ENTSO-E Overview of transmission tariffs in Europe: Synthesis 2011

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Background

- Transmission tariffs are one of the key elements of the International Electricity Market. There is no single “right solution” for recovering costs. Different methods will have to 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 a comparative overview of 2011 transmission tariffs for 32 European countries in order to understand the components of the transmission tariffs and other regulatory charges recovered or invoiced by TSOs, but not directly related to TSOs’ activities.
- In order to be comparable, as far as possible, the tariffs taken into account 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 supply 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 the ENTSO-E overview does not take into account the differences between countries in areas such as quality of service, main technical characteristics and environment of the networks are concerned (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 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 been 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	3%	97%	-	-	Yes	Yes
Estonia	0%	100%	x	-	Yes	Yes
Finland	10%	90%	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	Tariff for ancillary services
Ireland	20%	80%	-	Generation only	No, recovered in the energy market	Yes
Italy	0%	100%	-	-	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%	xxxxxxx	-	No	Tariff for ancillary services
Norway	24%	76%	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	23.12% use of system	76.88% 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	27%	73%	-	Location	Yes	Yes
Switzerland	0%	100%	-	-	By a separate tariff for losses	By separate tariffs for ancillary services

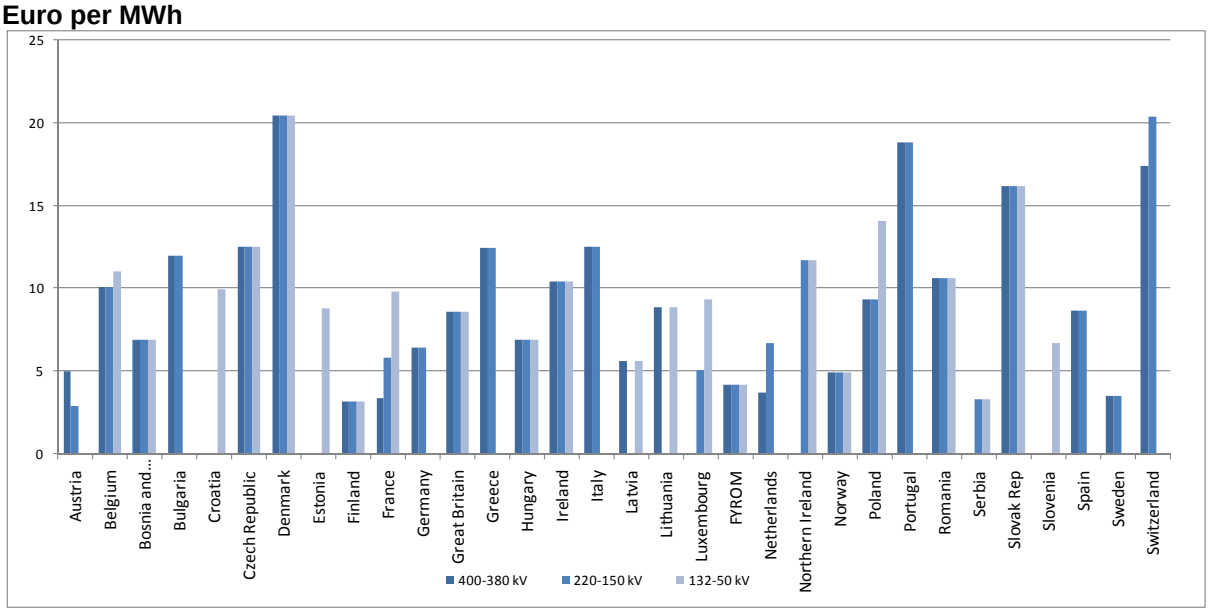
Remarks:

(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" (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 page 9.
- Other regulatory charges are included.

Country remarks:

- Austria: L includes the usage of the grid. G however includes 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: In Bosnia and Herzegovina there are two separate companies: NOS BiH (responsible for the system operation - ISO) and Elektroprenos BiH (owner of transmission grid - Transco). In this report synthetic tariff of TSO (just for comparison purpose) are sum of ISO and Transco tariff. System services and losses not purchased by the ISO and it is not included in synthetic TSO tariff. Costs for those services are part of end user price and suppliers pays it directly to the providers of ancillary services.
- 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.
- Germany: weighted average of the TSOs operating in Germany, KWK-G surcharge (combined cycle co-generation) not 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. The purchasers pay just the adjustment for losses.

- Ireland: transmission losses are accounted for in the market however purely for comparison purposes an estimated charge has been included in these figures.
- Italy: This figure includes the pass through components (some of which are calculate ex post and other ones calculated ex ante) of system services charge and the component to remunerate Terna for dispatching activities (DIS) as detailed in the graph “Components of transmission tariffs” in the following pages.
- Latvia: for 330kV transmission network (Latvia does not have 400kV networks).
- Northern Ireland: transmission losses are accounted for in the market however purely for comparison purposes an estimate is included
- Luxembourg: charge corresponding to consumers other then users that use electricity for the chemical reduction and the electrolysis as well as in the metallurgical procedures.
- 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:
    - 400-380 kV: Example of an end user with a flat power demand of 40 MW and one connection point; reactive energy within the tolerance range; including cost-covering feed-in remuneration fee
    - 220 -150 kV Example of an end user with a flat power demand of 10 MW and one connection point; reactive energy within the tolerance range; including cost-covering feed-in remuneration fee
    - The applied exchange rate is 1.2304 CHF/EUR (31.12.2011)

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	CAPEX	C	N
Bulgaria	C	C	C	(capacit	C (capacity)	(capacity	N	C	C	C	N	C	C	N
Croatia	C	C	N	C	C	C	C	C	C	C	C/B	C	C	C
Czech Rep.	C	C	C/B	C	C	C	C	C	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	C	C	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	N	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/B	C	C/B	N	C	C	N	N	C	C/B	N	C	C	N
Luxembourg	C	C	C/B	C	C	C	C	C	C	C	C	C	C	C
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	N	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	N	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	N
Slovenia	C/B	C/B	C/B	N	C	C	C	C/B	C	C	N	C/B	C/B	C
Spain	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sweden	C	C	C/B	C(2/5)	N	N	C	N	C	C	N	C	C	N
Switzerland	C	C/B	C	C/B	C/B	C/B	C/B	C/B	C/B	C/B	N	C	C	C

- Where:
  - o C if costs are covered by the transmission invoice
  - o 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)
  - o N if the costs are not included in the transmission invoice

Remarks:

- This table contains an 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.

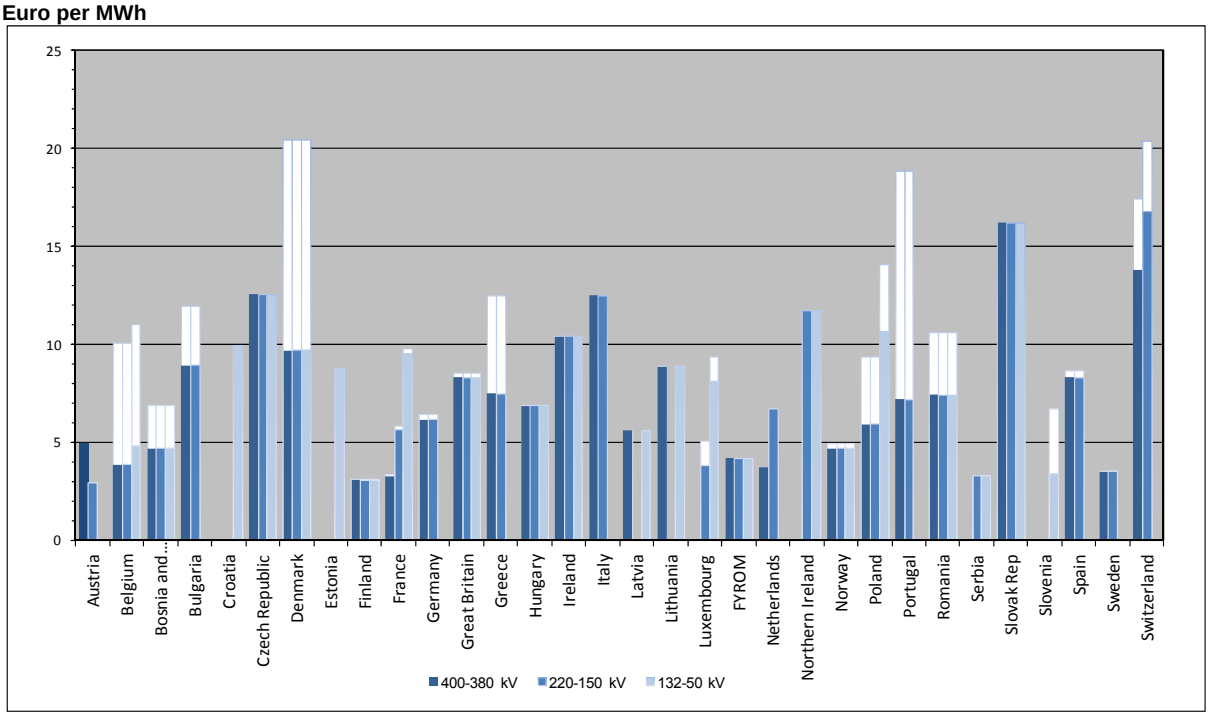
Country remarks:

- Austria:
  - o Primary Reserve: According to the Austrian legal framework every generator with a max. capacity > 5 MW has to provide primary reserve.
  - o System Balancing and Tertiary Reserve: The difference between the two expressions "tertiary reserve" and "balancing energy" is specific to the Austrian system. The TSO has nothing to do with the settlement of the system balancing.
- Bosnia and Herzegovina: The synthetic price for transmission system operation includes: Transco tariff (cost related to the maintenance of transmission grid), ISO tariff (cost related to the ISO operation), system service cost (the end users pay directly to the providers of ancillary services), cover of energy of losses (the end users pay directly to the providers of ancillary services
- Bulgaria: Primary, Secondary and Tertiary reserves only include cost for capacity.
- Germany: Secondary reserve and Tertiary reserve cover costs for capacity only.

- Hungary:
    - Total congestion rents on inter-connections are taken into account by regulatory authorities when approving the methodology for calculating network tariffs for the OPEX of system operation - not system-services - similar to ITC. This revenue always reduces the next year's tariff.
    - The difference between the realized and planned (at the tariff determination) profit of the system balancing reduces/increases the next second year's tariff for ancillary services.
- Nordic countries: "Secondary reserve" does not exist in the Nordic countries, with the exception of Denmark West, which is connected to the continental system
- 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: Other costs are costs covering feed-in remuneration fee for renewable energy and water.

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

Euro per MWh



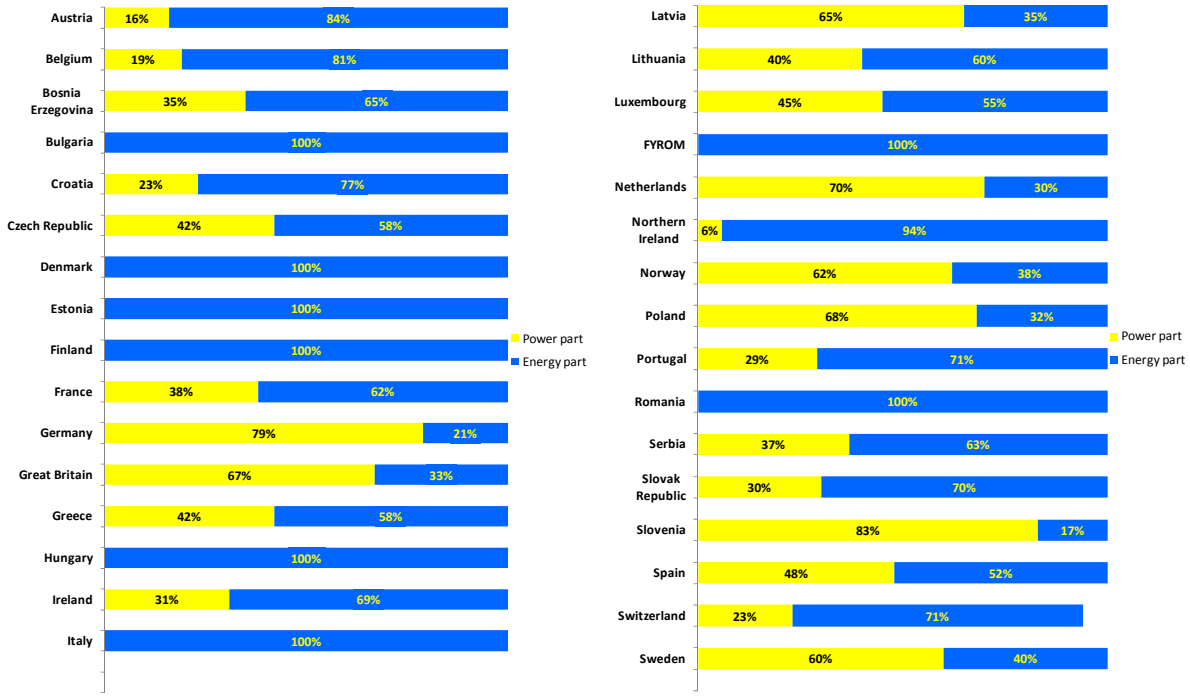
Costs related to TSO activities: infrastructure (capital and all operation charges), losses, system services, congestion.

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 in 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:

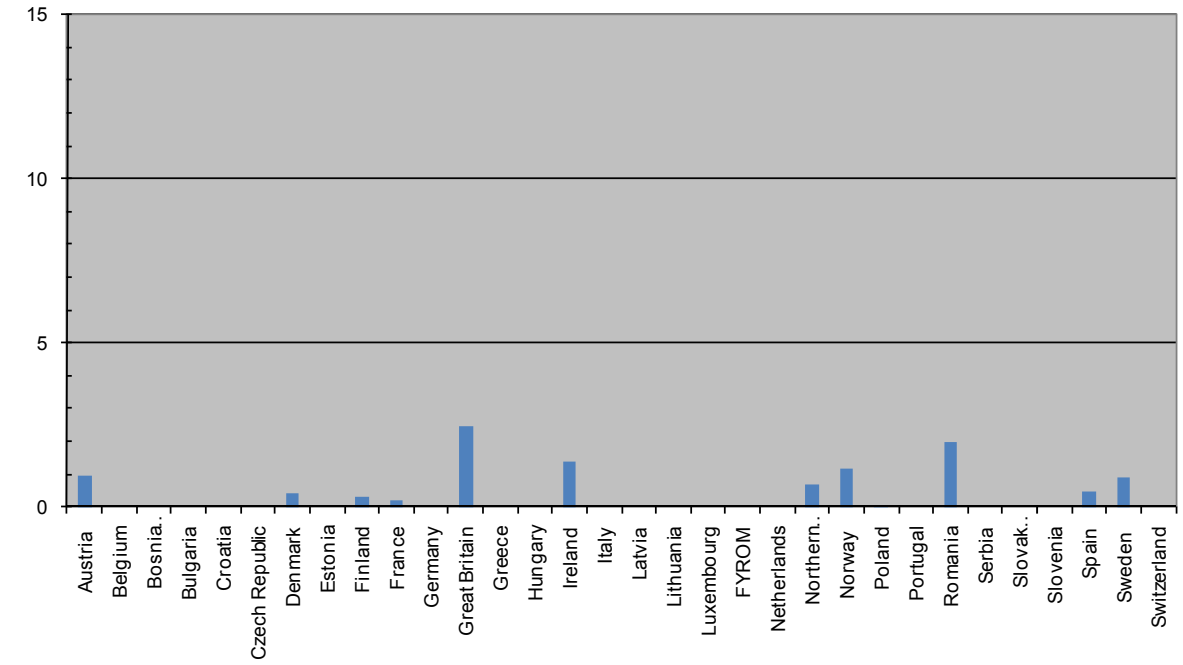
- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- For any transmission system user connected to the highest voltage level in each country.
- The values have been rounded.

Country remarks:

- Bosnia and Herzegovina: The above ratio apply only for Transco tariff (cost related to the maintenance of transmission grid)
- Belgium: the cost of losses has been added, but is not included in the TSO-tariffs for users connected at EHV.
- Germany: weighted average, KWK-G 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 50,5 % (power) and 49.5% (energy).
- Spain: percentages corresponding only to access tariffs without losses and system services.
- Switzerland: The fix part of the tariff for this example with one connection point represents 6%.

Range of G components paid in 2011 by producers across Europe

Euro per MWh



Remarks:

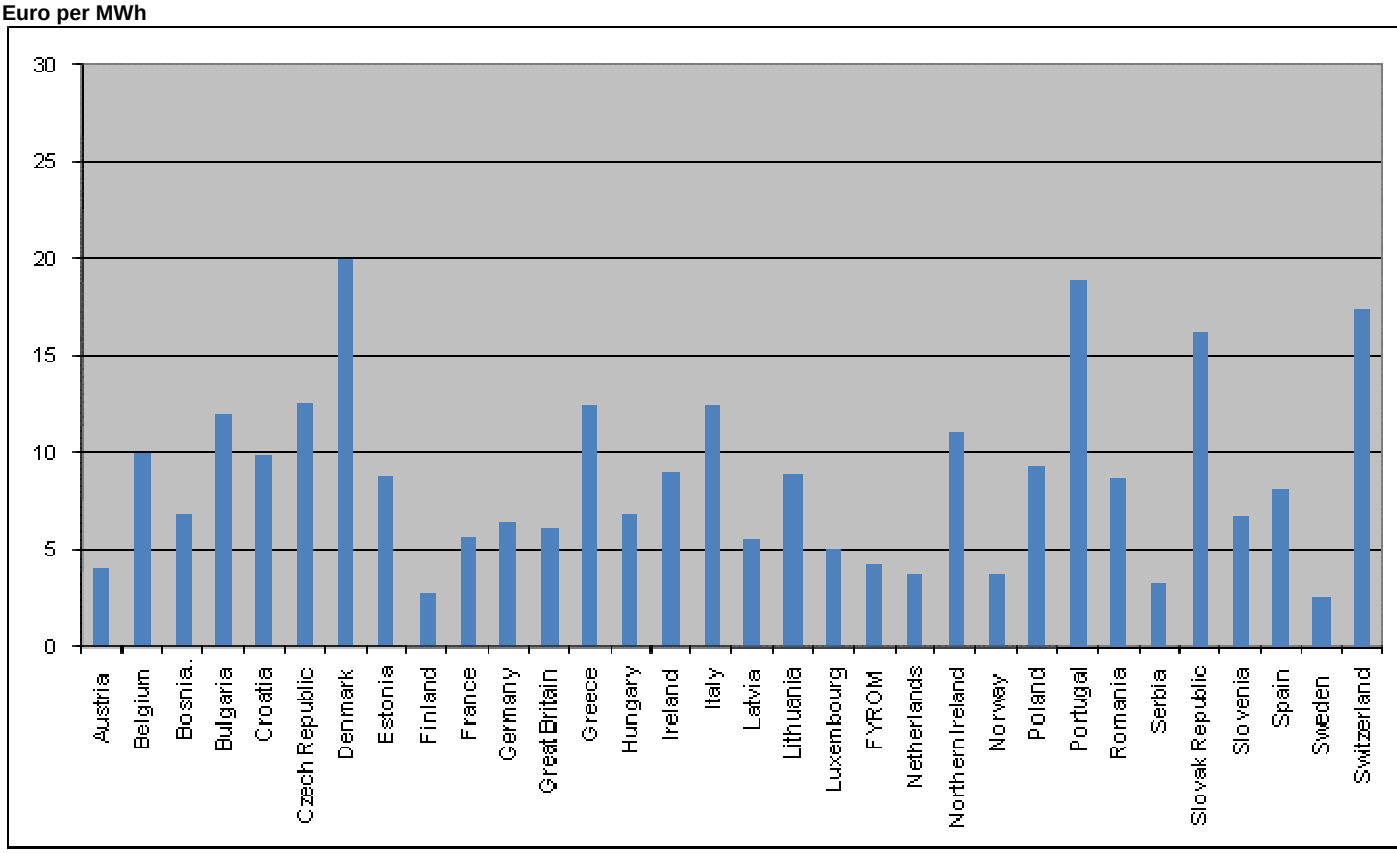
- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- For any transmission system user connected to the highest voltage level in each country.

Country remarks:

- Great Britain: Generation tariffs range from 25.59 €/kW in West Scotland to -7.20 €/kW in Central London. The average weighted TNUoS generation tariff is around 4.56 €/kW. The contribution from BSUoS charges has not been included.
- Spain: a new G charge of 0,5 €/MWh has been established by the Regulator since 1st of January 2011.

Range of L components paid in 2011 by load across Europe

Euro per MWh



Remarks:

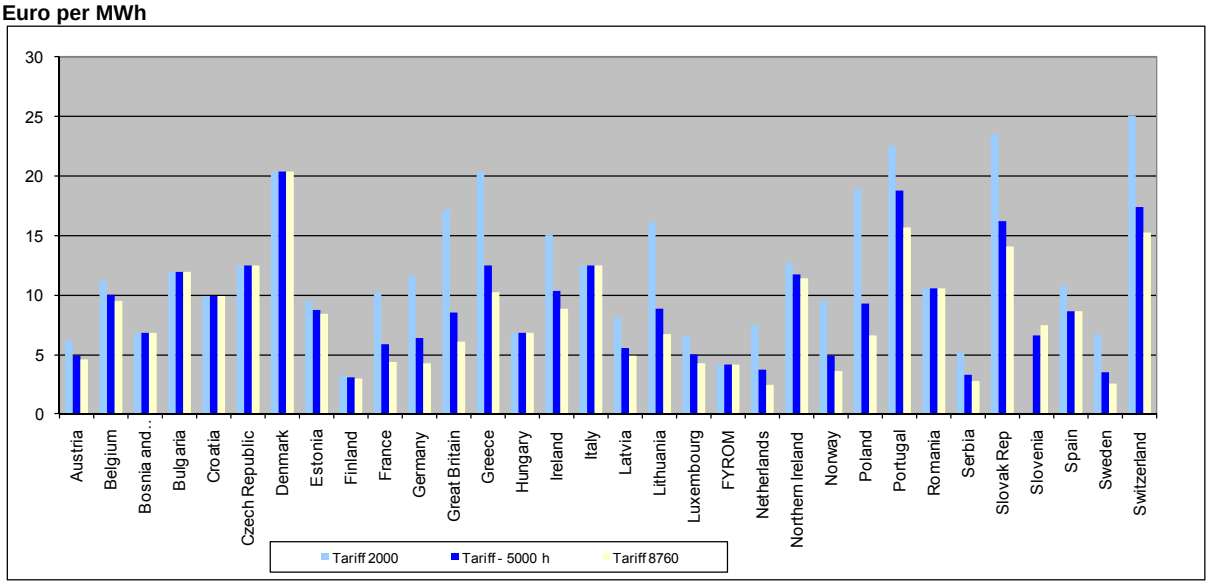
- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- For any transmission system user connected to the highest voltage level in each country.
- Other regulatory charges are included

Country remarks:

- Great Britain: Demand tariffs range from 6.59 €/kW in the North Scotland to 30.05 €/kW in the Central London zone. The weighted average TNUoS demand tariff is around 23.50 €/kW. The contribution from BSUoS charges has not been included.
- France: Charges corresponding to the "220-150" voltage level (highest voltage level with statistically representative data).
- 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.
- Italy: This figure includes the pass through components (some of which are calculate ex post and other ones calculated ex ante) of system services charge and the component to remunerate Terna for dispatching activities (DIS) as detailed in the graph “Components of transmission tariffs” in the following pages.
- 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.

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

Euro per MWh



Remarks:

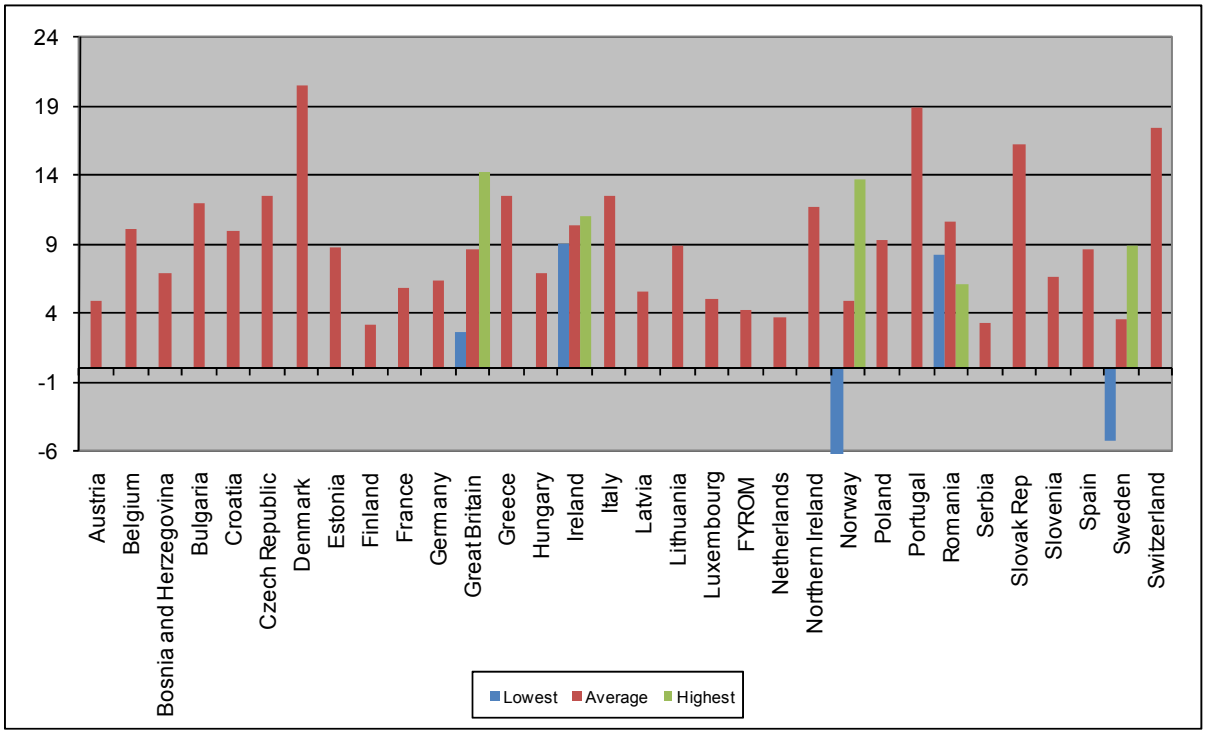
- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5) but taking into account the effect of the utilization time.
- For any transmission system user connected to the highest voltage level in each country.
- Other regulatory charges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

Country Remarks:

- Estonia: Seasonal tariff only for 110 kV
- **France**: Charges corresponding to the "220-150" voltage level (highest voltage level with statistically representative data).
- Italy: This figure includes the pass through components (some of which are calculate ex post and other ones calculated ex ante) of system services charge and the component to remunerate Terna for dispatching activities (DIS) as detailed in the graph “Components of transmission tariffs” in the following pages..
- 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

Comparison of transmission tariffs G+ L: impact of location

Euro per MWh



Remarks:

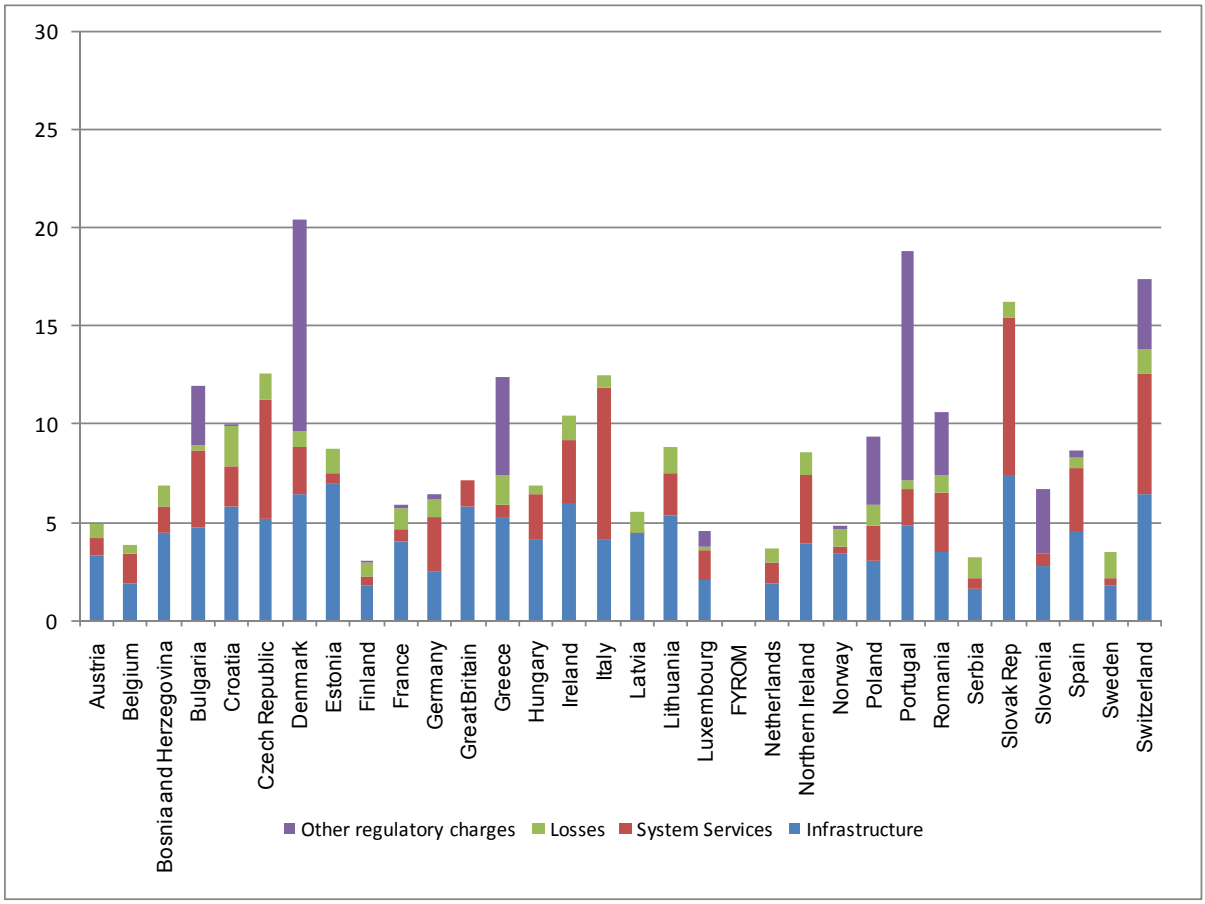
- The example taken for this comparison is the base case (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- For any transmission system user connected to the highest voltage level in each country.
- Other regulatory charges are included
- See also Appendix 4. Definition of the tariff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

Country Remarks:

- **France**: Charges corresponding to the "220-150" voltage level (highest voltage level with statistically representative data).
- Italy: This figure includes the pass through components (some of which are calculate ex post and other ones calculated ex ante) of system services charge and the component to remunerate Terna for dispatching activities (DIS) as detailed in the graph “Components of transmission tariffs” in the following pages.

Components of transmission tariffs

Euro per MWh



Remarks:

- The figures in the chart are estimates 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 system balancing where it applies.
- For any transmission system user connected to the highest voltage level in each country.

Country remarks:

- Bosnia and Herzegovina: Infrastructure cost (Transco tariff), System services (ISO tariff and cost of system services), Losses (cost of losses)
- 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)
- **France**: 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.
- 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.
- Hungary: Losses are part of transmission system operation tariff. It is set in the justified cost of losses by the Regulator in the yearly tariff.
- Netherlands: the cost of losses is part of the transmission tariff so the value of the chart is only estimation.

- Ireland: transmission losses are accounted for in the market however an estimated cost has been included here purely for comparison purposes.
- Italy:
    A. “System Services” includes the following items that are pass-through components.
    - UPLIFT: charge for provision of dispatching service.
    - UESS: charge paid to must run Production Units
    - INT: charge paid to final clients which provide service of load interruption
    - CD: charge paid to Production Units for availability of production power.

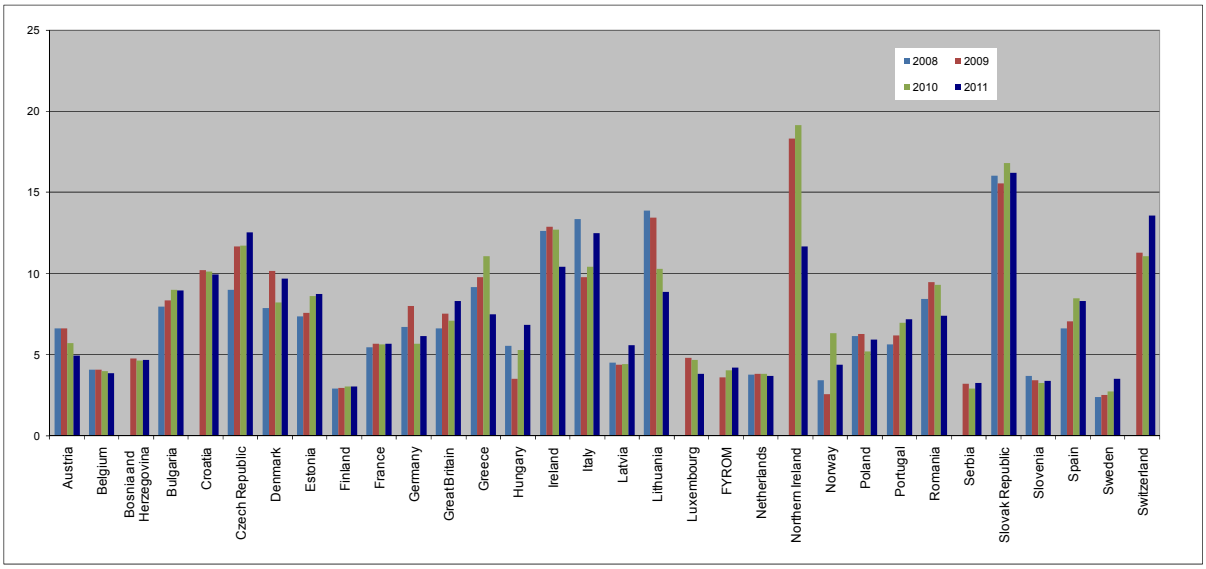
    Whereas
    - DIS is the component to remunerate Terna for dispatching activities equal to 0,308 €/MWh.

    B. Cost of losses for the year 2011 is the average electricity price of the year 2011
- FYROM: the splitting of the total invoice is 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.
- Slovenia: losses included in the transmission fee, no splitting available
- Switzerland:
    - o System services: cover general ancillary services and part(without loss compensation) of individual ancillary services
    - o Other costs: Cost-covering feed-in remuneration fee

Transmission tariffs evolution only TSO costs

Constant Euros of 2011

Euro per MWh



Remarks:

- The base case is taken (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- Prices updated to € 2011 (31st December).
- CPI used for each country is the published in Eurostat.
- For countries not in the Euro zone the exchange rate to € in December 31st 2011 is used.
- For any transmission system user connected to the highest voltage level in each country.

Country remarks:

- Denmark:
  - Danish transmission tariffs are based on estimated (budget) costs and revenues.
  - As Energinet.dk's economy is based on a break.even priciple, under- or overabsorption due to differences between estimated costs and realized costs in earlier years, are to be calculated into the tariffs. In 2010 an overabsorption of 0,9 £/MWh was calculated into tariffs. In 2011 an overabsorption of 1,2 €/MWh is calculated into tariffs.
  - Congestion Rents and auction revenues are estimated 0,5 €/MWh higher than in 2010.
  - Losses are estimated 0,3 €/MWh higher.
- **France**: Charges corresponding to the "220-150" voltage level (highest voltage level with statistically representative data).

- Greece: The decrease of costs related to TSO activities is due to the removal of the Cost Recovery component as this cost mainly stems from the Market design rather than system services.

- Hungary: The cause of changes in the tariff: the amount of items which reduces the transmission and system operation tariff are lower especially the Net Revenues from congestion management (CM) revenues on interconnections; unit price of reserved capacity increased and Regulator approved it in the yearly tariff; losses expenditures are approved by a predefined formula in the yearly tariff.

- Italy: increase of the pass through components included in the system services charge
- Latvia: Change regulatory period
- Slovenia: reduction in the capacity charge.

- Spain: Increase due to new G-charge of 0.5 €/MWh since 1st January 2011. 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..

- Sweden: High increase here. The increases from 2010 to 2011 are 19 % for power charge and 9 % for energy charge. An important factor is the rather extreme appreciation of the Swedish crown (SEK) compared to the Euro (€). Difference from 2009-12-31 to 2010-12-31 for 1 € = 10,35 SEK to 9,00 SEK.

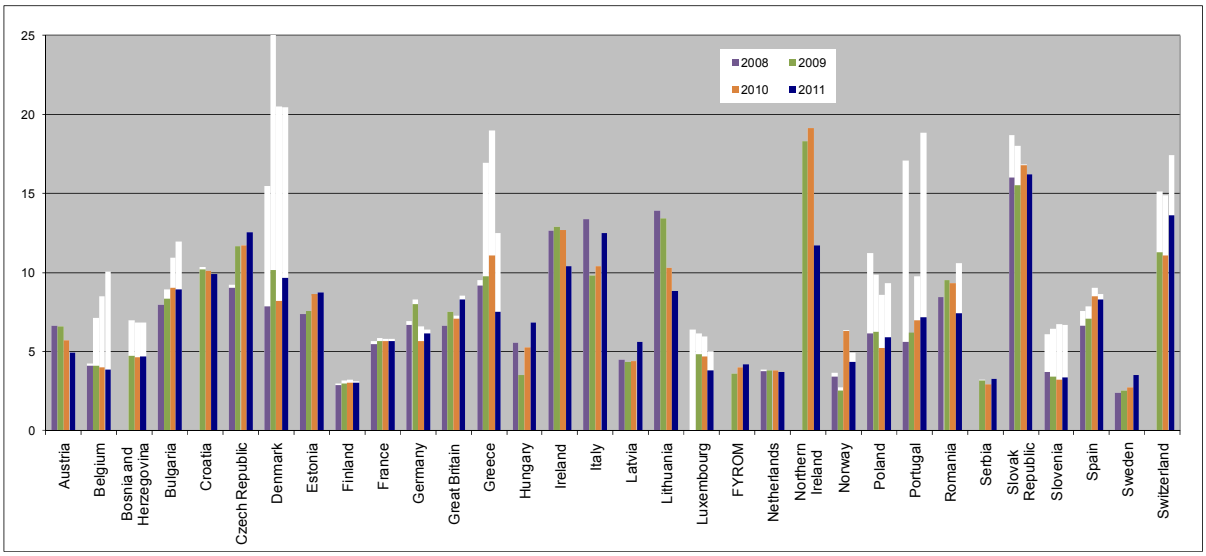
- Switzerland:

    1. Following a ruling by the Swiss Federal Administrative Court (BVGer) the Swiss regulator ElCom almost doubled the general ancillary services tariff for grid operators and end consumers connected to the transmission system.

    2. The exchange rate of the Swiss Franc to the Euro increased by almost 20% (31.12.2010 compared to 31.12.2009).

Transmission tariffs evolution including non TSO costs

Constant Euros of 2011



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 € 2011 (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 2011 is used.
- For any transmission system user connected to the highest voltage level in each country.

Country remarks:

- Portugal: The increase of other burdens not directly related to TSO activities are due to capacity payments to generators (a new item), and to the amount of the energy deviation. The energy deviation increase was due to the surplus costs of cogenerators (cost of the cogenerators above market prices) and to the reduction of the deviation of market prices from previous years.
- **France**: Charges corresponding to the "220-150" voltage level (highest voltage level with statistically representative data).
- Greece: The decrease of costs not directly related to TSO activities is due to a lower tariff for public services and a lower tariff for costs related to the compensation of RES Units.
- Romania: The major increase for the L tariff was due to the application of Directive 2004/8/EC on the promotion of cogeneration based on useful heat demand in the internal market beginning with 1st of April 2011, and have been introduced a contribution for high efficiency cogeneration of 18, 5 euro/MWh for 3 quarters.

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)	15%	47%	38%
Bosnia and Herzegovina	15%	26%	59%
Bulgaria (NEK)	16%	18%	65%
Croatia	17%	17%	66%
Czech Republic (CEPS)	68%	31%	1%
Denmark (Energinet.dk)	24%	48%	27%
Estonia (Elering)	30%	4%	67%
Finland (Fingrid)	30%	18%	52%
France (RTE)	20%	26%	53%
Germany	58%	42%	0%
Great Britain (NGT)	52%	27%	21%
Greece (HTSO)	28%	72%	0%
Hungary (Mavir)	58% (+ 6% - 750 kV)	31%	5%
Ireland (EirGrid)	7%	30%	63%
Italy (Terna)	19%	81%	0%
Latvia Augstsprieguma Tikls)	24%		76%
Lithuania (Lietuvos E.)	25%	0%	75%
Luxembourg	0%	100%	0%
FYROM	27%	6%	67%
Netherlands (TenneT)	32%	68%	0%
Northern Ireland (SONI)	0%	39%	61%
Norway (Statnett)	74%	0%	26%
Poland (PSE Operator)	39% (+1% 750 kV)	59%	1%
Portugal (REN)	25%	75%	0%
Romania (Transelectrica)	27%	73%	0%
Serbia (EMS)	17%	21%	62%
Slovak Republic (SEPS)	66%	33%	2%
Slovenia (Eles)	20%	13%	67%
Spain (REE)	52%	48%	0%
Sweden (Svenska K.)	69%	26%	5%
Switzerland	27%	73%	0%

These percentages are the ratio between the kilometers of circuits for each class of voltage level and the total kilometers of circuits operated by each TSO

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.
- Sweden: the figure of the last column corresponds to HVDC not at 132-50 kV.

Appendix 2: Comparison of network losses

Losses (€/MWh)	COUNTRY
below 0.7	Austria
	Belgium
	Bulgaria
	Great Britain
	Hungary
	Italy
	Luxembourg
	Netherlands
	Portugal
	Spain
0.7<…<1	Denmark
	Finland
	Germany
	Norway
	Romania
	Slovak Rep
above 1	Bosnia and Herzegovina
	Croatia
	Czech Republic
	Estonia
	France
	Greece
	Ireland
	Latvia
	Lithuania
	Northern Ireland
	Poland
	Serbia
	Slovenia
	Sweden
	Switzerland

Remarks:

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

Country remarks:

- Bosnia and Herzegovina: End users (through Balance responsible parties) pay to the providers of ancillary services energy for cover of network losses.
- France: there is no specific allocation of system services nor losses costs 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.
- Netherlands: Losses are part of transmission tariff; the value given is only estimation.
- Norway: not available.
- 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	Finland
	Latvia
	Norway
	Sweden
0,5<---<1	Austria
	France
	Greece
	Serbia
	Slovenia
1<---<3	Belgium
	Bosnia and Herzegovina
	Croatia
	Denmark
	Germany
	Great Britain
	Hungary
	Lithuania
	Luxembourg
	Netherlands
	Poland
	Portugal
above 3	Bulgaria
	Czech Republic
	Ireland
	Italy
	Northern Ireland
	Romania
	Slovak Rep
	Spain
	Switzerland

Remarks:

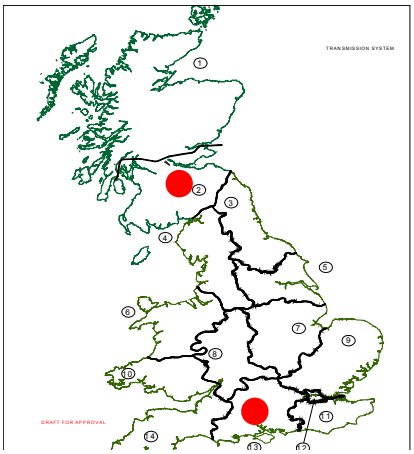
- The base case is taken (see Methods and hypotheses chosen for ENTSO-E overview on page 5).
- These figures cover the system services listed on the table Costs included in the comparison of transmission tariffs on page 9.

Country remarks:

- Bosnia and Herzegovina: End users pay system services directly to the provider of ancillary services. System balancing are not included in the system services.
- France: there is no specific allocation of system services or losses cost to any specific tariff, the values here are purely indicative.

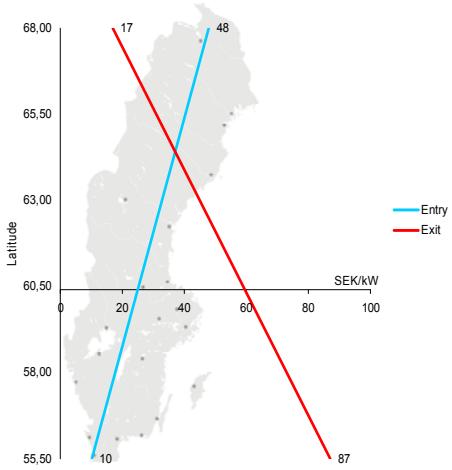
Appendix 4: Definition of the tariff areas in countries with generation/consumption geographic zonal differentiation (i)

England and Wales



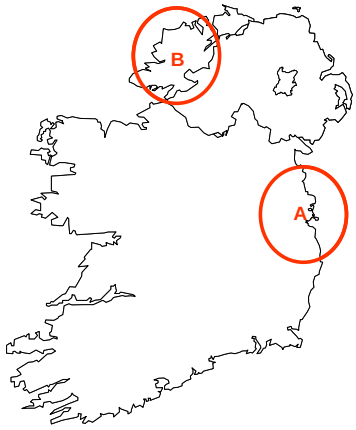
North area: Northern Scotland
South area: South of England

Sweden



The annual entry fees decreases linearly with the latitude to SEK 10/kW in the south. For the exit fees the reversed principle applies.

Ireland



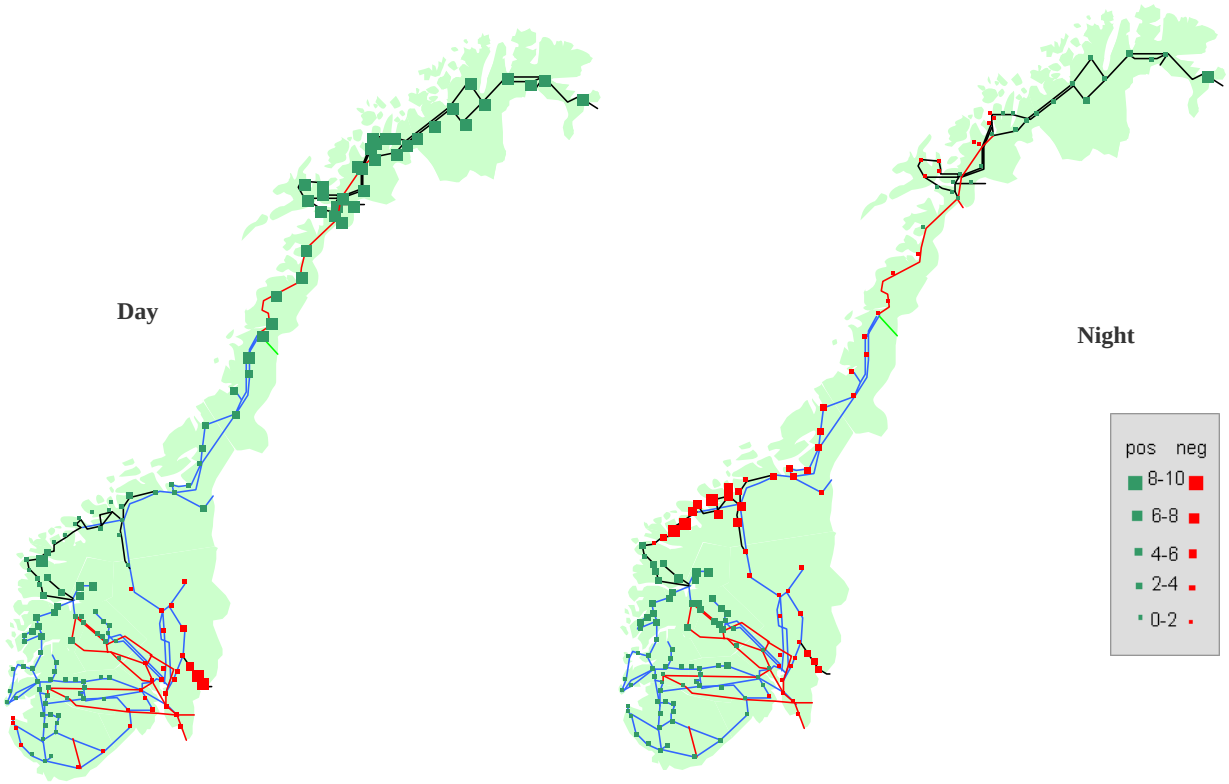
Highest case (A): G located in Dublin (surplus area)
Lowest case (B): G located in Donegal (shortage area)

Norway

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

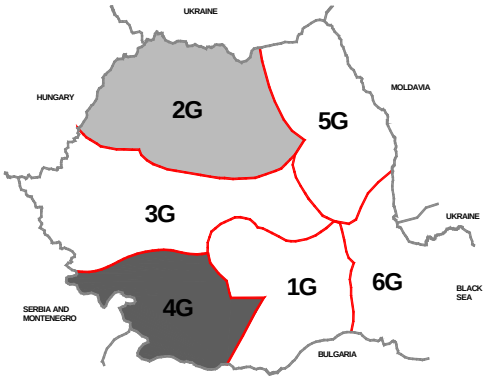
MLFs are symmetrical, i.e. MLF*input* = - MLF*output*

The MLFs below represent MLF*input*

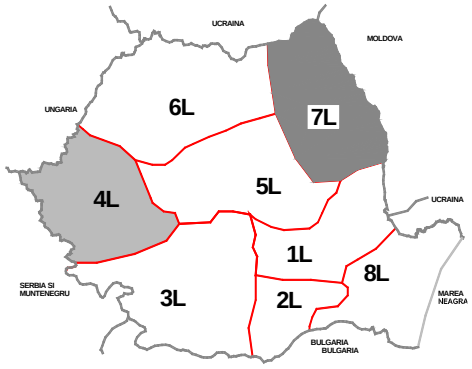


The energy element (€/MWh) = *Marginal loss factors (%)* * *market price (€)*

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: 6,19 €/MWh related to:

- Levy for federal contribution,
- Levy for financing connection of offshore wind turbine parks
- Levy for financing green certificates

Bosnia and Herzegovina:

Currently NOS BiH (Independent System Operator) and Elektroprenos BiH (Transco) are not responsible for the purchase of losses, secondary reserves, tertiary reserves.. Respective costs are included in the price which consumers pay directly to service providers, but those cost included in syntehtic values of „TSO tariffs“ in this report.
All licence holders (including Transco and ISO) are obliged to pay yearly fixed amounts to Regulatory Authorities which issued license to cover their administrations costs.

Bulgaria:

The fee (tariff) for green energy was introduced by the Regulator from 01.07.2009.
The fee (tariff) for cogeneration was introduced by the Regulator from 01.07.2010
The real value for both tariffs in 2011 is 3.02 EUR/MWh.
The regulatory periods in Bulgaria are starting as from July each year.

Croatia:

Regulator's activities: 0,0059 EUR/MWh (percentage of revenues of the previous year)

The annual entry fees decreases linearly with the latitude to SEK 10/kW in the south. For the exit fees the reversed principle applies.

Czech Republic:

Support of Renewable energy sources and Combined generation of electricity and heating (14,765 €/MWh).

Denmark:

- The PSO (Public Service Obligation) tariff was 10,26 €/MWh on average in 2011 in Denmark:
  - Direct subsidies to producers of environmentally friendly energy (79%).
  - Indirect subsidies (9%)
  - Research & development into environmentally friendly energy (7%).
  - Different public charges and other expenses (5%)

- Administration costs regarding the PSO are due to Danish legislation allocated to the System tariff (0.34 €/MWh).

- Payment to the Danish Energy Regulatory Authority and to the Danish Energy Agency to cover their administrations costs (0.16 €/MWh)

Finland:

Peak load power fee for consumption average 0,08 €/MWh.

France:

For the case base 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" (KWK-G), Modified Law for Combined Heat and Power Production Promotion.

Greece:

Total average charge is 4.98 €/MWh. It is a sum of Public Service Obligations (3.88 €/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 2011 the total cost for other requirements was 1.04 €/MWh. The cost related to the Regulatory Authority is 0.06 €/MWh.

Luxembourg:

The tax " Fonds de compensation " (0,75 €/MWh for consumers ≥ 65kV) serves for encouraging and for subsidizing the projects of production of national electrical energy on base of renewable sources of energy or the cogeneration.

The tax "Taxe Electricité" is used to the financing of the "Assurance dépendance".

0,50 €/MWh (consumers cat. B)*

0,10 €/MWh (consumers cat. C)*

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

cat. C: consumers > 25 MWh, electricity mainly used for the chemical reduction and the electrolysis as well as in the metallurgical procedures.

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 3,41 €/MWh.

Portugal:

11.64 €/MWh related to:

- Hydropower station land, 0.46 €/MWh
- Energy deviation (Surplus costs of cogenerators (cost of cogenerators above market prices) and compensation for the early termination of the Power Purchase Agreements (PPAs) are including) 6.68 €/MWh
- Islands' tariff convergence costs, 1.50 €/MWh
- Regulator costs, 0.13 €/MWh
- Interruptibility 0.86 €/MWh
- Capacity payments, 1.80 €/MWh
- Incentives related with consumption efficiency, 0.22 €/MWh

Romania :

The Contribution for promotion of cogeneration based on useful heat demand in the internal market (4,47 €/MWh) was introduced beginning with 1st of April 2011.

Serbia:

Payment for Regulator's activities: 0.0263 EUR/MWh

Slovenia:

3,283 €/MWh regarding:

- Power Market Operator's activities (0.13 €/MWh),

- Regulator's activities (0.17 €/MWh)
- Renewable energy (2,632 €/MWh)
- Domestic resources (0,351 €/MWh)

Spain:

Other regulatory charges are included as a percentage of the access tariffs. For the base case it is 0.36 €/MWh. On average for the year 2011, these percentages are the following:

- Permanent costs = 6.2 %,
- Diversification and security of supply cost = 2.7 %.

Switzerland:

Surcharge on the transmission costs to cover the costs arising from cost-covering feed-in remuneration is equal 3,6 €/MWh.

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 19.952€/installed MW, New consumption pay a lump sum connection fee of 7.981€/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 Chargeable shallow connection method. However the Least Cost Chargeable 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 bears the cost of his 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	**Deep** (100% of investment costs for customers and 100% for Generators. Exceptions are for connection of renewable 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 build 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 and co-generation units of installed capacity <=5MW pay 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 at meeting 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 fees aimed at supporting further network development. Connection fees are 43 000 €/MW per approved power. **Note**: Generally, in 110 kV network, grid users keep ownership over 110/x kV substations
Slovak Republic	**Partially Deep**. Distribution 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 the tariff.
Sweden	**Deep**
Switzerland	The cornerstones for the 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 at 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	None
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. 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
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 7 000 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.
Great Britain	- Small Generators' Discount: €0.145945/kW discount to generation tariff and €0.020083/MWh discount to energy charge for generators below 100MW. - Assistance for areas with high electricity distribution costs special tariff recovers an assistance amount, which is passed to the Relevant Distributor in certain areas with high distribution costs: €0.187782/MWh. (estimated from 2010 figures - based on conversion of £1 : € 1.167 at 31/12/2010)
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. FYROMn 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 Special tariffs is offered for interrupt load according to agreements. The tariffs are from 5% to 75 % of the regular L-tariff level 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 400 GWh, – utilization of the connection 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 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	Social tariff for vulnerable costumers (domestic consumers with a contracted power less than 4,6 kVA, who benefit from social insertion income, invalidity and old age social pension). For 2011, the discount is 1% at the fixed term of the access tariffs
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	Special tariffs for Public Lighting and alarming systems
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 the 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 case base (%)
Austria	No	
Belgium	For DSOs: -No subscriptions for the power component, - Formula for annual power. - No complementary power (annual/monthly).	+1.1% 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 colected by DSO and transferred to the TSO.	
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 differentiation between final customers and distributors. Tariffs just for load, not for generation.	
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 degree" - for the distributors. Thus: Transmission system operation charge for eligible costumer: 4.56 €/MWh Transmission system operation	69.7 % on transmission system operation tariff, on both tariff elements 46.4 % before rebate

	charge for distributor: 7.74 €/MWh Income of the positive difference of Transmission system operation charge for distributors is paid back for the distributors in percentage as **a rebate** since 2010. Calculation: [(injection /kWh/ * 318,2 c €) * (n_1+n_2+n_3+… %)], 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	Yes, in Italy distributors invoice to the final consumers the transmission component TRAS, differentiated according to the voltage level of the grid to take into account losses, and pay back to Terna the TRAS related to the voltage level of the grid higher than 220 kV. This figure in fact is equal to the amount of L component of the transmission tariff (HV and EHV over 220kV)[2]	
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	No	
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	The charge (without stranded costs) for users connected in “final PoDs” amounts to 65% of the charge paid by DSO in “network

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

[2] Italy- TRAS component:

Type of clients	TRAS (year 2011) c€/KWh
LV Public Lighting	0,457
LV other than Public Lighting	0,457
MV Public Lighting	0,433
MV other than Public Lighting	0,433
HV and VHV under 220kV	0,424
HV and VHV over 220kV	0,416

	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).	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 the customers.	
Sweden	No	
Switzerland	No	

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 tg φ=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 cases where 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 of an 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 is paid by eligible customers connected to the transmission network. The tariff set on 5.56 EUR/Mvarh.
Excessive take-on of reactive power is 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:
$Erp = Erconsumed - 0.49\ Eaconsumed$

Where,
Erp – Q-ty of reactive power for which penalty is imposed
$Erconsumed$ - Q-ty of consumed reactive power by the user</td></tr>
</table>

			0.49 – coefficient, corresponding to cos $\varphi = 0.9$ $Eaconsumed$ - Q-ty of consumed active power by the user The penalty for consumed reactive energy is 10% of 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. Tariff for reactive energy is 0,0203 EUR/kvarh.
Czech Republic	No for EHV	No for EHV	There is a penalty charged to customers connected to DSO. The penalty is charged by DSO.
Denmark	N	N	n/a
Estonia	Y	N	1,1 EUR/Mvarh for each Mvarh at 110kV 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 (charge ranges between 2,3 and 9,2 €/Mvarh). 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 charges are: -Reactive energy between 50% and 75% of active energy: 0,86 c€/Kvarh. - Reactive energy over than 75% of active energy: 1,1 c€/Kvarh. The difference paid/received by Terna increases/decreases 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€/MVArh (if tgφ≥0,4). Tariff for reactive power generation to the transmission network is 12,81€/MVArh.
Lithuania	Y	N	Tariff is paid by consumers above ≥30kV except households. Tariff is 0.516 €/MVarh for consumed 1 MVarh and 1.03 €/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 fi has to be between 0.8 and 1.0.
Northern Ireland	N	N	Currently no direct charge for reactive energy
Norway	Y	N	Reactive tariffs are applied in connection points where reactive load creates a problem on the system. Tariff rate is 25 NOK (=3,2 €) /kVAr (rounded off to the nearest 20 MVAr)
Poland	N	Y	Since the 1st January 2011 PSE Operator SA have applied in transmission tariff additional fees for excess take-off of passive energy by final consumers supplied from the high voltage network and passive energy fed into the transmission network by them. The charge is calculated for each MVahr of passive energy taken-off the HV 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, determined in transmission tariff, tgφ – real phase factor, measured value in a period used for settlement of the charges for excess take-off of passive energy, $tg\varphi_o$ – value of phase factor = 0,4 determined in a Agreement between PSE Operator SA and final consumer, A – amount of active energy taken-off the transmission network by final 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	N	Y	The reactive energy consumed outside the off-peak hours, is charged as follows: 0,00 €/MVArh, if tgφ <0,4 17,40 €/MVArh, if 0,4 < tgφ <0,5 52,20 €/MVArh, if tgφ > 0,5
Romania	Y	N	The difference of the quantity between cosφ=0.92 and cosφ=0.65
Serbia	Y	Y	All consumers of energy on HV grid except 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 1,12EUR/MVArh The reactive energy tariff for cosφ<0.95 is 2,24EUR/MVArh
Slovak Republic	N	N	
Slovenia	Y	Y	If Cos fi < 0,95 a penalty is charged in amount of 6,26 €/MVarh
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: 41, 554 €/MVArh 0.80 < cosφ<0,95 62.332 €/MVArh cosφ<0,80
Sweden	N	N	Limits set per point of connection
Switzerland	Y	N	Swissgrid distinguishes active and passive participants. Depending on the behavior (compliance or non-compliance) the following tariffs resp. remuneration rates are applied: **Active** (*compliant* / *non compliant*) **Passive** (*cosφ < 0.9* / *cosφ > 0.9*) Tariff [Rp./kvarh]: 0.30* / 0.61** / 0.61** / - *** Remuneration rate for active participants for reactive energy supplied according to requirements** **** Individual AS tariff for reactive energy**

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 the 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 inducing or hosting 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.

Other Regulatory Charges

Charges resulting from provisions imposed by national law regulations, recovered or invoiced by TSOs, but not directly related to TSOs' activities. Examples of costs recovered through such charges are: stranded costs, costs of supporting renewable or cogeneration energy production, regulatory levies, costs of diversification and security of supply.

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 in the public interest.

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; and
- 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 rate 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 involves activating 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 from generators which is reserved to respond to frequency changes 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.