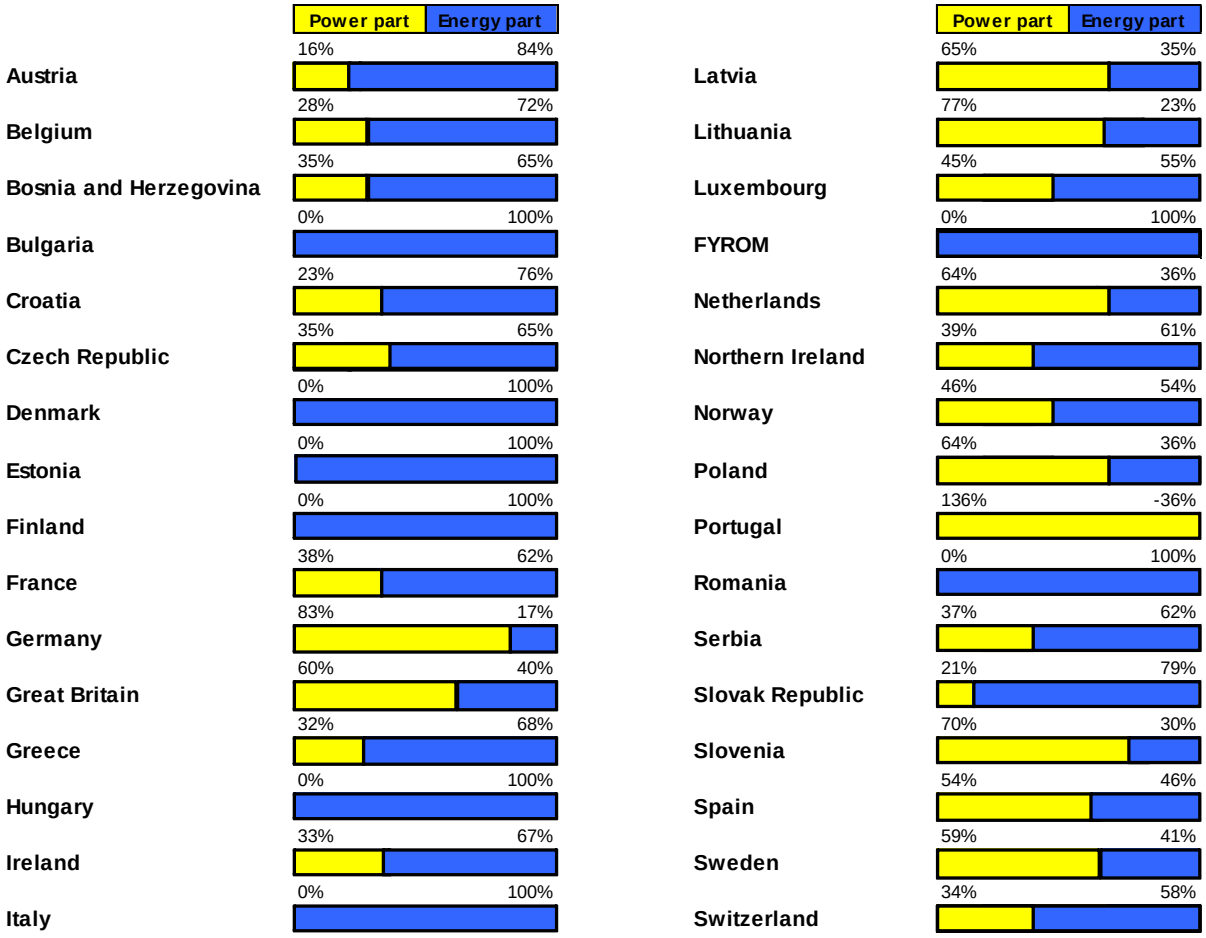
Costs related to TSO activities: infrastructure (capital and all operation charges), losses, system services, congestion.

Other regulatory charges not directly related to TSO activities: stranded costs, public interest contribution, renewable energy and other. Detailed in appendix 5.

Remarks:

- In this chart three voltage ranges are taken into consideration (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- For those countries where more than one transmission tariff is applied for the different transmission voltage levels, it results one different bar for each tariff applied to the corresponding voltage level.
- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5).

Energy-related components and power-related components in the transmission tariff



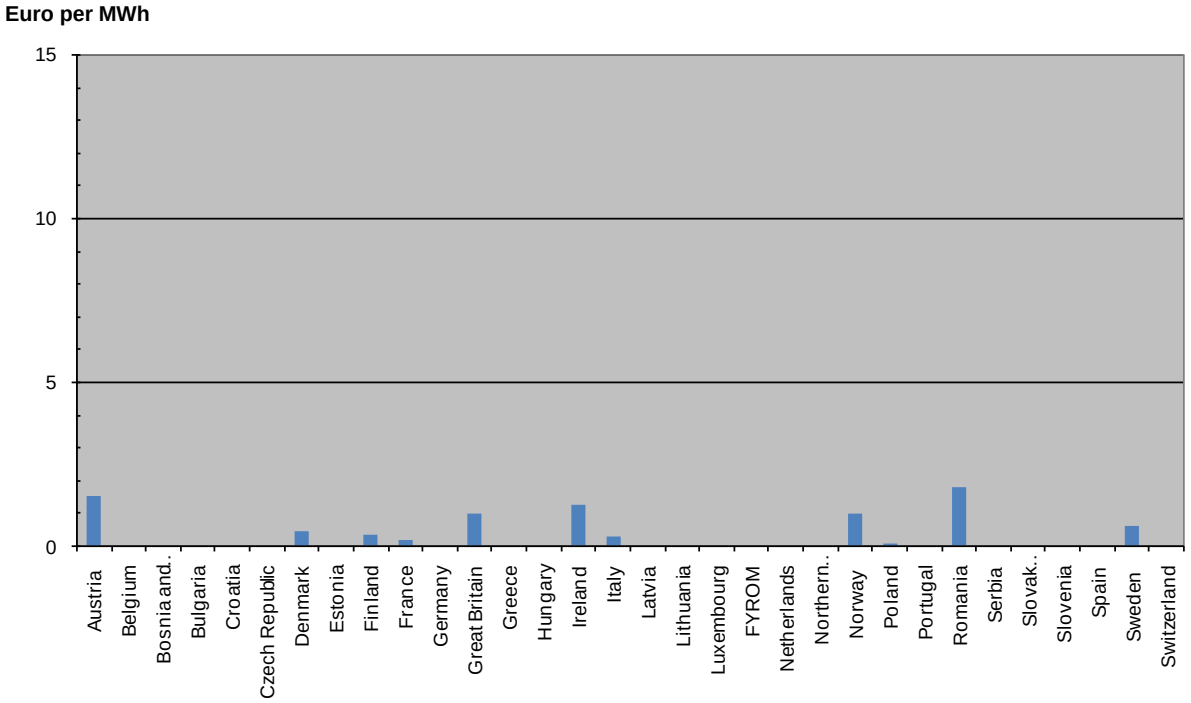
Remarks:

- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- For any transmission system user connected to the highest voltage level in each country.
- The values have been rounded.

Country remarks:

- Belgium: The cost of losses has been added, but is not included in the TSO-tariffs for users connected at EHV.
- Germany: Weighted average, KWKG surcharge (combined cycle co-generation) not included.
- Poland: Values given include other burdens, i.e. not only TSO related costs. The share without other burdens would be respectively 44 % (power) and 56% (energy).
- Portugal: 2009's regulated access tariffs are unusually low because they were deducted from exceptional costs of renewables (tariff deficit), which will be recovered through the next 15 years tariffs.
- Spain: Percentages corresponding only to access tariffs without losses and system services.
- Switzerland: Additionally there is also a fix part of the tariff for this example with one connection point that represents 8%.

Range of G components paid in 2009 by producers across Europe



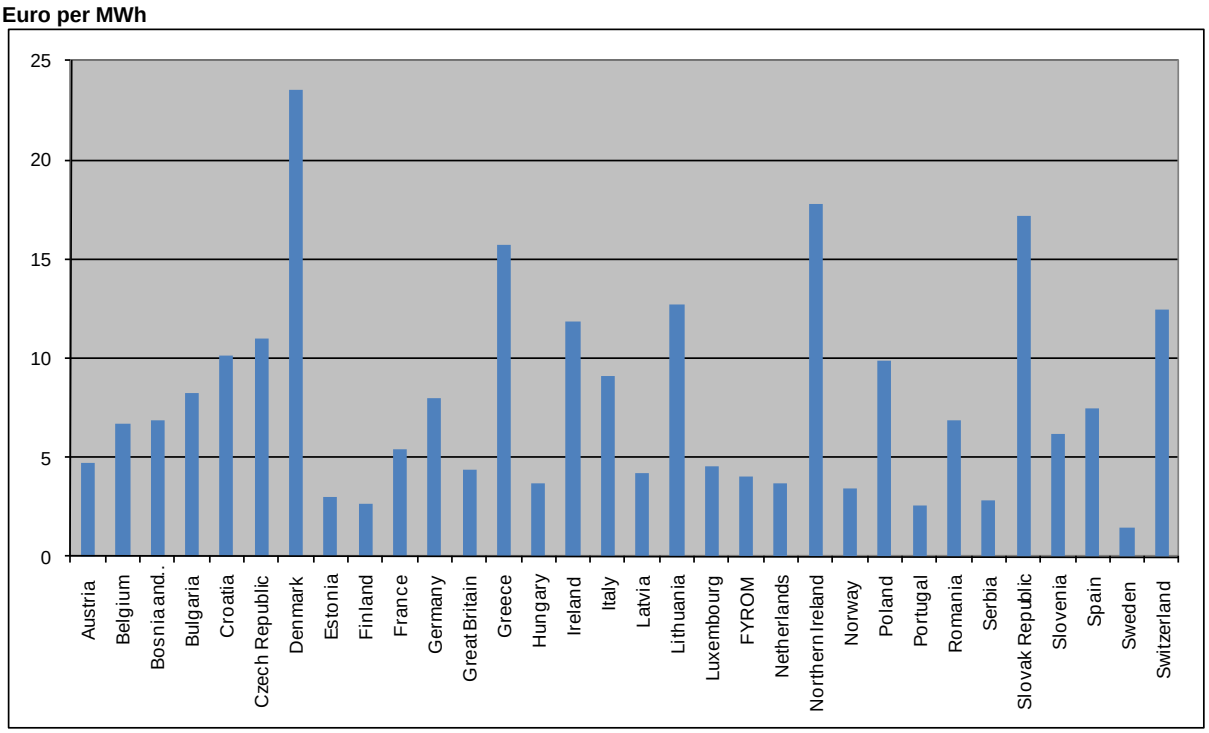
Remarks:

- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- For any transmission system user connected to the highest voltage level in each country.

Country remarks:

- Great Britain: Generation tariffs range from 24.24 €/kW in North Scotland to -7.84 €/kW in Central London. The average weighted TNUoS generation tariff is around 4.95 €/kW. The contribution from BSUoS charges has not been included.
- Northern Ireland has 100% Postage stamp Generator Tariffs therefore no "range" - Generation is currently charged £303.04/MW/Month.

Range of L components paid in 2009 by load across Europe



Remarks:

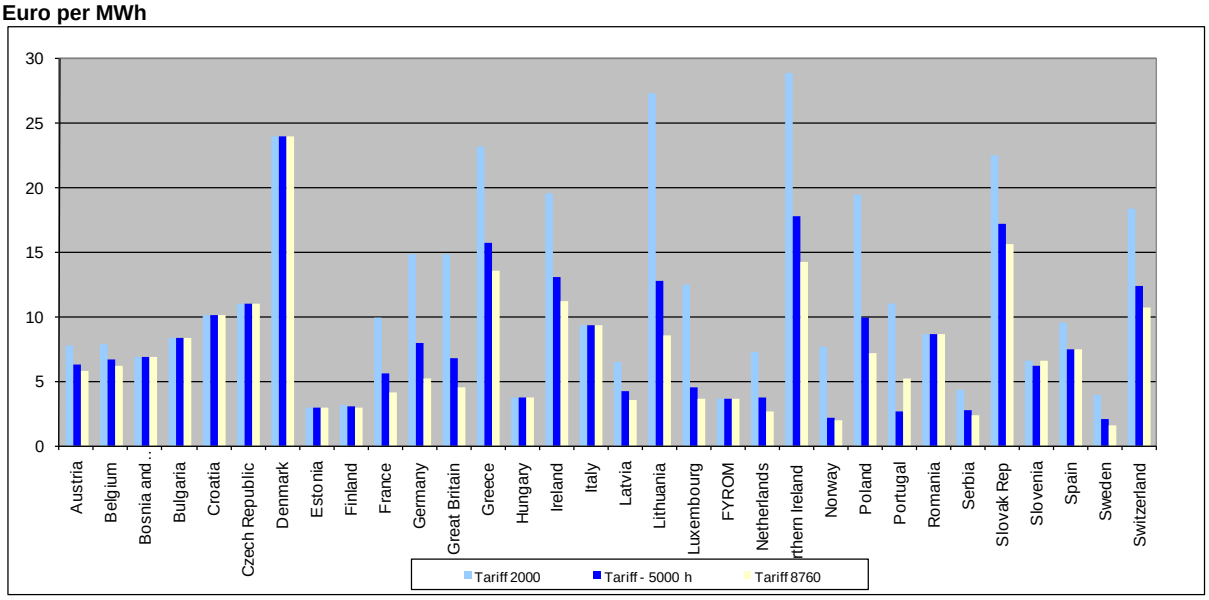
- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- For any transmission system user connected to the highest voltage level in each country.
- Other regulatory charges are included.

Country remarks:

- Great Britain: Demand tariffs range from 3.80 €/kW in the North Scotland to 29.09 €/kW in the Central London zone. The weighted average TNUoS demand tariff is around 21.76 €/kW. The contribution from BSUoS charges have not been included.
- Greece: Transmission losses are paid by those who inject energy in the transmission system (generators and importers), however an estimated cost has been included here for comparison purposes.
- France: Charge corresponding to the "220-150" voltage level (highest voltage level with statistically representative data).

Comparison of transmission tariffs G+ L: impact of utilisation time

Euro per MWh

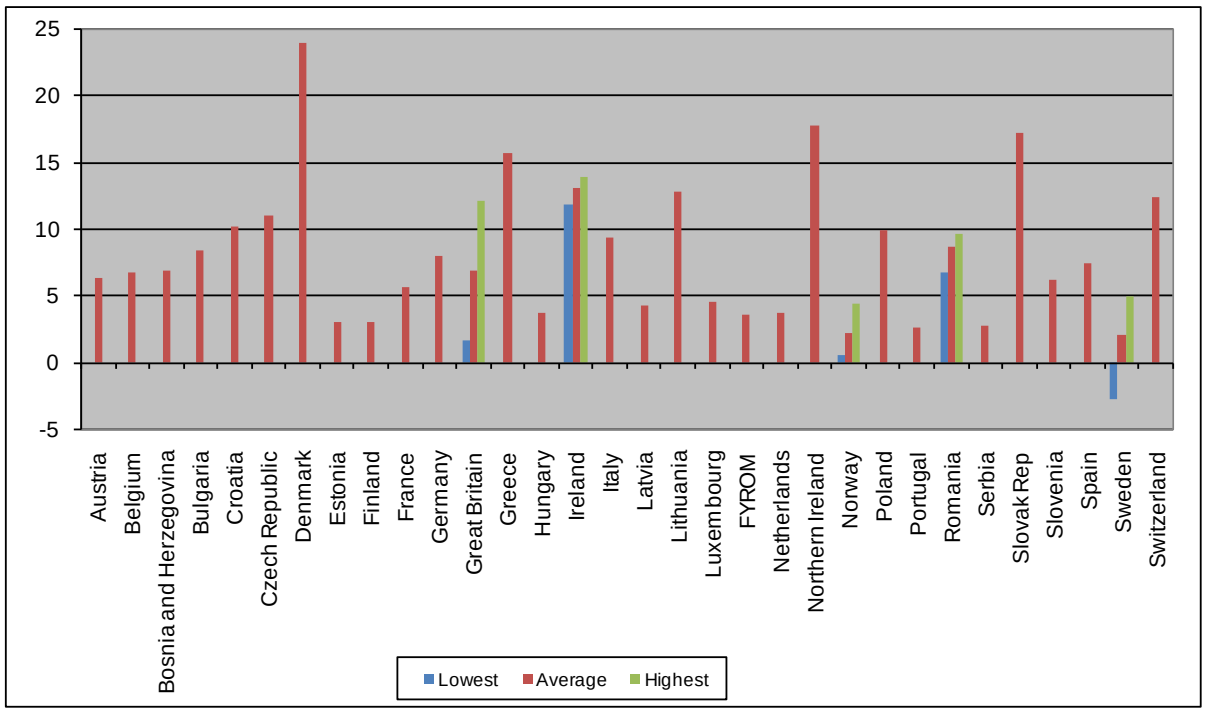


Remarks:

- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5) but taking into account the effect of the utilization time.
- For any transmission system user connected to the highest voltage level in each country.
- Other regulatory charges are included.

Comparison of transmission tariffs G+ L: impact of location

Euro per MWh

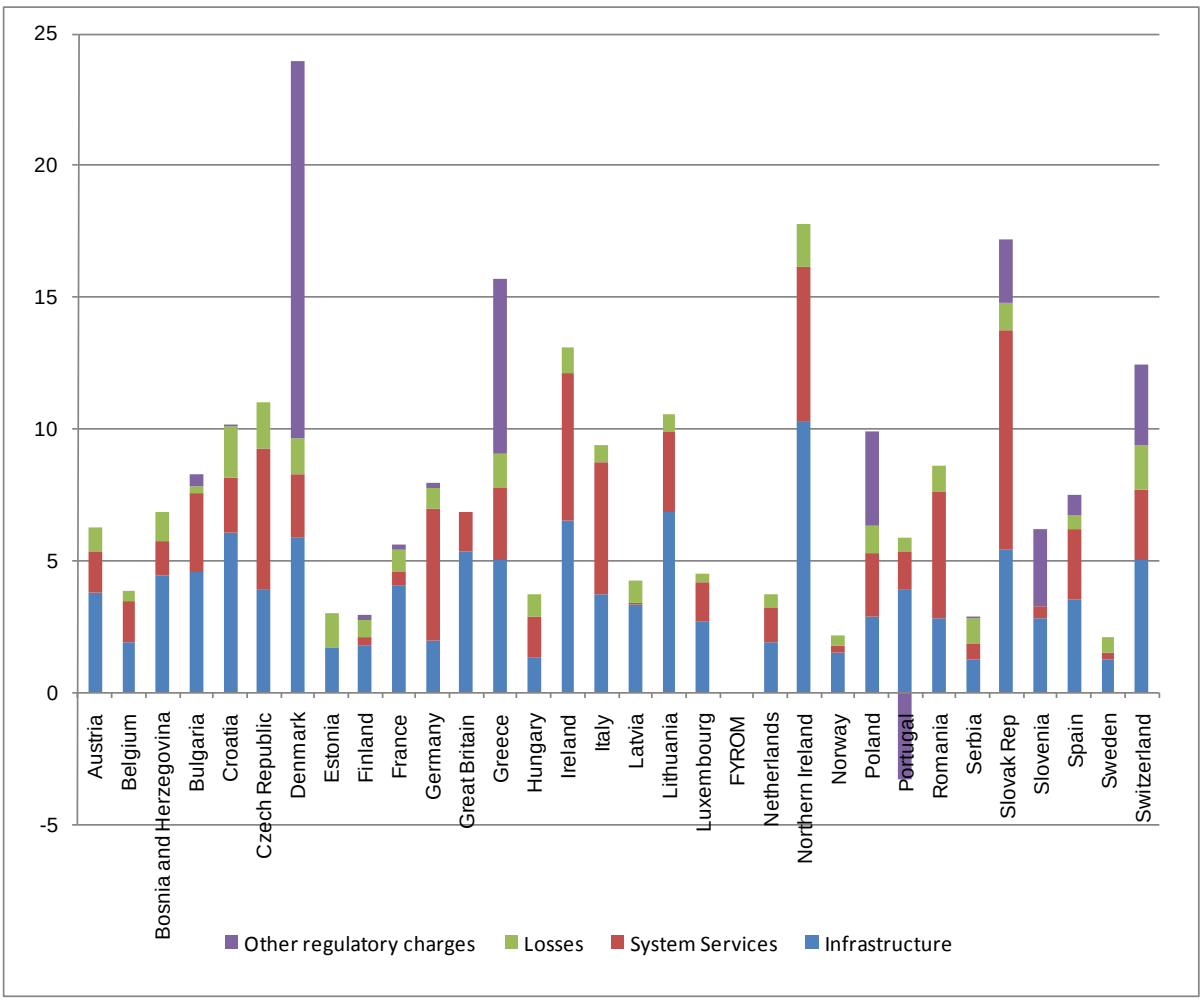


Remarks:

- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- For any transmission system user connected to the highest voltage level in each country.
- Other regulatory charges are included.
- See also Appendix 4. Definition of the tariff areas in countries with generation/consumption geographic zonal differentiation.

Components of transmission tariffs

Euro per MWh



Remarks:

- The figures of the chart are estimations of the value of each final price component.
- The base case is taken (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- System services include balancing of the system where it applies.
- For any transmission system user connected to the highest voltage level in each country.

Country remarks:

- For Netherlands and Czech Rep., the price of losses is not public so the value taken is an average within the range in which it is included (see Appendix 2: Comparison of network losses).
- Estonia: System services are not included.
- France: There is no specific allocation of system services or losses cost to any specific tariff, the values here are purely indicative.
- Greece: Transmission losses are paid by those who inject energy in the transmission system (generators and importers), however an estimated cost has been included here for comparison purposes.
- Great Britain: Data for losses are not available.

- Hungary: In the infrastructure component, the combined transmission and system operation tariff - including losses – is reduced due to surpluses of system operation OPEX of previous years given back to consumers through tariff decreases.
- Ireland: Transmission losses are accounted for in the market however an estimated cost has been included here purely for comparison purposes.
- Italy: “System Services includes the following items that are pass through components:
    1. UPLIFT: Charge for provision of dispatching service.
    2. UESS: Charge paid to mast run Production Units.
    3. INT: Charge paid to final clients which provide service of load interruption.
    4. CD: Charge paid to Production Units for availability of production power.

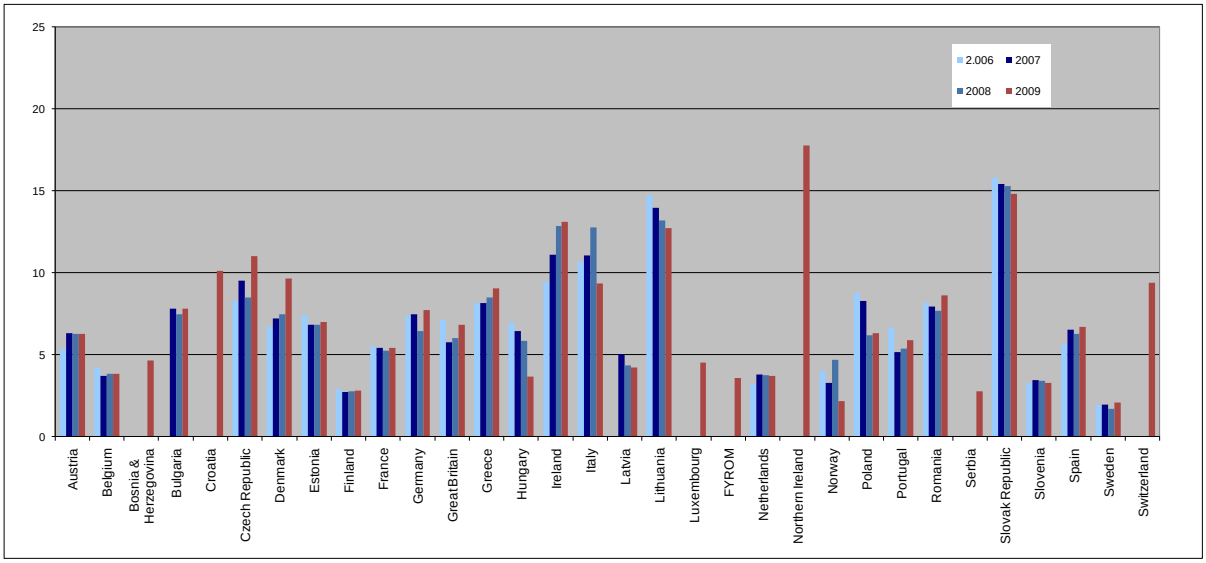
  Whereas:

    5. DIS is the component to remunerate Terna for dispatching activities equal to 0,14 €/MWh.
- FYROM: The splitting of the total invoice is not available.
- Netherlands: The cost of losses is part of the transmission tariff so the value of the chart is only estimation.
- Portugal: System services include cross border tariff. 2009’s regulated access tariffs are unusually low because they were deducted from exceptional costs of renewables (tariff deficit), which will be recovered through the next 15 years tariffs.
- Slovenia: Losses included in transmission fee, splitting not available.
- Spain: System services and losses are not included in the transmission tariff as they are recovered in the energy price in the market. They have been included only for comparison purposes.
- Switzerland:
    - System services: cover general ancillary services and parts (without loss compensation) of individual ancillary services.
    - Other costs: Cost-covering feed-in remuneration fee.

Transmission tariffs evolution only TSO costs

Constant Euros of 2009

Euro per MWh



Remarks:

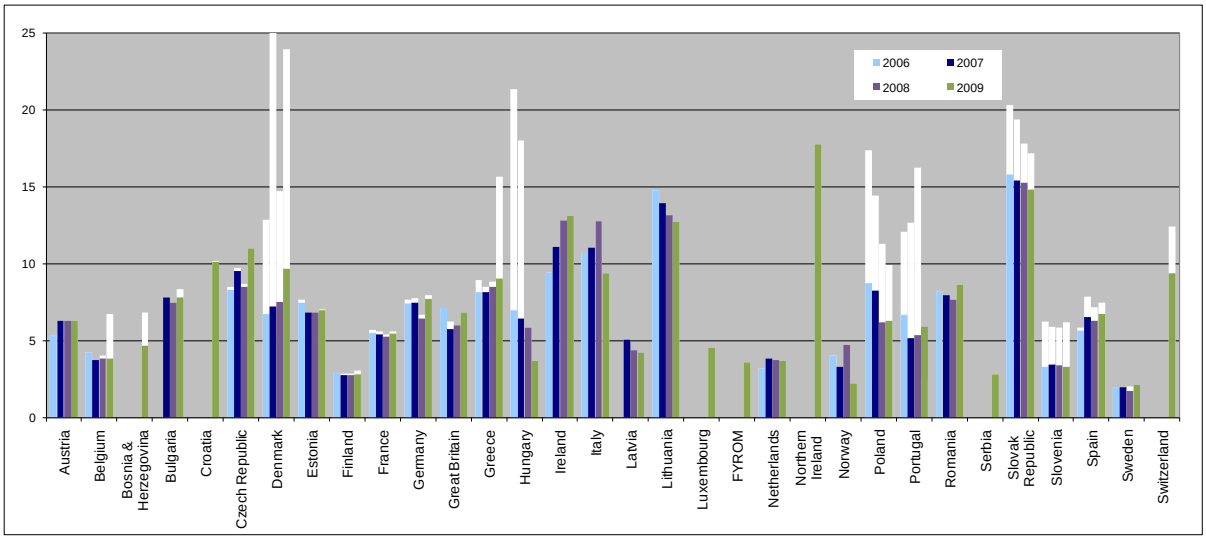
- The base case is taken (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- Prices updated to € 2009 (31st December).
- CPI used for each country is the published in Eurostat.
- For countries not being in the Euro zone the exchange rate to € in December 31st 2009 is used.
- For any transmission system user connected to the highest voltage level in each country.

Main changes compared to 2008:

- Greece: The increase in costs related to TSO activities is due to the Cost Recovery Mechanism that was introduced during 2008 and thus included only a part of 2008.

Transmission tariffs evolution including non TSO costs

Constant Euros of 2009



Costs related to TSO activities: infrastructure (capital and all operation charges), losses, system services, congestion.

Other regulatory charges not directly related to TSO activities: stranded costs, public interest contribution, renewable energy and other. Detailed in appendix 5.

Remarks:

- The base case is taken (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- Prices updated to € 2009 (31st December).
- CPI used for each country is the published in Eurostat.
- For countries not being in the Euro zone the exchange rate to € in December 31st 2009 is used.
- For any transmission system user connected to the highest voltage level in each country.

Main changes compared to 2008:

- Portugal: 2009's regulated access tariffs are unusually low because they were deducted from exceptional costs of renewables (tariff deficit), which will be recovered through the next 15 years tariffs.
- Greece: The increase in costs not directly related to TSO activities is due to the introduction of Public Services Obligations.
- Estonia: Evolution for 110 kV.

Appendices

1. Voltage level operated by TSO
2. Comparison of network losses: sum of producer and consumer fees connected at EHV, for a utilisation time of 5,000 h
3. Comparison of system services: sum of producer and consumer fees connected at EHV, for a utilisation time of 5,000 h
4. Definition of the tariff areas in countries with generation/consumption geographic zonal differentiation
5. Other regulatory charges not directly related to TSO activities
6. First connection charges
7. Special Tariffs
8. Treatment Final Customers vs Distribution System Operators
9. Reactive Energy

Appendix 1: Voltage level operated by TSO

% km	400-380 kV	220 -150 kV	132-50 kV
Austria (Verbund)	32	48	20
Belgium (Elia)	14	43	43
Bosnia and Herzegovina	15	26	59
Bulgaria (NEK)	16	19	65
Croatia	15	19	66
Czech Republic (CEPS)	63	35	2
Denmark (Energinet.dk)	25	49	26
Estonia (Elering OÜ)	29	4	67
Finland (Fingrid)	30	16	53
France (RTE)	21	27	52
Germany	100		0
Great Britain (NGT)	53	26	21
Greece (HTSO)	28	72	0
Hungary (Mavir)	57 (+ 6% 750 kV)	32	5
Ireland (EirGrid)	7	30	63
Italy (Terna)	18	82	
Latvia (Augstsprieguma Tikls	24	0	76
Lithuania (Lietuvos E.)	25	0	75
Luxembourg		30	70
FYROM	27	6	67
Netherlands (TenneT)	30	70	0
Norway (Statnett)	73	1	26
Poland (PSE Operator)	39 (+ 1% 750 kV)	59	0
Portugal (REN)	21	79	0
Romania (Transelectrica)	27	73	0
Serbia (EMS)	17	21	62
Slovak Republic (SEPS)	64	35	2
Slovenia (Eles)	20	13	68
Spain (REE)	51	49	0
Sweden (Svenska K.)	69	27	4
Swiztzerland	27	73	0

Remarks:

- Percentages calculated as the ratio between the kilometers of circuits for each voltage level and the total kilometers of circuits operated by each TSO.
- Values have been rounded.
- Denmark: About 6% of the total circuits under the operation of Energinet.dk are within the range 380-220kV.
- Latvia. Highest voltage level operated in Latvian TSO is 330kV.

Appendix 2: Comparison of network losses

Losses (€/MWh)	COUNTRY
below 0.7	Bulgaria
	Luxembourg
	Norway
	Belgium
	Netherlands
	Spain
	Portugal
	Italy
	Sweden
	Finland
	Lithuania
above 0.7	Germany
	Croatia
	Hungary
	Latvia
	France
	Austria
	Serbia
	Ireland
	Romania
	Poland
	Bosnia and Herzegovina
	Slovak Rep
	Greece
	Estonia
	Denmark
	Northern Ireland
	Switzerland
	Czech Republic

Remarks:

- The base case is taken (see Methods and hypotheses chosen for ENTSO-E overview on page 5).

Country remarks:

- France: There is no specific allocation of system services or losses cost to any specific tariff, the values here are purely indicative.
- Greece: Transmission losses are paid by those who inject energy in the transmission system (generators and importers), however an estimated cost has been included here for comparison purposes.
- Great Britain: Not available.
- FYROM: Data not available.
- Netherlands: Losses are part of transmission tariff, the value given is only estimation.
- Ireland: Transmission losses are accounted for in the market however an estimated cost has been included here purely for comparison purposes.

Appendix 3: Comparison of system services

System Services (€/MWh)	COUNTRY
below 0.5>	Latvia
	Norway
	Sweden
	Finland
	Slovenia
0,5<---<1	Serbia
	France
1<---<3	Netherlands
	Bosnia and Herzegovina
	Portugal
	Great Britain
	Luxembourg
	Croatia
	Austria
	Belgium
	Hungary
	Poland
	Denmark
	Spain
	Switzerland
	Greece
	Bulgaria
above 3	Lithuania
	Romania
	Germany
	Italy
	Czech Republic
	Ireland
	Northern Ireland
	Slovak Rep

Remarks:

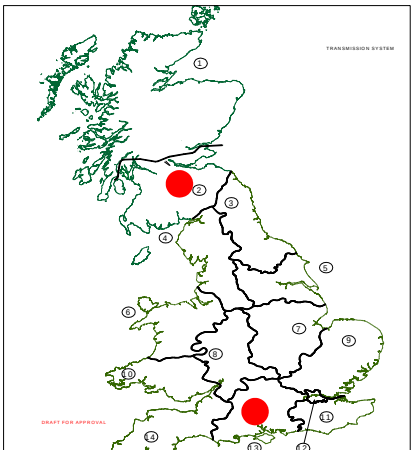
- The base case is taken (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- These figures cover the system services listed on the table Costs included in the comparison of transmission tariffs on page 9.

Country remarks:

- France: There is no specific allocation of system services or losses cost to any specific tariff, the values here are purely indicative.

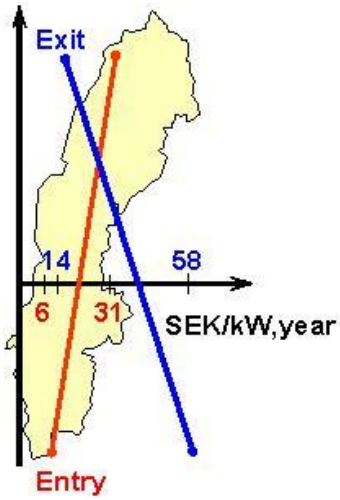
Appendix 4: Definition of the tariff areas in countries with generation/consumption geographic zonal differentiation (i)

England and Wales



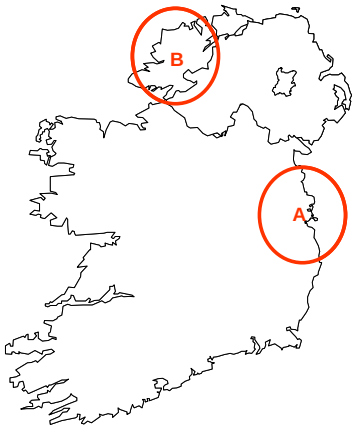
North area: Northern Scotland
South area: South of England

Sweden



The annual entry fees decreases linearly with the latitude to SEK 6/kW in the south. For the exit fees the reversed principle applies

Ireland



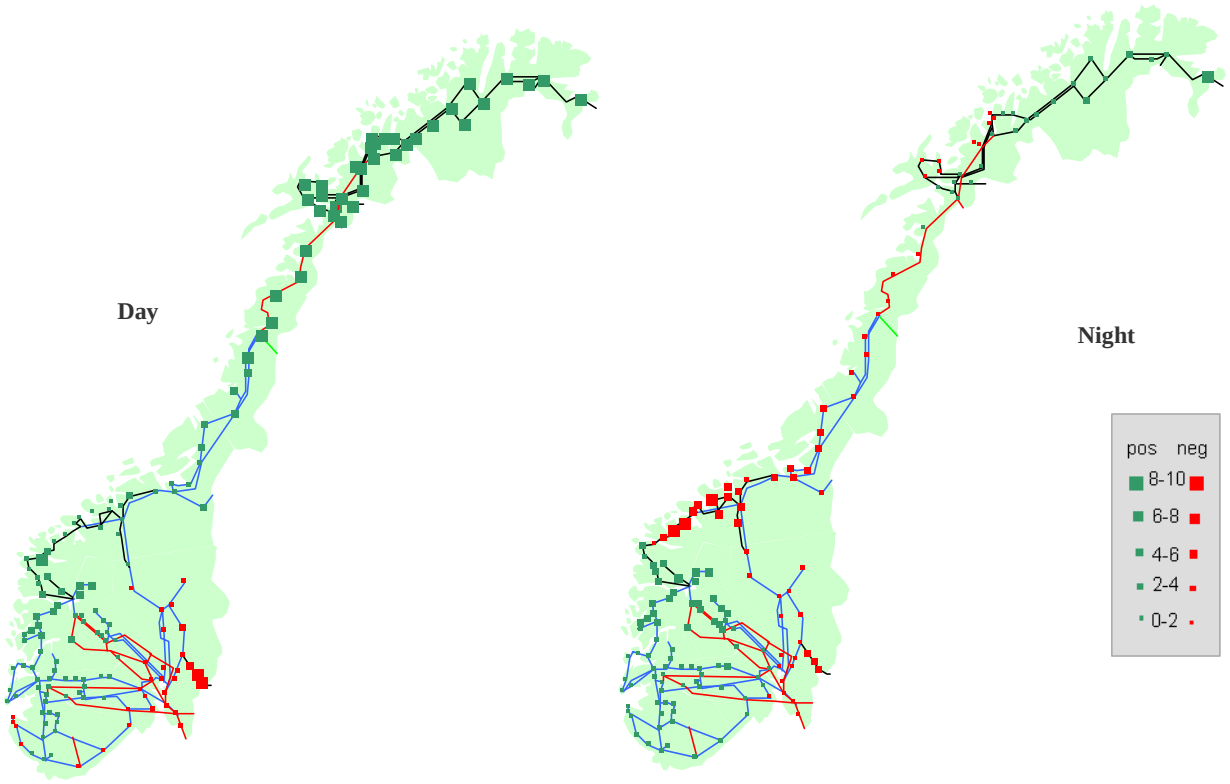
Highest case (A): G located in Dublin (surplus area)
Lowest case (B): G located in Donegal (shortage area)

Norway

(Marginal loss factors (MLF) week 7- 2007)

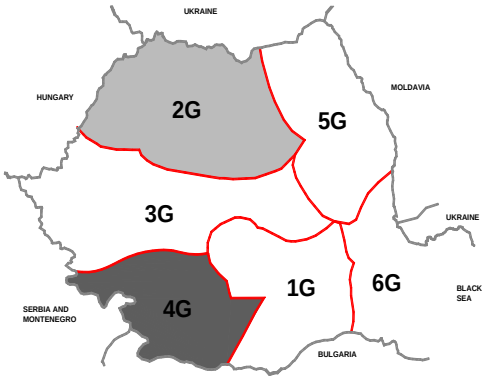
MLFs are symmetrical, i.e. MLF*input* = - MLF*output*

The MLFs below represent MLF*input*

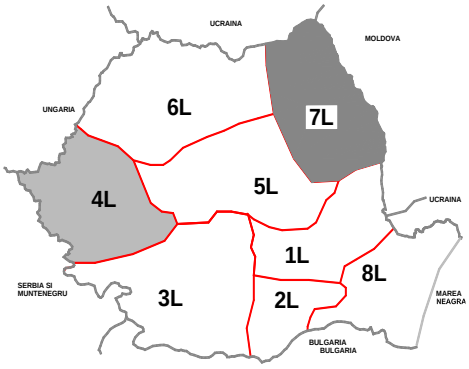


*The energy element (€/MWh) = Marginal loss factors (%) * market price (€)*

Romania



6 Generation zones highlighting the generation surplus area (4G) and generation deficit area (2G)
4G – highest G value
2G – lowest G value



8 Load zones highlighting the load deficit area (4L) and load surplus area (7L)
4L – lowest L value
7L – highest L value

Appendix 5: Other regulatory charges not directly related to TSO activities

Belgium: 2,87 €/MWh related to:

- Levy for federal contribution (as from July 1st 2009),
- Levy for financing connection of offshore windturbine parks
- Levy for financing green certificates

Bosnia and Herzegovina:
Currently ISO (Independent System Operator) and TRANSCO are not responsible for purchase energy of losses, secondary reserves, tertiary reserves... Respective costs are included in the price which consumers pay directly to service providers. For comparability purposes only the costs in this report were presented as "other regulatory charges not directly related to TSO activities.

Bulgaria:
The fee (tariff) for green energy was introduced by the Regulator as from 01.07.2009 at the amount of 1.09 EUR/MWh (0.545 EUR/MWh taking into consideration the whole 2009).
The regulatory periods in Bulgaria are starting as from July each year.

Croatia:
Regulator's activities: 0,0061 EUR/MWh (percentage of revenues of the previous year)

Denmark:
- The PSO (Public Service Obligation) tariff was 13,97 €/MWh on average in 2009 in Denmark:
  - Cost of guarantee of generation reserves required to secure the supply (depreciation) - 10%
  - Direct subsidies to RES - 79%
  - Indirect subsidies to RES - 3%
  - R&D into RES - 5%
  - Different public charges and other expenses - 3%
- Administration costs regarding the PSO are due to Danish legislation allocated to the System tariff (0.20 €/MWh).

- Payment to the Danish Energy Regulatory Authority and to the Danish Energy Agency to cover their administrations costs (0.11 €/MWh)

Finland:

Peak load power fee 0,18 €/MWh. Feed-in tariff for peat 0,04 €/MWh.

France:

For the base case this is 0.17 €/MWh. 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 Additionnelle (Additional 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.

Germany:

The level of this charge here is at least 0.25 Euro /MWh applied to all utilisation times and voltage levels. Extra charge for extra costs according to the German law "Gesetz für die Erhaltung, die Modernisierung und den Ausbau der Kraft-Wärme-Kopplung" (KWKG), Modified Law for Combined Heat and Power Production Promotion.

Greece:

Total average charge is 6,65 €/MWh. It is a sum of Public Service Obligations (6,29 €/MWh) and costs related to the compensation of RES Units and the cost for the coverage of the Use of System

charge for RES units. For the year 2009 the total cost for other burdens was 0.3 €/MWh which includes compensation of RES Units and for the compensation of the cost for the coverage of the Use of System charge for RES units. The cost related to the Regulatory Authority is 0.06 €/MWh.

Poland:

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 transitory charge in the Tariff. The average value for the base case is 3,65 €/MWh.

Portugal: – 3,28 €/MWh resulting from:

- Hydropower station land 0.33 €/MWh
- Surplus costs arisen by renewables and cogenerators -0,55 €/MWh
- Interruptibility 0,97 €/MWh
- Islands' tariff convergence costs 1.19 €/MWh
- Regulator costs 0.11 €/MWh
- Compensation for the early termination of the Power Purchase Agreement 2,94 €/MWh
- Incentives related with consumption efficiency 0.16 €/MWh

Serbia:

Payment for Regulator's activities: 0.0162 EUR/MWh

Slovak Republic:

2.36 €/MWh regarding System Operations cost i.e. social cost of the coal mining, that are covered by generation

Slovenia*:*

2.89 €/MWh regarding*:*

- Power Market Operator's activities (0.13 €/MWh),
- Regulator's activities (0,15 €/MWh)
- Domestic Resources (0,50 €/MWh)
- Renewable energy (2,11 €/MWh)

Spain:

They are included as a percentage of the access tariffs. For the base case it is 0.77 €/MWh. For the year 2009, these % are the following:

- Permanent costs = 14%,
- Diversification and security of supply cost = 5%.

Switzerland:
To cover the costs arising from cost-covering feed-in remuneration (CRF), each year the Swiss Federal Office of Energy (SFOE) defines the surcharge on the transmission costs of the high-voltage grids in advance. The Swiss Federal Office of Energy (SFOE) defined a surcharge of 0.45 Rp./kWh for 2009.

Appendix 6: First connection charges

First connection charges can be:
- Shallow: only for the connection line and other equipments belonging to the connection
- Deep: connection line and other equipments belonging to the connection plus the investment costs in the grid due to the connection that has to be borne by the TSO

First connection charges have an impact on the tariff for use of the system since in case of a "deep" approach the concerned costs in the grid are not to be socialized in the tariff.

Country	First connection charges are "Shallow" or "Deep"?
Austria	**Deep**. Grid user builds own connection line. If grid reinforcements are necessary the user has to pay for this.
Belgium	**Shallow**
Bosnia and Herzegovina	**Shallow**
Bulgaria	**Shallow**
Croatia	**Deep**
Czech Republic	**Shallow.** Customer pays connection lines up to connecting point of TSO. New generation pay a lump sum connection fee of 18.900€/installed MW, New consumption pay a lump sum connection fee of 7.560€/installed MW
Denmark	**Shallow** to partially **Shallow** (in some cases charges are calculated to a fictitious point that can be closer than the physical connection point)
Estonia	**Deep.** All the equipment, belonging to the connection + all reinforcements, needed prior to the connection are included in the connection fee.
Finland	**Shallow** in most cases, but a possibility to **Deep** in exceptional cases.
France	**Shallow**. The first connection is made to the nearest substation where the adapted voltage level is available and where this connection is technically possible.
Germany	**Deep** (customers) **shallow** (power plants)
Great Britain	**Shallow**
Greece	**Shallow**
Hungary	**Partially Deep** Maximum of 70% of investment costs for customers and 100% for generators; or generators build own connection line. If the generator used at least 50 % of renewable energy for its production per year, it pays only 70 % of the investment costs, and if this value is at least 90 %, it pays only 50 % of the investment costs.
Ireland	**Shallow to Partially Deep**. The connection charge is based on the Least Cost Technically Acceptable shallow connection method. However the Least Cost Technically Acceptable shallow connection method depends on the availability of appropriate transmission infrastructure in the area e.g. voltage level etc. Charges can also include station common costs or station extension costs (if higher). Demand customers pay only 50% of the charge, generators 100%.
Italy	**Shallow**. Grid user builds own connection line. Enhancements of the grid are socialized in tariff.
Latvia	**Deep.** Grid users builds own connection line. All connection equipment and reinforcement are included in the connection fee.
Lithuania	**Partially Deep** (until the 1st of September 2009 - 40% of investment costs for customers, from the 1st of September 2009 -20% investment costs for customers and 100% for generators)
Luxembourg	**Shallow** Grid user has to pay for his own connection line and substation. General reinforcements of the grid are socialized in tariff
FYROM	**Shallow** Grid user has to pay for the connection line other equipments belonging to the connection. General reinforcements of the grid are socialized in tariff.
Netherlands	**Shallow**
Northern Ireland	**Shallow**
Norway	**Shallow**
Poland	**Shallow.** The enterprise which is going to be connected finance all the expenditures to

	built the connection site which contains extension or rebuilding costs for the substation (if such necessary). The reinforcement and development of existing network is performed by TSO. Final customers pay 25%, RES 50%, generators and distribution companies 100% of investment expenditures for typical connection.
Portugal	**Shallow**
Romania	**Deep**
Serbia	**Shallow:** Generators and distributors pay for connection lines aimed to meet security criteria (the most frequent case is the building of 'in-out' connection toward an existing line) and for substation. **Deep**: Industrial customers, in addition to payment for connection lines and substations, have to pay connection fee aimed to support further network development. Connection fee is 43 € per approved power in MW. **Note**: Generally, in 110 kV network, grid users keep ownership over 110/x kV substations
Slovak Republic	**Partially Deep**. Distributions companies pay 40% charge, TSO pay 60 % charge. Direct customers connected on the TSO pay 100% charge.
Slovenia	**Deep**
Spain	**Shallow**. The generator builds own connection line. Enhancements of the grid that affect the rest of system are socialized in tariff.
Sweden	**Deep**
Switzerland	The cornerstones for first connection charges for consumers and power plants have to be clarified by the NRA.

Appendix 7: Special tariffs

Special tariffs 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 (eg. any public utilities, army
- etc

Country	Special Tariff Conditions
Austria	Special tariffs for 150-220 kV; special tariffs for hydro pump / storage energy producers
Belgium	Grid users with a local production unit (offtake and injection in the same access point) can introduce a special yearly subscription for maximum 75 MW that gives them 30% reduction on the price. This subscription will only be applied for maximum 1.000 hours a year. For the mobile charges of the railway company, the price for subscribed power is reduced with 7%.
Bosnia and Herzegovina	None
Bulgaria	None
Croatia	None
Czech Republic	Special tariff for system services 2,22€/MWh for the local consumption of producer (installed capacity above 30 kW)
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. 3) A reduced PSO tariff is used for autoproducers for the part of their consumption that they cover by their own production. The reduction corresponds to the costs relating to subsidies for renewable energy and local CHP units. 4) For customers with consumption of more than 100 GWh/year per place of consumption, a reduced PSO tariff is used for the part of their consumption that exceeds 100 GWh/year per place of consumption. The reduction corresponds to the costs relating to subsidies and balancing costs relating to renewable energy.
Estonia	None
Finland	None
France	Specific tariff for a second connection used for emergency situations
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 same applies to energy intensive customers (typically heavy industry customers), if the energy consumption of a customer exceeds 7 500 hours per year and 10 GWh. The individual tariff must not be lower than 20 % of the published regular tariff. The agreement on an individual tariff requires the approval of the regulator. If such an approval has been given in 2008 the fulfilment of the preconditions outlined above does not have to be proven again.
Great Britain	Small Generators' Discount: €0.1002839/kW discount to generation tariff and €0.0126944/kWh discount to energy charge for generators below 100MW in Scotland (based on conversion of £1 : €1.123 at 31/1/2009)
Greece	None
Hungary	None
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	None
Latvia	None
Lithuania	**None**
Luxembourg	Distribution companies don't have the binominal tariff but a tariff respecting their

	simultaneity factor related to the power peak of the grid
FYROM	Only one user pays a special tariff – company of public interest i.e. FYROM Public Railway Company.
Netherlands	A reduced tariff is used for a spare connection with a utilization time of less than 600 hours/year.
Northern Ireland	None
Norway	Interruptible load The special tariff on interruptible load looks like an option two interrupt load that has entered into an agreement. The pay for this load is an option premium that acts like a reduced tariff from 5 % of the regular tariff level to 75 % depending on the kind of agreement. Power intensive industry Load of 15 MW+ and utilization time of 7000+ hours receive a reduced load tariff. The reduction is about 50 % compared to regular load. The special tariff is based on the so called k-factor model described in the Excel sheet. More information on: www.statnett.no/en/.
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 500 GWh, – utilization of the connection power was not less than 50%, – overall costs related to electric energy (purchase and transportation) constitute not less than 20% of the total production costs A final consumer is entitled to pay 27% of the transitory charge (covering stranded costs) if in the preceding year he fulfilled the following technical and economic conditions: - yearly consumption was not less than 500 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.
Portugal	None
Romania	None
Serbia	All network users are charged for active energy, reactive energy and active power except the following special categories of network users: - auxiliary power for power plants are charged only for active energy, - pump plants are charged only for active and reactive energy, - reversible pumped storage power plants are not charged.
Slovak Republic	None
Slovenia	None
Spain	None
Sweden	None
Switzerland	None

Appendix 8: Treatment Final Customers vs Distribution System Operators

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

Country	Different treatment between final customer and distributor	Difference with the total charge applied to the base case (%)
Austria	No	
Belgium	For DSOs: -No subscriptions for the power component, - Formula for annual power. - No complementary power (annual/monthly).	+2% higher charge then for final customers under condition of optimal subscriptions by these customers (in practice: difference is lower)
Bosnia and Herzegovina	No	
Bulgaria	No	
Croatia	TSO charges only transmission fees for eligible customers directly on TSO network. For customers that are not directly connected to TSO network transmission fee is charged by DSO.	
Czech Republic	No	
Denmark	The TSO does not charge the costumer directly. It is the DSO that charge the costumers.	N/A
Estonia	No	
Finland	No	
France	No	
Germany	No	
Great Britain	No	
Greece	Presently HTSO does not charge final customers but distributors and producers. It is the distributor who charges final customers connected to the transmission network. In the case that a final customer will be charged by HTSO, the current legislation doesn't provide for different treatment.	
Hungary	The transmission system operation tariff is regulated by the type of costumers. 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 "price decree" - for the distributors. Thus: Transmission system operation charge for eligible costumer: 3,69 €/MWh Transmission system operation charge for distributor: 7,72 €/MWh Income of the positive difference of Transmission system operation charge for distributors is paid back for the distributors in percentage. [(injection /kWh/ * 402,5 c €) * (n_1+n_2+n_3+… %)],	109,2 %

	where Σ n = 100 % Charge for ancillary services is the same for every company.	
Ireland	Yes, final customers connected to the transmission system and customers connected to the distribution system[1] are treated in a slightly different manner. The Demand Network Capacity Charge (DNCC) charged to transmission connected customers is greater than the DNCC charged to distribution connected customers	The DNCC charged to customers connected to the distribution system is approx 15% less than that charged to final customers connected to the transmission system. The actual difference in a TUoS bill would depend on the magnitude of other elements of the TUoS bill which are determined by energy consumption
Italy	Y*	
Latvia	No	
Lithuania	No	
Luxembourg	Distribution companies have a tariff respecting their simultaneity factor related to the power peak of the grid	
FYROM	No	
Netherlands	The distributor passes on the system services tariff for its final customers to the TSO. The distributor has a higher tariff than final customers connected at HV/EHV, because of a transitional provision.	7%
Northern Ireland	No	
Norway	No	
Poland	There is no differentiation between final consumers and distributors but between kinds of points of delivery (PoD) the users have. There are two different rates for access to the transmission network: one for so called “final” PoDs (to this group belong all PoDs of final consumers and some PoDs of DSOs) and the other so called “network” PoDs which are assigned to DSOs and are “connections” between transmission and meshed distribution network (110 kV).	Total charge (with stranded costs) for users connected in “network PoDs” is 17% higher then for users connected in “final PoDs”.
Portugal	The TSO charges distribution by all the energy delivered and is the distributor who charge customers connected to the transmission network.	
Romania	No	
Serbia	There is no difference in treatment of distributors and final customers. The only difference is in the billing procedure. Eligible customers and distributors are charged directly by TSO, while tariff (captive) customers are charged by distributors as public retail suppliers.	
Slovak Republic	No	
Slovenia	No	
Spain	In Spain the TSO does not charge directly to customer. It is the distributor who charge customers connected to the transmission network.	
Sweden	No	

[1] The Distribution System Operator is not charged TUoS, customers connected to the distribution system are charged TUoS via their supplier

Switzerland	No	

*

In Italy Distributors invoice to the final consumers the Transmission component TRAS that is different according to the voltage level of the grid to take into account losses (see to the following table) and pay back to Terna the TRAS related to the voltage level of the grid higher than 220Kv. This figure in fact is equal to the amount of L of the transmission tariff (0.344 c€/KWh)

Type of clients	TRAS (4) c€/KWh
LV Public Lighting	0,375
LV ther than Public Lighting	0,375
MV Public Lighting	0,356
MV ther than Public Lighting	0,356
HV and VHV under 220kV	0,348
HV and VHV over 220kV	0,344

Appendix 9: Reactive Energy

In some countries, a tariff is applicable on the measured reactive energy (based on MVarh) or a penalty is applicable for the part exceeding predefined conditions (also based on MVarh).
These charges/penalties are not included in the tariff overview of this document.

<table>
<tr><th>Country</th><th>Reactive Tariff (Y/N)</th><th>Penalty (Y/N)</th><th>Quantity/Conditions of application</th></tr>
<tr><td>Austria</td><td>N</td><td>N</td><td></td></tr>
<tr><td>Belgium</td><td>N</td><td>Y</td><td>

Elia System Operator makes quarter-hourly deliveries of reactive power that exceed tgφ=0,329 per off take point. This leads to a term for supplementary deliveries of reactive energy, according to the article 209 §4 and §5 of the Technical Code.

<table>
<tr><th>Voltage level (kV)</th><th>Penalty (€/MVarh)</th></tr>
<tr><td>400- 380</td><td>2,5</td></tr>
<tr><td>220-150</td><td>2,5</td></tr>
<tr><td>132-50</td><td>5</td></tr>
</table>

In the case the offtaken active energy does not exceed, on a quarterly basis, 10% of the valid subscriptions at any given point, the additional delivery of reactive energy will be defined as the excess in respect of 32,9% of the 10% of the valid subscriptions at that point.
In the case in offtake regime, the capacitive reactive power doesn't exceed the following limit values, penalty for supplementary deliveries of reactive energy equals 0€/MVarh.

<table>
<tr><th>Voltage level (kV)</th><th>Limit values capacitive reactive power (MVar)</th></tr>
<tr><td>400- 380</td><td>9</td></tr>
<tr><td>220-150</td><td>9</td></tr>
<tr><td>132-50</td><td>2,5</td></tr>
</table>
</td></tr>
<tr><td>Bosnia and Herzegovina</td><td>Y</td><td>N</td><td>The tariff for excessive take-on of reactive power shall be paid by eligible customers connected to the transmission network. The tariff set on 4,98 EUR/Mvarh.
Excessive take-on of reactive power shall be a positive difference between the measured reactive power and reactive power which corresponds to the power factor cos φ=0, 95 inductivity, i.e. it is the reactive power exceeding 33% of active power which is taken over.</td></tr>
<tr><td>Bulgaria</td><td>N</td><td>Y</td><td>Penalty is imposed to users with connection capacity ≥ 100 kW
The calculation of the quantity of reactive power for which the penalty is imposed is according to formula:
$Erp = Erconsumed - 0.49Eaconsumed$

Where,
Erp – Q-ty of reactive power for which penalty is imposed

$Erconsumed$ - Q-ty of consumed reactive power by the user
0.49 – coefficient, corresponding to cos ϕ = 0,9
$E_{aconsumed}$ - Q-ty of consumed active power by the user</td></tr>
</table>

			The penalty for consumed reactive energy is 10% from the market wholesale price of the active energy The penalty for injected reactive energy is 100% of the market wholesale price of the active energy
Croatia	Y	N	Reactive energy is paid monthly according to metered consumption.
Czech Republic	No for EHV	No for EHV	There is penalty charged to customers connected to DSO. Penalty is charged by DSO.
Denmark	N	N	
Estonia	Y	N	1,1 EUR/MVArh for each MVArh at 110 kV only
Finland	N	Y	Agreed limits on use of reactive energy for each group of connection points. If the limits are exceeded, the penalties are used • 3000 €/Mvar for excess reactive power (monthly maximum) 10 €/Mvarh for excess reactive energy •
France	N	Y	If reactive energy/active energy >0.4 for each connection point from 01/11 to 31/03 (on working days and 6h-22h): *1.3 c€/kvarh is invoiced for 400-380 kV customers *1.39 c€/kvarh is invoiced for 220-150 kV customers * 1.55 c€/kvarh is invoiced for 132-50 kV customers
Germany	Y, partly	Y, partly	In particular circumstances customers are charged for reactive power usage. Power Plants are reimbursed for the provision of reactive power.
Great Britain	N	N	
Greece	N	N	
Hungary	N	N	
Ireland	N	N	While not relevant to transmission, the Distribution System Operator does charge non-domestic customers a low power factor surcharge
Italy	N	Y	A charge in c€/Kvarh is applied to the distributors/Terna for reactive energy withdrawn from the transmission grid/distribution grid exceeding a certain threshold of active energy. The charge for reactive energy between 50% and 75% of active energy is 0,86 c€/Kvarh. The charge for reactive energy over 75% of active energy is 1,1 c€/Kvarh. The difference paid/received by Terna increase/decrease the amount of the ancillary services. There is also a charge issued by the distributors and paid by the final consumer for reactive energy withdrawn from the distribution grid exceeding a certain threshold of active energy.
Latvia	Y	N	Reactive power tariffication between TSO and DSO not applied in Latvia. Reactive power tariff exist only for consumers, in cases where phase factor tgφ is above 0,4: reactive power tariff for consuming is 4,27€/MVAr (if tgφ≥0,4). Reactive power generating to the transmission network not allowed.
Lithuania	Y	N	Tariff is paid by consumers above ≥30kV except households. Tariff is 5.79 €/MVarh for consumed 1 MVarh and 11.58 €/MVarh for generated 1 MVarh.
Luxembourg	N	Y	A penalty of 11.16€/MVarh is applied in case the average cos φ per ¼ hour is below 0.9
FYROM	N	Y	Reactive energy penalties are applied for

			every excessive consumption of reactive energy when it exceeded 33% of the active power. Penalties are not paid when the value of reactive power doesn't exceed 33% of Active power.
Netherlands	N	N	Cos φ has to be between 0.8 and 1.0. Regulation doesn't apply to agreements between the TSO and customers/DSO about reactive energy. This subject is included in the connection contract.
Northern Ireland	N	N	Currently no direct charge for reactive energy
Norway	Y	N	Areas where reactive load really is a problem for the grid are defined. In these areas the reactive load is metered during 5 control hours (the same hours country wide), 3 of these hours are peak load and the last 2 is chosen randomly. The basis for the tariff is the highest of these 5 hours. The metered level is rounded off to the nearest 5 MVar, and the tariff applied is 25 000 NOK/MVar (3076 Euro/MVar) a year.
Poland	N	N	There are not any rates nor penalty fees for reactive energy in TSO's transmission tariff in Poland. DSOs in their tariffs apply additional fees (penalties) for energy taken off from medium and high voltage network, in cases where phase factor tgφ is above 0,4.
Portugal	N	Y	The reactive energy consumed outside the off-peak hours, which exceeds 40% of the active energy consumed in the same period, must be invoiced, which price is 0.0161€/kvarh.
Romania	Y	N	The difference of the quantity between cosφ=0.92 and cosφ=0.65 An average tariff for the reactive energy is 0.0122 euro/kVArh. There are zonal differentation of tariffs.
Serbia	Y	Y	Base tariff for reactive energy is 1.17 €/MVarh and it is paid according to the monthly metered consumption of reactive energy per site. Reactive energy penalties (equal to the double base tariff) are applied for every excessive consumption of reactive energy which corresponds to power factor below cosφ=0.95.
Slovak Republic	N	N	
Slovenia	N	Y	For cos φ< 0,95
Spain	N	Y	A charge in €/MVArh is applied to the reactive energy consumption exceeding the 33% of active energy consumption. The charges are the following 1-1-09 to 30-06-2009: 0,01 €/MVArh, if 0,90 < cosΦ < 0,95 13,091 €/MVArh, if 0,85<cosΦ<0,90 26,182 €/MVArh, if 0,80<cosΦ<0,85 39,274 €/MVArh if cosΦ<0,80 From 1st July to 31 December 2009: 0.01€/MVArh 0.90 < cosφ<0,95 17, 018 €/MVArh 0.85 < cosφ<0,90 34, 037 €/MVArh 0.80 < cosφ<0,85 51.056 €/MVArh cosφ<0,80
Sweden	N	N	Limits set per point of connection
Switzerland	N	N	

Glossary of terms

Black-Start

The ability of a generating unit to go from a shutdown condition to an operating condition and start delivering power without assistance from the electric system.

CAPEX

Capital cost.

Cross-border congestion

Congestion produced in transmission network between countries or TSO control areas.

Energy-related components

Components of charges that are allocated according to the energy consumed, offtaken or injected (consumption and offtaken energy can be different in case that generation is connected to the same transmission access point).

First Connection charges

Charge for the party (producer or consumer) that wants to be connected to the transmission network.

G component

Transmission tariff component applied to generation (producers).

Internal congestion

Congestion produced in transmission network within a country or TSO control area.

ITC

Inter TSO Compensation, costs or revenues for Transmission System Operators (TSOs) as a result of hosting or inducing cross-border flows of electricity.

L component

Transmission tariff component applied to load (consumers).

Locational signals

Economic signals for efficient location of generation and consumption.

Losses

In this document the term losses refers to transmission losses which are 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…). Measured losses can be different, higher or lower than the real losses due to measurement errors and even accounting mistakes.

OPEX

Operational costs.

Power-related components

Components of charges that are allocated according to contracted power and/or peak power which is consumed, offtaken or injected.

Primary Reserve

Power available in the generators which is reserved to respond to frequency changes and which have a very fast response time. Keeping these reserves creates costs that are charged to the users one way or another.

Public Service Obligation

Public Service Obligations (PSOs) are compulsory services the Regulators apply to companies designed to satisfy public interests.

The transmission system operator and grid owners are subject to a number of PSOs. Examples include:

- supply security
- payment of subsidies for environmentally-friendly electricity
- along with research and development of environmentally-friendly production technology

Stranded costs

Stranded costs have to do with the transition from a regulated to a more competitive market.

Seasonal/Time-of-day differentiation

Tariff rates differentiation related to season of year or time-of-day or type of day (working day/holiday).

Secondary reserve

Power available in the generators which is reserved to respond to frequency changes and which have a higher time of response than primary reserves. Keeping these reserves creates costs that are charged to the users one way or another.

System balancing

This system service which consists in activating the secondary and tertiary reserves, is used for correcting in real time energy deviations from the values specified in contractual schedules of market participants.

System Services or Ancillary Services

Interconnected Operations Services identified as necessary to effect a transfer of electricity between purchasing and selling entities and which a provider of transmission services must include in an open access transmission tariff.

Tertiary reserve

Power available in the generators which is reserved to respond to frequency changes and which are manually activated. Keeping these reserves creates costs that are charged to the users one way or another.

Voltage Control and Reactive Power

The purpose of this system service is to maintain voltage in the power system within the allowed limits and to control flows of reactive power in the network. Voltage and reactive power control is carried out by producing reactive energy in power plants, by using compensation devices and by changing transformer transmission ratios.

Voltage levels

Voltage levels of the transmission networks vary across the Member States, in particular the lowest voltage level which is classified as transmission network varies largely. However, in all Member States the voltage levels of 220 kV and above are included as transmission network.