Regional reporting on electricity interconnections management and use in 2009

The creation of a single European electricity market has come up against a major obstacle, which is the lack of sufficient interconnections between Member States. Looking forward to solutions to solve this major obstacle, National Regulatory Authorities should at least ensure that congestion management methods currently applied in Europe are efficient.

This regional report on electricity interconnections management and use mainly aims to provide a "detailed evaluation of the economic efficiency of congestion management methods" at a regional level. It should ideally complete the Compliance report exercise undertaken at European level.
This regional report should also help National Regulatory Authorities to reach not only a common understanding about the functioning of congestion management methods, but also a common view about the best way to further improve their functioning.

This report deals with the Central-South European Region for Electricity as defined by the Congestion Management Guidelines annexed to the EC Regulation 1228/03 (Italy, France, Germany, Austria, Slovenia, Greece). Although Switzerland, as not an EU country, is not part of any region according to the existing European legislation, the Swiss borders are taken into account for reporting purposes only because of their significant importance in the region. However the data used for the Swiss borders were provided by neighbouring countries and are not validated by either the Swiss regulator or the Swiss TSO.

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1. Cross-border flows of the CS region in 2009

a. Introduction

Most of the European electricity interconnections were managed for years by the means of administrative mechanisms. During these years the interconnections were mainly used to ensure grid safety and exports or imports of electricity based on long-term contracts.

The profound changes in European energy legislation set the aim of a single European electricity market. The liberalisation process led to an increase of cross-border power flows, causing congestion to occur more frequently, which constitutes a barrier for an effectively working and non-discriminatory internal electricity market.

In order to join the markets separated by congestion, the above mentioned congestion management mechanisms needed to evolve as to enable the creation of a single European electricity market.

One step into this direction was the entry into force of European regulation 1228/2003 on conditions for access to the network for cross-border exchanges in electricity. Among other issues, it stipulated that "network congestion problems shall be addressed with a non-discriminatory market based solutions which give efficient economic signals to the market participants and transmission system operators involved", which led to the implementation of cross-border capacity auctions. The guidelines of Regulation 1228/2003, with their entry into force on 1st of December 2006, provided more precise requests in order to further improve the efficiency of the allocation mechanisms in place, and strongly encourage regional approaches for calculating and allocating cross-border issues.

The regional approach, creating seven electricity regions in Europe, has been set up by ERGEG in 2006 with the simple but effective concept of each region identifying the more serious market distortions to trading energy within the region and finding solutions through the cooperation of the key stakeholders. This approach is expected to lead eventually to the real target, which is the creation of a single European market in electricity. Although some countries may be part of several regional initiatives, the Central-South region of Europe will be the main focus hereafter within this report.

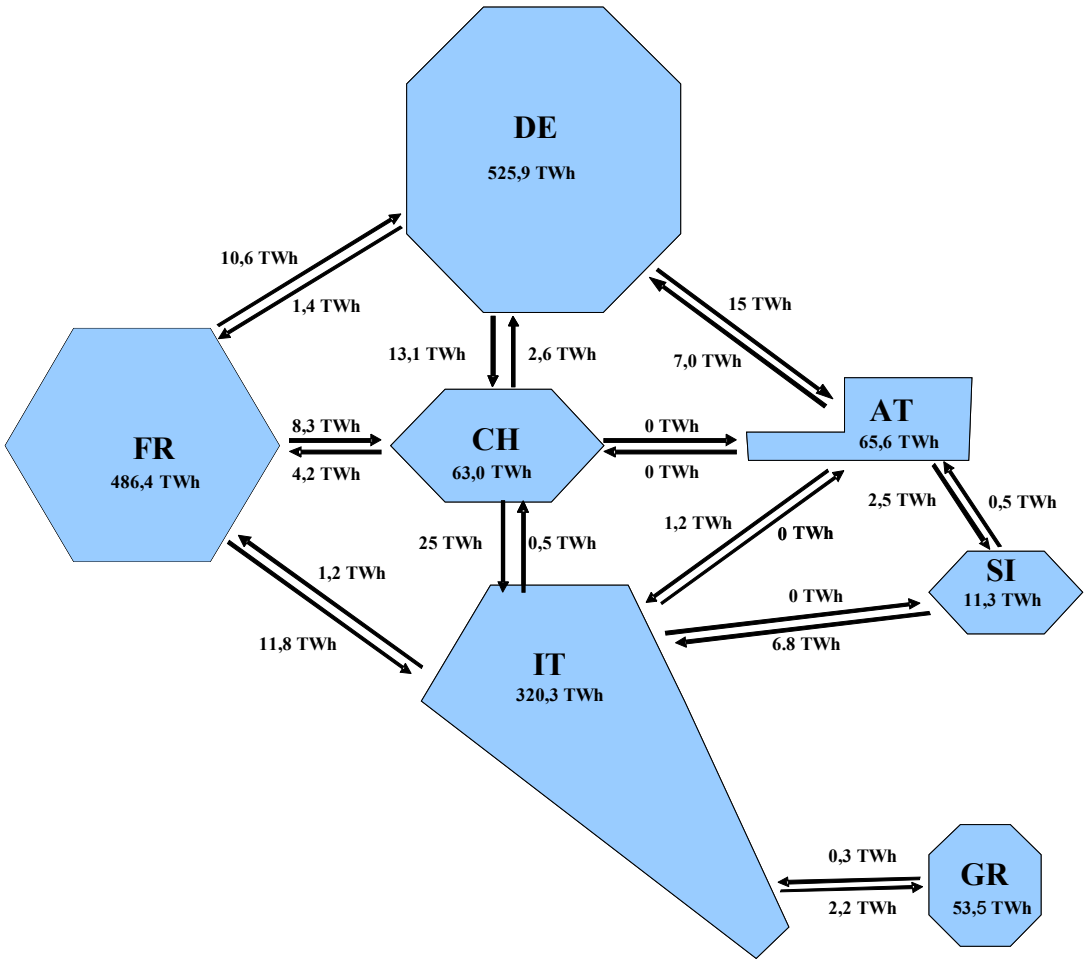
The member countries of the Central-South region are Italy, France, Germany, Austria, Slovenia and Greece. Because of its geographical situation, Switzerland participates as well in the region as an observer, although it is not a member country. This monitoring report focuses on commercial cross-border flows between the member countries of the region, but also between the member states and Switzerland. Some borders between member states of the region, i.e. France-Germany, Austria-Germany and Austria-Slovenia, are taken in charge by other regional initiatives and are, as a consequence, not described in this report.

b. Within the region

The Central-South (CSE) region is a highly interconnected region and most of the countries are interconnected to three or four others within the region. Only Greece is connected to only one CSE country, Italy, through a underwater HVDC cable. As a consequence, Greece is not a part of the highly meshed grid that connects the other CS countries to northern Italy.

Consumption, import and export of energy within the region are described in figure 1. The import and export flows considered are commercial flows, not necessarily equivalent to physical flows.

Figure 1: Within the region 2009 (source: ENTSO-E)



c. *Outside the region*

Because of its central place in Europe, CS region is interconnected with 13 countries from five different regions (8th region -South-East Europe- included).

Table 1 Detailed Import and Export between CSE – non CSE Countries

Non CSE Country	CSE Country									
	AT		DE		FR		GR		SI	
	Export (in GWh)	Import (in GWh)	Export (in GWh)	Import (in GWh)	Export (in GWh)	Import (in GWh)	Export (in GWh)	Import (in GWh)	Export (in GWh)	Import (in GWh)
AL							1,034	61		
BE					1,709	6,630				
BG							0	3,418		
CZ	262	6,859	965	8,687						
DK			3,615	6,232						
ES					3,957	2,351				
GB					6,889	3,358				
HR									3,574	5,196
HU	1,393	240								
MK							6	3,811		
NL			8,870	3,510						
PL			5,618	135						
SE			1,189	968						
Total	**1,655**	**7,099**	**20,257**	**19,532**	**12,555**	**12,339**	**1,040**	**7,290**	**3,574**	**5,196**

(source: ENTSO-E)

d. *Average cross-border capacity compared to generation capacity per country*

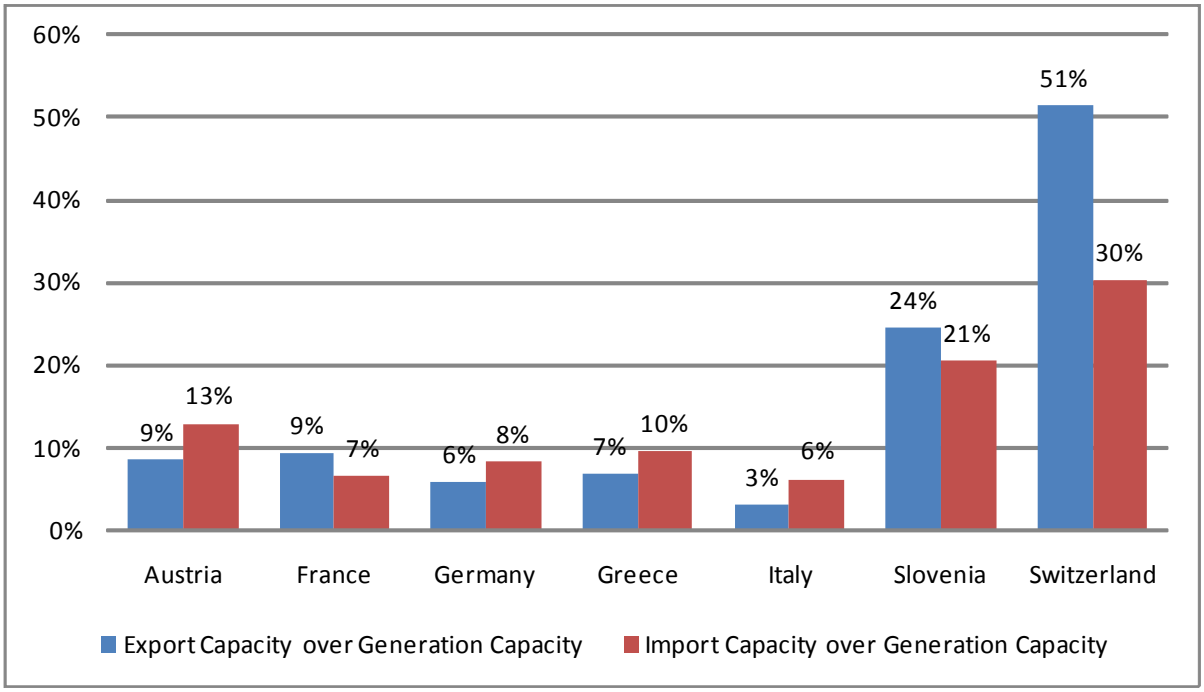
In the conclusions of the Barcelona summit of March 2002[1], the European Council agreed the target for Member States of a level of electricity interconnections equivalent to be at least 10% of their installed production capacity by 2005. Table 2 enables to monitor whether this ratio is reached.

When reading Table 2, one should be aware that for installed production, also intermittent generation like solar and wind capacity is taken into account. In countries with significant solar or wind generating capacity, the de facto utilizable generation capacity level observed might be quite much lower than this, as maximum availability/use of all intermittent energy is unusual. As a consequence, the ratios might be underestimated for such countries. Average interconnection capacities have been used for these calculations.

[1] http://ue.eu.int/ueDocs/cms_Data/docs/pressData/en/ec/71025.pdf

Table 2: Average cross-border NTC / installed generation capacity in 2009

CSE Countries	Export Average NTC (MW, data provided by EtsoVista)	Import Average NTC (MW, data provided by EtsoVista)	Net Generation Capacity (MW, data provided by ENTSO-E)	Export Capacity over Generation Capacity	Import Capacity over Generation Capacity
Austria	1,722	2,616	20,179	9%	13%
France	11,365	7,993	122,344	9%	7%
Germany	8,362	11,872	141,609	6%	8%
Greece	1,014	1,403	14,737	7%	10%
Italy	3,197	6,434	103,556	3%	6%
Slovenia	1,224	1,026	5,003	24%	21%
Switzerland	10,119	5,946	19,688	51%	30%



2. Congestion management methods in the CS region

a. General description of congestion management mechanisms

The allocation rules for all the Italian borders are harmonised and described in one single document, approved yearly by the concerned regulators. On these borders, capacity is allocated through explicit auctions, divided between yearly, monthly and daily capacities. On these borders, capacities are netted after nomination of long and medium term capacities, so that additional capacity can be offered in the daily auctions.
Another feature common to these borders is the absence of intraday auctions and balancing exchanges. This is partly due to the structure of the Italian market.
In 2008, capacities on most borders were allocated by the exporting TSO. During 2008, the creation of a single point of contact for allocation of interconnection capacities on Italian and Swiss borders was discussed by regulators and TSOs. It was concluded that capacities on CSE borders should be allocated by CASC, the CWE region Auction Office, from 2011.
Meanwhile, RTE and TERNA have decided that all capacities on the French- Italian border should be allocated by TERNA from April 2010.

The three Northern Swiss borders are also described in this report. The allocation rules on these borders are concluded bilaterally between the concerned TSOs.
On the Swiss-German and Swiss-Austrian borders, long term, medium term and daily capacities are allocated through a market-based mechanism as required by the European legislation (explicit auctions). On the Swiss-German border intraday capacities are allocated as well, by the principle of "first come, first served".
On the Swiss-French border, however, allocation rules are not market based. Daily capacities from France to Switzerland are reserved for historical long-term contracts between French and Swiss market players. These contracts were signed before the opening of the European power market, and included granted cross-border capacities. Similar contracts between member states have been cancelled. Daily capacities from Switzerland to France and intraday capacities in both directions of this border are allocated by an enhanced *pro rata* mechanism.
France-Switzerland is also the only border described in this report where balancing exchanges are offered (from Switzerland to France). The cross-border capacity for balancing is allocated by the same enhanced *pro rata* mechanism as the other products offered to the operators of the free market on this border.

Detailed information on the allocation and nomination procedures can be found on the concerned TSOs' website.

Table 3 Publication of the rules for capacity allocation and nomination

Interconnection	Website
Italy-France	http://www.terna.it/default/Home/SISTEMA_ELETTRICO/mercato_elettrico/import_export/Interconnessione_FR_IT.aspx
France – Italy	http://clients.rte-france.com/lang/an/clients_traders_fournisseurs/services_clients/inter_france_italie.jsp
Italy –Austria	http://www.terna.it/default/Home/SISTEMA_ELETTRICO/mercato_elettrico/import_export/Interconnessione_AT_IT.aspx
Austria –Italy	http://www.auction-office.at/austrian_italian_border/
Italy - Slovenia	http://www.terna.it/default/Home/SISTEMA_ELETTRICO/mercato_elettrico/import_export/Interconnessione_SL_IT.aspx
Slovenia- Italy	http://www.eles.si/en/for-business-users/cross-border-transfer-capacities.aspx
Italy – Greece	http://www.terna.it/default/Home/SISTEMA_ELETTRICO/mercato_elettrico/import_export/Interconnessione_GR_IT.aspx
Greece- Italy	http://www.desmie.gr/content/index.asp?parent_id=741&lang=2
Italy – Switzerland	http://www.terna.it/default/Home/SISTEMA_ELETTRICO/mercato_elettrico/import_export/Interconnessione_CH_IT.aspx
Switzerland – Italy	http://www.swissgrid.ch/power_market/commercial_grid_management/congestion_management/ch-it/
France – Switzerland	http://clients.rte-france.com/lang/an/clients_traders_fournisseurs/services_clients/inter_france_suisse.jsp#tab
Switzerland -France	http://clients.rte-france.com/htm/an/offre/telecharge/Regles_IFS_V1.0_ang.pdf
Austria – Switzerland	http://www.auction-office.at/austrian-swiss_Border/
Switzerland -Austria	
Germany - Switzerland	http://www.enbw.com/content/en/system_user/power/auction_d_ch/index.jsp
Switzerland - Germany	

Table 4 Main features of allocation procedures

Interconnection	Long term	Medium term	Day-ahead	Intraday	Balancing
Italy – France	Explicit auction	Explicit auction	Explicit auction	NA	NA
France – Italy					
Italy –Austria	Explicit auction	Explicit auction	Explicit auction	NA	NA
Austria –Italy					
Italy - Slovenia	Explicit auction	Explicit auction	Explicit auction	NA	NA
Slovenia- Italy					
Italy – Greece	Explicit auction	Explicit auction	Explicit auction	NA	NA
Greece- Italy					
Italy – Switzerland	Explicit auction	Explicit auction	Explicit auction	NA	NA
Switzerland - Italy					
France – Switzerland	ong term contract	NA	NA	Enhanced pro rata	NA
Switzerland -France					
Austria – Switzerland	Explicit auction	Explicit auction	Explicit auction	FCFS	NA
Switzerland -Austria					
Germany - Switzerland	Explicit auction	Explicit auction	Explicit auction	FCFS	NA
Switzerland - Germany -					

b. Long and medium term capacities

As for any commodity, the price that the market operators are willing to pay for this commodity depends on the intrinsic characteristics of the product sold: the more reliable the product sold is (firmness, compensation in the event of curtailment, etc.) and easy-to-use (existence of a secondary market, nomination procedure, financial/physical nature, etc.), the more valuable it is.

On most borders, a secondary market exists, but in 2008 capacities could only be resold on request. From 2009, a UIOSI-mechanism has been implemented on all Italian borders in order to facilitate the secondary market by automating resale of long term capacities to daily capacities. This measure completes the publication of long term capacity holders implemented on the same borders (except for capacities from Slovenia to Italy), implemented in order to facilitate OTC trading of interconnection capacities (transfers).
On most borders as well, the nominations are firm, and allocated capacities are compensated at 100% of 110% of the clearing price in case of reduction.
The Swiss-Austrian border is the only one where nominations are not firm.
On the French-Swiss border, the table is not relevant as long term capacities are not available on this border.

Table 5 Tradability and firmness: main characteristics of the long & medium term capacity rights

Interconnection	Secondary market			Compensation for Curtailments	
	Bilateral transfers	Resale of long to medium term	Resale of long & medium term to daily	of allocated but not yet nominated capacities	of nominated capacities
Italy – France	Publication of capacity holders	On request	On request	100% of clearing price	Nominations are firm
France – Italy	Publication of capacity holders	On request	On request	110% of clearing price	Nominations are firm
Italy –Austria	Publication of capacity holders	On request	On request	100% of clearing price	Nominations are firm
Austria –Italy	Publication of capacity holders	On request	On request	100% of clearing price	Nominations are firm
Italy - Slovenia	Publication of capacity holders	On request	On request	100% of clearing price	Nominations are firm
Slovenia- Italy	No special mesures	On request	On request	100% of clearing price	Nominations are firm
Italy – Greece	Publication of capacity holders	On request	On request	100% of clearing price	Nominations are firm
Greece- Italy	Publication of capacity holders	On request	On request	100% of clearing price	Nominations are firm
Italy – Switzerland	Publication of capacity holders	On request	On request	100% of clearing price	Nominations are firm
Switzerland - Italy	Publication of capacity holders	On request	On request	100% of clearing price	Nominations are firm
France – Switzerland	NA	NA	NA	NA	NA
Switzerland -France	NA	NA	NA	NA	NA
Austria – Switzerland	No special mesures	On request	On request	100% of clearing price	100% of clearing price
Switzerland -Austria	No special mesures	On request	On request	100% of clearing price	100% of clearing price
Germany - Switzerland	On request	On request	On request	110% of clearing price	110% of clearing price
Switzerland - Germany	On request	On request	On request	110% of clearing price	110% of clearing price

In 2008, long term capacities were allocated by the exporting TSO on most borders. As mentioned in the general description of capacity allocation rules (part 2.a), CASC will be allocating capacities on Italian borders from 2011. As CASC also will allocate long term capacities for CWE region, the harmonisation of long term allocation rules for both regions is an aim for regulators.

Table 6 Organisation Responsible for allocation, secondary market and nomination

Interconnection	Annual auction	Monthly auction	Resale through subsequent auctions	Bilateral transfer	Nomination
Italy – France	TERNA	TERNA	TERNA	TERNA	RTE - TERNA
France – Italy	RTE	RTE	RTE	RTE	RTE - TERNA
Italy –Austria	TERNA	TERNA	TERNA	TERNA	TERNA
Austria –Italy	APG	APG	APG	APG	APG
Italy – Slovenia	TERNA	TERNA	TERNA	TERNA	TERNA
Slovenia- Italy	ELES	ELES	ELES	ELES	ELES
Italy – Greece	TERNA	TERNA	TERNA	TERNA	TERNA
Greece- Italy	HTSO	HTSO	HTSO	HTSO	HTSO
Italy – Switzerland	TERNA	TERNA	TERNA	TERNA	TERNA
Switzerland – Italy	Swissgrid	Swissgrid	Swissgrid	Swissgrid	TERNA
France – Switzerland	NA	NA	NA	NA	NA
Switzerland -France	NA	NA	NA	NA	NA
Austria – Switzerland	APG	APG	APG	APG	Swissgrid-APG
Switzerland -Austria	APG	APG	APG	APG	Swissgrid-APG
Germany - Switzerland	EnBW	EnBW	EnBW	EnBW	EnBW
Switzerland - Germany	EnBW	EnBW	EnBW	EnBW	EnBW

c. *Day-ahead capacities*

As allocation and nomination of day-ahead capacities are very close in time, the possibility to transfer such capacities are most probably not very interesting for users. This service is not available on any border studied in this report.

On Italian borders, resale of daily capacity to intraday couldn't be possible, as no intraday products are available. A resale service would not be possible for capacities from Switzerland to France either, as allocation and nominations are simultaneous.

Table 7 Tradability and firmness main characteristics of the day-ahead capacity rights

Interconnection	Secondary market		Compensation for Curtailments	
	Bilateral transfers	Resale of daily capacity to intraday	of allocated but not yet nominated capacities	of nominated capacities
Italy – France	NA	NA	Capacities are firm	Nominations are firm
France – Italy	NA	NA	Capacities are firm	Nominations are firm
Italy –Austria	NA	NA	Capacities are firm	Nominations are firm
Austria –Italy	NA	NA	Capacities are firm	Nominations are firm
Italy – Slovenia	NA	NA	Capacities are firm	Nominations are firm
Slovenia- Italy	NA	NA	Capacities are firm	Nominations are firm
Italy – Greece	NA	NA	Capacities are firm	Nominations are firm
Greece- Italy	NA	NA	Capacities are firm	Nominations are firm
Italy – Switzerland	NA	NA	Capacities are firm	Nominations are firm
Switzerland – Italy	NA	NA	Capacities are firm	Nominations are firm
France – Switzerland	NA	NA	NA	NA
Switzerland –France	NA	NA	NA	None
Austria – Switzerland	NA	NA	100% of clearing price	100% of clearing price
Switzerland –Austria	NA	NA	100% of clearing price	100% of clearing price
Germany – Switzerland	NA	NA	110% of clearing price	110% of clearing price
Switzerland - Germany -	NA	NA	110% of clearing price	110% of clearing price

In 2008, day-ahead capacities were allocated by the exporting TSO on most borders. As mentioned in the general description of capacity allocation rules (part 2.a), CASC will be allocating capacities on Italian borders from 2011.

Table 8 Organisation responsible for allocation, secondary market and nomination

Interconnection	Daily auction	Resale through subsequent auctions	Bilateral transfer	Nomination
Italy – France	TERNA	NA	NA	TERNA-RTE
France – Italy	RTE	NA	NA	TERNA-RTE
Italy –Austria	TERNA	NA	NA	TERNA-APG
Austria –Italy	APG	NA	NA	TERNA-APG
Italy - Slovenia	TERNA	NA	NA	TERNA-ELES
Slovenia- Italy	ELES	NA	NA	TERNA-ELES
Italy – Greece	TERNA	NA	NA	TERNA-HTSO
Greece- Italy	HTSO	NA	NA	TERNA-HTSO
Italy – Switzerland	TERNA	NA	NA	TERNA-Swissgrid
Switzerland - Italy	Swissgrid	NA	NA	TERNA-Swissgrid
France – Switzerland	NA	NA	NA	NA
Switzerland –France	NA	NA	NA	NA
Austria – Switzerland	Swissgrid	NA	NA	APG-Swissgrid
Switzerland –Austria	Swissgrid	NA	NA	APG-Swissgrid
Germany – Switzerland	EnBW	EnBW	EnBW	EnBW-Swissgrid
Switzerland - Germany -	EnBW	EnBW	EnBW	EnBW-Swissgrid

d. Intraday capacities

Table 9 Main characteristics of the intraday capacity

Interconnection	Number of intraday gates	Compensation for Curtailments	
		of allocated but not yet nominated capacities	of nominated capacities
Austria – Switzerland	Capacity must be requested 45' before the next trading hour, from 18.00 D-1	Capacities are firm	Capacities are firm
Switzerland – Austria	Capacity must be requested 45' before the next trading hour, from 18.00 D-1	Capacities are firm	Capacities are firm
France – Switzerland	12, from 21.00 D-1	Capacities are firm	Capacities are firm
Switzerland – France	12, from 21.00 D-1	Capacities are firm	Capacities are firm
Germany – Switzerland	Capacity must be requested 1h' before the next trading hour, from 18.00 D-1	Capacities are firm	Capacities are firm
Switzerland – Germany	Capacity must be requested 1h' before the next trading hour, from 18.00 D-1	Capacities are firm	Capacities are firm

Table 10 Organisation responsible for allocation, secondary market and nomination

Interconnection	Intraday allocation	Bilateral transfer	Nomination
Austria – Switzerland	APG	APG	APG-Swissgrid
Switzerland – Austria	APG	APG	APG-Swissgrid
France – Switzerland	RTE	NA	RTE (allocation and nomination in one
Switzerland – France	RTE	NA	RTE (allocation and nomination in one
Germany – Switzerland	EnBW	EnBW	EnBW
Switzerland – Germany	EnBW	EnBW	EnBW

The overview above makes clear, that only on a limited set of borders of the CSE Region intra-day trading is possible. For the borders facilitating intra-day the organizational set is also different. Partly gates are defined, or continuous allocation (in case of available capacities) with a certain lead-time is the rule. Allocated capacities are usually firm. The creation of a coordinated intra-day regime will be an important issue to be elaborated further in the CSE Region.

3. Economic efficiency of congestion management methods

a. Global figures

Table 11 : Competition indicators

Here we look at the actual congestion income (i.e. the auction revenue), which reflects the market operators' inclination to pay, along with an indicator of the theoretical congestion income, whose calculation is based on ex-post hourly price differentials between the national markets.

- The actual congestion rent is the sum of all auction revenues of the year (yearly, monthly and daily)
- The ex-post assessment of the congestion rent is the sum of the allocated interconnection capacity of each hour multiplied by the market price differential, for all hourly steps of the year. This number could not been calculated for the border between Italy and Slovenia, as the Slovenian day-ahead market is not liquid enough to return a reliable price.
- The number of auction participants is the number of companies (the relationship between them is not taken into account : subsidiaries count as companies) that participated in at least one auction, whatever the timeframe, during the year.
- The numbers of interconnection capacity holders and of interconnection users are calculated in the same way as the previous column with regards to companies.
- The two last columns represent the largest market share(s) of nominated capacities (in MWh), whatever the kind of nominated capacities.

For some borders, all figures for participation in auctions and holding/use of capacities were not available. For these borders (marked with ">") we can only give a minimum number of participants/holders/users.
For the French-Swiss border, some indicators are not available, as no auctions are organised on this border.

	Actual congestion rent or auction revenues (M€)	Ex-post assessment of the congestion rent (M€)	Number of auction participants	Number of interconnection capacity holders
Italy – France				
France – Italy				
Italy –Austria				
Austria –Italy				
Italy - Slovenia				
Slovenia- Italy				
Italy – Greece				
Greece- Italy				

	Number of interconnection users	Largest share	Sum of the three largest shares
Italy – France			
France – Italy			
Italy –Austria			
Austria –Italy			
Italy - Slovenia			
Slovenia- Italy			
Italy – Greece			
Greece- Italy			

Assuming perfect foresight the real congestion income should equal the theoretical congestion income. In reality, that is not the case, because of:

- the difficulty the market operators experience with forecasting day-ahead price differentials, and all the more so, for one month or one year ahead. As a consequence, capacity bought on longer timeframes has an optional nature and reflects an higher value due to premium risk;
- the market operators' preference for trades of longer-term products (such as baseload and peakload products of a day), along with the difficulty or even impossibility for the market operators to carry out arbitrage in hourly steps (e.g.: because of limited flexibility supply contracts);
- failures in the interconnected markets (small number of operators, information asymmetry, size differences).

Moreover, an inter-temporal monitoring of the ratio between the real income revealed by market mechanisms and this theoretical congestion income could be a useful first step to reveal congestion management mechanism failures, incompatibility between market designs, or lack of competition at the interconnection. [2] Further investigations would anyhow be required.

It could also be used to evaluate the impact of modifications of the interconnection access rules and changes in national market designs and to assess, whether, and to what extent, the process is evolving towards the establishment of an internal electricity market.

Table 12: Prices attributed to interconnection capacities

Allocation mechanisms by auction, whether explicit or implicit, mean that the value the market gives to interconnection capacities can be estimated.
The average hourly price revealed by the auctions for each interconnection MW, for all timeframes, is one way of comparing the various interconnections within the CSE region[3]. Notably, it can be used:

- within the perspective of investment in new interconnection lines, alongside further analysis on the potential benefit of the new line in increasing efficiency (because of increased competition, more efficient use of existing generation…etc..) ;
- to improve the method used by TSOs for sharing export capacity on their borders

	Average prices[4]		Total
	€/MWh	€/MW	€/MW
Italy – France			
France – Italy			
Italy –Austria			
Austria –Italy			
Italy - Slovenia			
Slovenia- Italy			
Italy – Greece			
Greece- Italy			

The values in the first column correspond to the average price for a MWh in one particular direction. It is computed in the following way:

Sum of the revenues from different auctions/ (sum of the capacities sold in MWh)

The second column gives the average price for one MW for the whole year. It is the average price for one MWh multiplied by the number of hours in the year.

[2] The monitoring of this ratio will be more precise if a distinction is made between the different timeframes according to which the capacities are allocated (see sections b and c).

[3] The figures in this table take into account all the revenues and all the allocated capacities at the different timeframes.

[4] Note: this is an average of marginal values of an additional MW. This does not necessarily correspond to the average value (per MW) that a new interconnection would bring to the market.

The last column gives the average value of one MW in both directions. This is the sum of the values for one MW in each direction.

Table 13: Efficient utilisation of interconnection capacity

In order to investigate whether the interconnection is used in a logical and efficient way, it is interesting to check whether the net flow on the interconnector is coherent with the price spread. In addition, an indication about the level of use of the interconnector when it is justified is given. The second column indicates when the use of the interconnection (net scheduled flow) is not coherent with the economic signal given by the price differential. On the opposite, the third and the fourth columns indicate when the use of the interconnection is coherent with a significant price differential and the level of utilisation of the interconnection capacity (partial utilisation versus maximum utilisation). Theoretically, in such a case, the interconnection must be used at the maximum. That may be not the case because of a lack of transparency, flexibility, the forecast errors of traders …

Interconnection between	Percentage of time when the price differential is not significant	Percentage of time when the net scheduled flow is coherent with a significant price differential and capacity is:		Percentage of time when the net scheduled flow is not coherent with a significant price differential
		not used at the maximum	used at the maximum	
Italy & France	5%	32%	40%	23%
Italy & Austria	4%	38%	44%	14%
Italy & Slovenia	*NA*	*NA*	*NA*	*NA*
Italy & Greece	4%	47%	24%	25%

On all borders where necessary data is available, the capacity is quite often not used at the maximum when the price differential is significant. Indeed, a substantial part of the time (14-29%) when the price differential is significant, the net scheduled flow is incoherent with it. As mentioned above, this inefficient use of interconnection capacity can be explained in different ways. The only known way to avoid this inefficient use is the implementation of market coupling.

b. Long and medium term capacities

On all the interconnections within the CS region, capacities are allocated on different timeframes. The long-term products on offer are generally as follows:

- annual: at the end of each calendar year, a capacity band (base), peak-hours or off-peak hours are allocated for the whole of the next year;
- monthly: every month, a capacity band (base), peak hours or off-peak hours are allocated for the next month;

On Italian borders, annual products without August were also allocated in 2008.

The French-Swiss border is the only border where no long term capacities are allocated.

Holding long-term capacities is one of the main methods for market operators to gain a lasting position on a foreign market. In this regard, improving the quality of the products offered by the TSOs and maximising interconnection capacities are important challenges for developing competition and constructing the European electricity market.

As for any commodity, the price that the market operators are willing to pay to obtain this commodity depends on the intrinsic characteristics of the product sold: the more reliable the product sold is

(firmness, compensation in the event of curtailment, etc.) and easy-to-use (existence of a secondary market, nomination procedure, financial/physical nature, etc.), the more valuable it is.
Market operators wishing to participate in long-term auctions can consider two price references in order to determine their willingness to pay for the capacity. On the one hand, if they are involved in long-term arbitrages, they can consider the price differential of forward products available on the day of the auction. On the other hand, if they are interested in shorter-term arbitrages, this initial value has to be supplemented by their estimate, for the period in question, of price differential volatility on an hourly, (or daily, weekly, etc.) basis.

As National Regulatory Authorities usually does not have access to these estimates, which differ for every market operator, this report considers the theoretical value of capacities, calculated ex-post, based on volatility of hourly price differentials. When the operators' forecasts do not materialise, typically in the case of unexpected weather conditions (heat wave, very cold spell, etc), this value may be lower than the marginal auction price. With this exception, the marginal price revealed by annual (or monthly) auctions must, in principle, be:

- at least the same order of magnitude as the price differential of corresponding annual (or monthly) forward products, observed on the date the auction is held;
- lower than the theoretical capacity value, calculated ex-post based on the hourly price differential between the organised markets throughout the year (or month)[5].

On Italian interconnections, the forward price cannot be calculated, as the Italian forward market was introduced only in 2009 and was not in operation in 2008.

In table 13, 14, 15, 16, 17, 18 and 20 operators are counted without regards to the relationship between them (subsidiaries…). In case of A-to-B or A-to-N nominations, only exporting operators have been counted.

Table 14 : Competition indicators for yearly auctions

- The sold capacity (first column) is an average by hour of the different available products on the concerned interconnection (peak, off-peak, with or without August…).
- The third column, number of capacity holders, could not be correctly filled in for all borders and directions, as the complete data was not available. In this case, only the lower limit of the number of participants to the auction, which is equal to the number of capacity holders, has been filled in (together with the sign ">").
- The last column of this table, ex-post assessment of the congestion rent is equal to the theoretical value of the capacity.

The theoretical upper limit to the price, i.e. the theoretical value of the capacity has been exceeded by the price of annual capacities from Italy to Austria and from Switzerland to Italy. This may mean that market operators have over-estimated the value of these capacities.
For other borders, in particular between Greece and Italy (both directions), the price of annual capacities is far below theoretical value. This might mean that the value of the capacities has been largely under-estimated, or that competition is not significant enough on these products.
For other capacities, as those from France and Austria to Italy, the price is very close to the theoretical upper limit. This indicates that market operators has a good estimation of the value of these products, and that competition is well-functioning.

	Capacity sold (MW)	Number of participants to the auction	Number of capacity holders	Marginal price (€/MWh)	Forward price differential (€/MWh)	Ex-post assessment of the congestion rent (€/MWh)
Italy – France						
France – Italy						
Italy –Austria						
Austria –Italy						

[5] The theoretical value of the annual (or monthly) export capacity from market A to market B is the average of the price differential between the two markets over all the hourly steps in the year (or month) during which the market B price is higher than the market A price.

Italy - Slovenia
Slovenia- Italy
Italy – Greece
Greece- Italy

Table 15 : Competition indicators for monthly auctions

- The average sold capacity (first column) is an average by hour of the different available products on the concerned interconnection (peak, off-peak, with or without August…).
- The third and fourth columns could not be correctly filled in for all borders and directions, as the complete data was not available. In this case, the lower limit of the number of participants to the auction, which is equal to the number of capacity holders, has been used to calculated a lower estimate (marked by the sign ">").

	Average capacity sold (MW)	Capacity sold standard deviation (MW)	Average number of participants to the auctions	Total Number of participants
Italy – France	243	62	21,9	33
France – Italy	585	225	32,8	44
Italy –Austria	14	18	3	13
Austria –Italy	36	48	13	23
Italy - Slovenia	46	16	4	11
Slovenia- Italy	97	52	>4	>16
Italy – Greece	250	0	10	13
Greece- Italy	0	0	0	0

Table 16 : Competition indicators for LT auctions

- As in table 13-14, data could not be correctly filled in for number of participants (first column) for all borders. When only a lower limit could be calculated, this is indicated by a ">".
- The market shares are calculated according to nominated capacities and not to allocated capacities. As a consequence, this indicator should be understood as the shares of the commercial flow on long term capacities in each direction of each border.

A high number of participants, holders and users of long term capacities is an indicator of a well-functioning capacity market, but it also depends on other factors as the accessibility to the national wholesale markets.
On most borders, nomination of long term capacities is dominated by a few important users, as more than 50% of the capacities are nominated by three users or less. The only exceptions are on capacities from France to Italy (34%) and from Austria to Italy (47%).
The border between France and Switzerland is a special case, as all long term capacities are reserved to one single user.

	Number of participants to LT auctions	Number of LT capacity holders	Number of LT capacity users	Largest share[6]	Sum of the three largest shares
Italy – France	39	29	26	40%	58%
France – Italy	47	41	54	15%	34%
Italy –Austria	23	18	5	62%	92%
Austria –Italy	35	23	16	22%	47%
Italy - Slovenia	19	12	3	56%	100%
Slovenia- Italy	>16	16	20	42%	79%
Italy – Greece	20	15	13	32%	66%
Greece- Italy	13	7	7	36%	80%

Secondary markets

On several borders, long term capacities can be negotiated on a secondary market through to different mecanisms :

- Resales : parts of long term capacities at a lower timescale (annual to monthly, annual or monthly to daily capacities) at the auctions organised by TSOs. The reseller receives the price of the auction
- Transfers : long term capacities are resold bilaterally to other market operators. Transfers must be notified to concerned TSOs.

Table 17 : Resale of annual capacities to monthly auctions
This table shows the use of mechanisms for reselling annual capacities to monthly auctions. On the borders where such a service is available, this service is used by very few users, and that the share of yearly capacities which is resold does not exceed 8% (France-Italy). This might indicate a lack of interest of this service, or that the resale procedure is not convenient to the users.

Resale data on the border between Italy and Switzerland were not available for these calculations.
The absence of data on the border between France and Switzerland is due to the lack of auctions and of a secondary market of long term capacities on this border.

	number of operators using this service	proportion of operators using this service compared with the number of	Average capacity resold (MW)	Capacity resold standard deviation	Average share of yearly capacities

[6] This represents the largest percentage of long-term capacities nominated by one user, whatever the nominated capacities is monthly or yearly.

		holders of annual capacities		(MW)	
Italy – France	3	10%	13	23	2%
France – Italy	6	15%	131	97	8%
Italy –Austria	0	0%	0	*NA*	0%
Austria –Italy	1	8%	6	15	3%
Italy - Slovenia	0	0%	0	*NA*	0%
Slovenia- Italy	1	16,7%	1	0	0%
Italy – Greece	0	0%	0	*NA*	0%
Greece- Italy	0	0%	0	*NA*	0%

Table 18 : Resale of annual and monthly capacities to daily auctions

On several borders, long term capacities who are not nominated can, on request, be resold as daily capacities. The share of long term capacity holders using this service is high on most borders where this service is available, reaching 73% on capacities from Italy to Greece. On this border, almost half the long term capacities are resold at daily auctions. On other borders, the share of resold capacities is lower.

Compared to table 16, this illustrates a bigger interest in resale to daily capacities than to monthly capacities. This difference might be explained by the fact that resale of long term capacities to daily capacities can be done closer to real-time, which facilitates estimation of the value of the capacity to be sold.

It might as well indicate that market operators use long term capacities as a hedging tool, and that the capacity market on the concerned interconnection could be mature for financial transmission rights.

	Number of operators using this service	Proportion of operators using this service compared with the number of holders of LT capacities	average capacity resold (MW)	capacity resold standard deviation (MW)	average share of long-term capacities
Italy – France	14	48%	163	99	17%
France – Italy	20	49%	331	284	14 %
Italy –Austria	5	28%	9	11	11%
Austria –Italy	2	10%	1	5	1%
Italy - Slovenia	6	50%	28	22	22%
Slovenia- Italy	4	25%	0	1	0%
Italy – Greece	11	73%	235	139	47%
Greece- Italy	2	29%	23	28	25%

Table 19 : Bilateral transfers of annual and monthly capacities

The transfer of long term capacities is used on capacities between France and Italy, between Greece and Italy, from Slovenia to Italy and from Austria to Italy. The share of operators using this service is quite high, which means that the service is accessible and interesting to users.

	number of operators using this service	proportion of operators using this service compared with the number of holders of long-term capacities	average capacity transferred (MW)	Capacity transferred standard deviation (MW)	average share of long-term capacities
Italy – France	8	28%	144	60	15%
France – Italy	16	18%	201	20	9%
Italy –Austria	0	0%	0	*NA*	0%
Austria –Italy	2	9%	26	7	13%
Italy - Slovenia	0	0%	0	*NA*	0%
Slovenia- Italy	5	42%	5	2	2%
Italy – Greece	6	40%	83	81	16%
Greece- Italy	2	29%	74	42	80%

Table 20: Consistency of nominations with price differentials

The following table should be read as follows:

- the first column gives the average capacity allocated in the yearly and monthly auctions;
- the second column for the number of hours when the price differential was in a particular direction, gives the average capacity nominated in the other direction;
- the third column gives the ratio of the number of hours during which the nominations were in the opposite direction;
- the fourth column gives the annual average capacity not nominated in the direction of the price differential;
- finally, the fifth column gives the number of hours during which the capacity was not fully nominated in a particular direction divided by the number of hours during which the price differential was in the same direction.

The ideal use of capacities described above would produce all zeros in the four last columns.

These indicators show the reactivity of market operators to the variability of the market price differential. They measure the efficiency of the use of long term capacities.

On most borders, the use of capacities is not very efficient. Especially capacities from France to Italy between France and Switzerland and from Austria to Italy are always or nearly always nominated when the price differential is in the opposite direction. The case of capacities from France to Switzerland is special, as long term capacities are dedicated to historical long term contracts, whose terms are not market based. On the other borders, inefficiency can have several explanations :

- difference between OTC prices and the prices of the organised market (bad price references);
- difficulties for market operators to estimate the prices;
- on borders where the price differential is in the same direction most of the time, capacities can be nominated according to a “business as usual” principle.

It must be recalled that on borders were nominated long term capacities are netted before the available capacity for daily auction is calculated, the inefficiency of use of long term capacities can be covered up by efficient nomination of daily capacities.

	Average capacity allocated in the yearly and monthly auctions	**Average capacity nominated in the opposite direction to the price differential (MW)**	**Proportion of hours concerned**	**Average capacity not nominated in the price differential direction (MW)**	**Proportion of hours concerned**
Italy – France	943	162	30%	660	100%
France – Italy	2316	1765	100%	216	46%
Italy –Austria	84	20	3%	64	100%
Austria –Italy	203	180	96%	39	41%
Italy - Slovenia	126	*NA*	*NA*	*NA*	*NA*
Slovenia- Italy	325	*NA*	*NA*	*NA*	*NA*
Italy – Greece	500	116	46%	171	95%
Greece- Italy	96	62	20%	197	31%

Table 21 : Simultaneous nominations in both directions

The following table represents a subgroup of the data observed in the second column of the previous table: it focuses on the users that nominated capacities both in the direction to the price differential and in the opposite.
Although the nomination in the opposite direction to the price differential can be explained by a lack of flexibility or reactivity, the nominations in both directions can not be explained economically. It is therefore important to know the importance of this phenomenon as it may indicate some gaming strategy, or at least an inefficient behaviour.
On the interconnection between France and Italy and between France and Switzerland, long term capacities are regularly nominated simultaneously in both directions. On the latter border, this seems to be due to the particularity of the long term capacities of the border (dedicated to historical contracts). Between France and Italy, simultaneous nomination of long term capacities seems to be a quite usual behaviour, as it occurs about 20% of the time and 15 actors are concerned. On this border, capacities are netted before daily auctions, so no capacity is lost by this behaviour.

Between	Number of concerned actors	Number of hours	Average concerned capacity (MW)
Italy & France	15	2265	88
Italy & Austria	1	3	15
Italy & Slovenia	2	332	12
Italy & Greece	5	158	18

c. Day-ahead capacities

The value of the daily capacities, hour by hour, should be viewed in relation to the hourly price differential between the markets.

In reality, because the daily explicit auctions take place before the prices are fixed on the organised markets, those taking part in the auctions can only use estimates of the price differential, and this could partially explain the difference between the auction result and the price differential. This is one characteristic of the separation of the energy and transmission capacity markets (allocation by explicit auctions).

Table 22 : Competition indicators

	Average capacity sold (MW)	Capacity sold standard deviation (MW)	Average number of participants[7] to the auctions	Total number of participants
Italy – France	1721	1002	*NA*	*NA*
France – Italy	612	454	*NA*	*NA*
Italy –Austria	116	103	2,4	>14
Austria –Italy	13	26	3	>8
Italy - Slovenia	260	144	2,3	>10
Slovenia- Italy	50	49	NA	>10
Italy – Greece	361	122	4,7	>11
Greece- Italy	246	272	3,7	>12

	Average number of DA capacity holders[8]	Total number of DA capacity holders	Average number of DA capacity users	Total number of DA capacity users
Italy – France	NA	23	0,8	21
France – Italy	NA	28	4,5	28
Italy –Austria	2,4	14	1	14
Austria –Italy	1,9	8	3	8
Italy - Slovenia	2,3	10	1	7
Slovenia- Italy	*NA*	10	4	10
Italy – Greece	4,5	11	4	11
Greece- Italy	3,6	12	3	11

	Largest share [9]	Sum of the three largest shares[10]	Average of the marginal price (€/MWh)	Marginal price standard deviation (€/MWh)	Ex-post assessment of congestion rent (€/MWh)
Italy – France	22%	57%	0,03	0,28	2,45
France – Italy	20%	41%	7,20	11,82	11,98
Italy –Austria	23%	50%	0,02	0,1	1,46
Austria –Italy	45%	80%	6,75	10,08	12,13
Italy - Slovenia	51%	37%	0,04	0,40	NA
Slovenia- Italy	38%	77%	8,49	11,59	NA
Italy – Greece	30%	81%	1,73	3,73	6,04
Greece- Italy	37%	72%	0,17	1,17	5,73

Table 23 : Consistency of nominations with price differentials

The following table should be read as follows:

- the first column gives the annual average for nominations in the opposite direction to the price differential;
- the second column, for the number of hours when the price differential was in a particular direction, gives the ratio of the number of hours during which the nominations were in the opposite direction;

[7] This figure is the number of participating companies whatever the relationship between them (for example : subsidiaries)

[8] This figure is the number of participating companies whatever the relationship between them (for example : subsidiaries) that win DA capacity in average.

[9] This represents the largest percentage of daily capacities nominated by one user.

[10] This represents the sum of the percentages of daily capacities nominated by three largest users.

- the third column gives the annual average capacity not nominated in the direction of the price differential;
- finally, the fourth column gives the number of hours during which the capacity was not fully nominated in a particular direction divided by the number of hours during which the price differential was in the same direction.

Ideal use of daily capacities would correspond for each hour in the year to:

- maximum use in the direction of the price differential: the rate of use of these capacities (nominated capacities divided by available capacities) should be equal to 1;
- no use in the opposite direction to the price differential: the rate of use should then be zero.

So the ideal use of capacities described above would therefore produce all zeros in the four columns.
Nomination data for borders between Switzerland and Italy and between Switzerland and Austria was not available. For the border between Switzerland and France, day ahead capacity is only available in one direction. On this product, nomination and allocation are performed at the same time.
For the border between Italy and Slovenia, nomination data was not available.

	Average capacity nominated in the opposite direction to the price differential (MW)	**Proportion of hours concerned**	**Average capacity not nominated in the price differential direction (MW)**	**Proportion of hours concerned**
Italy – France	338	28%	2354	99%
France – Italy	337	91%	438	39%
Italy –Austria	55	4%	226	94%
Austria –Italy	14	41%	15	36%
Italy - Slovenia	*NA*	*NA*	*NA*	*NA*
Slovenia- Italy	*NA*	*NA*	*NA*	*NA*
Italy – Greece	208	42%	284	67%
Greece- Italy	115	12%	427	38%

Table 24 : Simultaneous nominations in both directions

On some borders, actors nominate capacities simultaneously in opposite directions. This kind of behaviour is not problematic if the nominated product is netted (like long-term products before day ahead auction), but if it is the last timescale available on the concerned border, it creates inefficiency, just like nominations in the opposite direction of the price differential.

Some possible explanations of this behaviour could be :

- Green certificates : on some borders, national legislation demands nomination of capacities for import of green energy. Some actors might nominate for trading of green energy in one direction and of regular power in the other.
- Different entities of the same company might have different strategies.
- When simultaneous nominations are rare, they might simply be a result of an error
- In some cases, simultaneous nominations might also be a sign of manipulation of market or prices (for instance, if a market operator wants to decrease the total import or export volume);
- In countries with a zonal system with different entries for import like Italy, simultaneous bids and offers on the power exchange might result, for a market operator,importing to this country, in simultaneous nominations.
- …

Simultaneous nominations are most frequent on the borders between France and Italy.

Between	Number of concerned actors	Number of hours	Average concerned capacity (MW)
Italy & France	15	2160	87
Italy & Austria	3	30	7
Italy & Slovenia	3	150	28
Italy & Greece	5	8	33

Table 25 : Estimate of the loss associated with the absence of netting between long-term capacity nomination and day-ahead allocation

The netting of long-term capacities allows for long-term capacity nominated in the opposite direction to be reallocated at the daily auctions. Netting is a requirement of Regulation (EC) No 1228/2003.
Netting between nomination of long term capacities and allocation of day-ahead capacities are applied on all borders except between France and Switzerland, where no long term capacities are available.

	Loss due to the absence of netting (M€)[11]	Total
Italy – France	0	0
France – Italy	0	
Italy –Austria	0	0
Austria –Italy	0	
Italy - Slovenia	0	0
Slovenia- Italy	0	
Italy – Greece	0	0
Greece- Italy	0	
Total		

[11] This is estimated by multiplying the nominated long and medium term capacities not taken into account in the daily allocated capacities (i.e. the capacity nominated in one direction is not added to the ATC computed for the opposite direction) by the price differential if positive, zero otherwise.

Table 26 : Day-ahead price convergence

When the prices of two interconnected markets are converging, it is a sign of appropriate interconnection capacity and use according to the given situation. On the contrary, diverging prices are a sign of at least one of the following :

- The interconnection capacity between the two countries is not high enough to make prices converge
- The use of the existing interconnection capacity is inefficient

On all borders where data was available, the price convergence is quite low. As can be seen from table 22, the utilisation of interconnection capacity in CSE region is not always very efficient.

	% of time where prices are the same
Italy & France	5%
Italy & Austria	4%
Italy & Slovenia	*NA*
Italy & Greece	4%

Table 27 : Estimate of the "loss in social welfare" associated with the absence of implicit methods

The "loss in social welfare"[12] associated with the absence of market coupling between two borders is estimated as follows: for each hour, it is the product of the positive part of the price differential between the exchanges and the daily capacity that remains unused or is used in the opposite direction. This estimate should be considered with caution (see the inset below). However, it does at least give an idea of the scale of this loss of social welfare on each border.

Within the region

	Loss in social welfare (M€)	Total
Italy – France	51,3	75,6
France – Italy	24,3	
Italy –Austria	2,0	2,7
Austria –Italy	0,7	
Italy - Slovenia	*NA*	*NA*
Slovenia- Italy	*NA*	
Italy – Greece	14,6	29,7
Greece- Italy	15,1	
	Total	

Inset – Limitations of this estimate

• The estimate assumes "all else being equal" and in particular it does not take account of the possible change in behaviour of the market operators in the organised markets following the introduction of market coupling. It is difficult to make an ex ante assessment of the impact of introducing market coupling on the buying and selling offer strategies of market operators in the organised markets.

• The estimate does not take account of market resilience, i.e. the impact on prices of altering the volumes exchanged. Better use of daily capacities would lead to price convergence; the figures given in Table 13 are therefore the upper bounds of actual loss of social welfare, which can only be estimated precisely using aggregated curves of supply and demand on each market.

d. Intraday capacities

[12] Or loss of collective surplus.

Access to cross-border intraday trades offers operators greater flexibility for balancing their position when coping with an unexpected event, and also enables them to engage in short-term arbitrages. Intraday capacities are available on three of four Swiss borders.

Table 28 : Competition indicators

In the table below, companies are counted without regard to the relationship between them (subsidiaries count as companies).
For the French-Swiss border, we remind that because of the simultaneous allocation and nomination, capacity holders and users are the same.

	Total number of participants to the allocation procedure	Total number of capacity holders
Austria – Switzerland	*NA*	*NA*
Switzerland – Austria	*NA*	*NA*
France – Switzerland	*NA*	8
Switzerland – France	*NA*	9
Germany – Switzerland	*NA*	*NA*
Switzerland – Germany	*NA*	*NA*

Table 29 : Available and used capacity

For borders where intraday capacities are not available, the “average available capacity” is calculated by subtracting nominated netted capacities from NTC. This is not necessarily exactly what would have been offered by TSOs if an intraday product was available (the capacity might be reduced from time to time), but it should be a tolerable assessment of the amount of capacities that could have been offered to the market.
In some directions the average available intraday capacity is very important. This can be explained by nominated flows going in the opposite direction most of the time.

	Average available intraday capacity (MW)	Average intraday capacity used (MW)
Italy – France	2953	*NA*
France – Italy	380	*NA*
Italy –Austria	264	*NA*
Austria –Italy	16	*NA*
Italy – Slovenia	465	*NA*
Slovenia- Italy	46	*NA*
Italy – Greece	268	*NA*
Greece- Italy	341	*NA*

4. Capacity calculation and management of cross-border flows

The question of capacity levels is a very difficult one, and a major challenge for the development of the European energy market.
The challenge in the short term is to optimise the use of existing infrastructure by making available to the market operators "*the maximum capacity of the interconnections and/or the transmission networks affecting cross-border flows […], complying with safety standards of secure network operation*" (Article 6(3) of Regulation (EC) No 1228/2003). At present, however, we have to aknowledge that there is great disparity between the information available to regulators and TSOs on the margins for manoeuvre actually available to the TSOs to increase the interconnection capacity available to the market operators.
In the longer term, the challenge is to develop new transmission infrastructure. This requires, on the one hand, major coordination by the TSOs to identify actual investment needs, and on the other, the simplification of authorisation procedures for the construction of new lines, and finally, coordination between the regulators on financing investment.

a. Principles of the capacity calculation method by TSOs

General capacity calculation procedure
The assessment of the transmission capacity on the northern Italian border is jointly performed by the involved TSOs within the activities of the technical working table.
The security analyses are performed adopting the N-1 security criterion on the grids under the control of the involved TSOs. An Alternate Current (AC) load-flow algorithm is used. The NTC assessment is carried out on the basis of network datasets, called "*base cases*", processed in order to represent the forecast reference status of the interconnected network at the time frames considered. These cases are built on real and complete UCTE data sets properly selected. The NTC is assessed on a yearly basis during the year Y with reference to the year Y + 1,

Table 30 : Transmission reliability margin
By definition, the Transmission Reliability Margin (TRM) is a security margin that copes with uncertainties arising from:

- Unintended deviations of physical flows during operation due to the physical functioning of load-frequency regulation.
- Emergency exchanges between TSOs to cope with unexpected unbalanced situations in real time.
- Inaccuracies in data collections or measurements.

TRM is then associated to real time operation, being its value calculated by each TSO. In order to guarantee the operation security of its own power system. Thus, TRM can vary seasonally or may be updated due to modifications occurred in the power system.

	Average TRM computed by the exporting TSO (MW)	Average TRM computed by the importing TSO (MW)
Italy – France	??? (Ask your TSO)	100
France – Italy	100	??? (Ask your TSO)
Italy –Austria	??? (Ask your TSO)	??? (Ask your TSO)
Austria –Italy	15	??? (Ask your TSO)
Italy - Slovenia	??? (Ask your TSO)	??? (Ask your TSO)
Slovenia- Italy	??? (Ask your TSO)	??? (Ask your TSO)
Italy – Greece	??? (Ask your TSO)	0

Greece- Italy	0	??? (Ask your TSO)

For TERNA, the total Transmission Reliability Margin (TRM) is assumed 500 MW, following the operational experience, and is assigned to the complete northern interconnection.

Table 31 : Application of Use-It-Or-Lose-It and netting

As a reminder, the so called "Use It Or Lose It" principle implies that long-term rights are lost if they are not nominated[13] and the netting of long-term capacities allows for long-term capacity nominated in the opposite direction to be reallocated at the daily auctions[14].

In 2008 the UIOLI principle and netting were applied between long term and day-ahead capacities to all Italian borders as well as on the border between Germany and Switzerland. On all the Italian borders the UIOLI principle was replaced by Use-It-Or-Sell-It (automatic resale) 2009. Regarding capacity calculation, the two mechanisms have the same impact.

[13] In order to check whether the UIOLI is applied, the capacity offered at the sub timeframe (for example, day ahead) must take into account the capacity not nominated at the upper timeframe (for example, year ahead)

Example: 50 MW sold in the year ahead auction and only 30 MW are nominated at a particular day: the day ahead auction for that particular day must .offer the ATC computed plus the 20 MW non nominated.

The UIOLI is cumulative with the netting.

[14] In order to check whether the netting is applied, the capacity offered in a direction in the sub time frame (for example, day ahead) must take into account the capacity nominated in the opposite direction in the upper time frame (for example, year ahead)

Example: 50 MW of the year ahead capacities are nominated from A to B for a particular day. In the day ahead auction for that particular day, the capacity offered from B to A must offer the ATC computed plus the 50 MW nominated in the other direction.

The netting is cumulative with the UIOLI.

	Between long term capacity nomination and day-ahead allocation		Between day-ahead capacity nomination and intraday allocation		Between intraday allocation and nomination	
	UIOLI	Netting	UIOLI	Netting	UIOLI	Netting
Italy – France	Yes	Yes	*NA*	*NA*	*NA*	*NA*
France – Italy	Yes	Yes	*NA*	*NA*	*NA*	*NA*
Italy –Austria	Yes	Yes	*NA*	*NA*	*NA*	*NA*
Austria –Italy	Yes	Yes	*NA*	*NA*	*NA*	*NA*
Italy - Slovenia	Yes	Yes	*NA*	*NA*	*NA*	*NA*
Slovenia- Italy	Yes	Yes	*NA*	*NA*	*NA*	*NA*
Italy – Greece	Yes	Yes	*NA*	*NA*	*NA*	*NA*
Greece- Italy	Yes	Yes	*NA*	*NA*	*NA*	*NA*

b. Net transfer capacity

Table 32 : Evolution of the net transfer capacity

The data given in the following table give insights about the way the NTC computed two days before the delivery day evolves compared to the previous years.
The average permits to judge whether the capacity increase or decrease.
The standard deviation permits to understand whether the daily NTC evolve in a range close to the average.

	2008		2007		2006	
	Average NTC[15]	Standard deviation	Average NTC	Standard deviation	Average NTC	Standard deviation
Italy – France	1020	104	1020	104	NA	NA
France – Italy	2430	300	2366	481	2407	356
Italy –Austria	84	19	86	11	NA	NA
Austria –Italy	207	12	*NA*	*NA*	*NA*	*NA*
Italy - Slovenia	153	22	153	22	NA	NA
Slovenia- Italy	365	73	365	76	375	49
Italy – Greece	451	139	434	169	NA	NA
Greece- Italy	451	140	431	172	475	108

The previous comparison enables to know whether the net transfer capacity is stable for a year to another and whether within a year the net transfer capacity varies in an important way. This allows us to appreciate the difficulty for TSOs to allocate a high level of long-term capacities.

[15] This is the average of the hourly values of NTC D-2 computed in 2008 published on the RTE's website

Table 33 : Comparison between the NTC and the offers made at the long and medium capacity auctions

The indicators computed in the following table are designed to give insights about the risk taken by TSOs in order to optimize the level of long- and medium-term capacities.
The second and third columns enable us to see whether TSOs took actions in order to maintain the level of the allocated capacities and its level and whether reductions occurred and the duration over the year.
The fourth and fifth columns allow comparing the yearly capacity allocated to the capacity that would have been allocated if specific measures (such as curtailments, counter-trading, buy back strategy by TSOs…) were applied less than 1% of the time in one month (about 8 hours in only one month).
The sixth and seventh columns allow comparing the yearly and monthly capacities allocated along the year to the average capacity that would have been allocated if specific measures were applied less than 1 % of the time in every month (about 8 hours every month).

	Number of hours where counter–trading occurred	Number of hours where reductions occurred	Yearly capacity offered	Minimum first percentile observed for one month	Average of the sum of the yearly and monthly capacities offered	Average first percentile observed monthly
Italy – France	123	207	700	870	949	950
France – Italy	0	151	1800	1482	2430	2317
Italy –Austria	*NA*	239	70	0	80	50
Austria –Italy	*NA*	256	182	182	204	200
Italy - Slovenia	*NA*	0	80	120	129	145
Slovenia- Italy	*NA*	68	240	100	346	307
Italy – Greece	*NA*	834	250	0	500	236
Greece- Italy	*NA*	73	250	0	96	236

*Non available

Remark: Those figures enable to know the importance of countertrading actions undertaken by TSOs to guarantee the firmness of allocated capacities or nominations, as well as the occurrence of the reductions. They also enable to compare the offered capacities (yearly and monthly) to the level of capacity that could be made available with a small and arbitrary level of redispatching. Nevertheless, it should be highlighted that to be able to correctly assess to which extent TSOs are maximizing or not the level of long and medium capacities, further information would be needed regarding the cost of additional redispatching actions.

c. Costs for ensuring the compatibility of the cross-border flows with grid security

TSOs regularly have to deal with situations where not all the long-term capacities they have allocated can be physically used, because that would jeopardise the safety of the grid. Five tools are potentially available for them to cope with these constraints:

- Repurchase of capacities by the TSOs: the TSOs could participate in the secondary market like any other operators, enabling them to buy back the “excess” capacity allocated to the market operators. For the TSOs this means outsourcing the management service of the secondary market, which has to be provided in the form of an anonymous organised market. At present this facility is not available to the TSOs.
- Curtailment of the allocated capacities: subject to payment of compensation, holders of long-term capacities can have some of their transfer rights reduced.
- Countertrading by the TSOs on D-1: the TSOs could use existing allocation mechanisms to trade in the opposite direction to the price differential, to remove the constraint. This would be

particularly easy in a market-coupling situation because it is the TSOs who convey the trades, but this procedure is not used at present.

- Redispatching: the TSOs can activate offers through the balancing mechanisms on both sides of the border, to lift the constraints.
- Changing the topology of the grid: the TSOs can use phase-shifting transformers installed on certain lines to redirect flows on the grid in real time.

Not all these tools are equivalent or as effective as one another for dealing with the constraints. Repurchasing capacity and reducing capacity only work if the decision to do so is made far enough in advance – and in any case before the long-term capacities are nominated – as a *preventive* measure that helps to guarantee the safety of the grid. To the extent that they can only have an indirect impact on the physical flows, without any guarantee that the change this causes to the physical flows will actually lift the constraint, these tools cannot in any way be seen as last-resort curative solutions to guarantee the safety of the grid.

On the other hand, since they have a direct impact on the physical flows and on the constraints, redispatching and changing the topology of the grid are the only effective curative actions to guarantee the safety of the grid approaching real time.

All these tools have a cost for the TSOs: for example, installing phase-shifting transformers to change the grid topology amounts to a substantial fixed cost. Redispatching also has a cost, which is that of the offers activated in the balancing mechanism. These offers have to be activated in increasing price order so that, in accordance with point 1.3 of the new guidelines for Regulation (EC) No 1228/2003, the action taken by the TSOs is economically efficient. Economical efficiency of activated offers depends apart from their price also on their technical efficiency which is determined by their location according to the congestion.

Similarly, capacity curtailments are also at a cost to the TSOs, which have to compensate the operators who lose their rights. The current compensation scheme for continental interconnections is the rule known as the '110% rule': the loss of an allocated transfer right is compensated at 10% of its initial value, in addition to its reimbursement. The implementation of a compensation scheme that pays the day-ahead market price differential is being considered.
In the same way, capacity curtailment costs can be shared between TSOs involved in the operation. However it may be difficult to determine the real cost occurred for each of them in a meshed network.

Table 33 – Redispatching costs
This table shows the total redispatching costs for each TSO.

	Redispatching costs (M€)
Austria	0
France	40.6
Germany	44,2 M€
Greece	3,6 [16]
Italy	approx 85 M€
Slovenia	*NA*
Switzerland	NA

Table 344 – Cost of ensuring compatibility of cross-border flows with grid security
When the TSOs cannot ensure the physical capacities that have been sold and/or nominated, they use mainly two different tools:

- Coordinated redispatching/countertrading : this means that TSOs pay generators on each side of the border to produce less/more power, so that more physical capacity is available. This measure assures physical rights and have no impact on capacity holders.
- Compensation for curtailments : in CSE, long term capacities can be curtailed before nomination. The holder is then compensated at 100-110% of the clearing price.

The cost of the use of these tools are listed in the table below.

[16] This is only an estimation of the redispatching cost

High costs do not necessarily mean that too much capacity has been allocated. On the contrary, for high-value capacities, the need for countertrading/curtailment shows that the TSOs have been taking necessary risks to offer more of a scarce resource to the market. This table could be compared to table 10, which shows the assessed capacity value for all the border and directions.

	Coordinated redispatching / counter-trading costs	Compensation for curtailments (k€)	Compensation for auction cancellations (k€)	Capacity buying back costs
Italy – France	0	0	0	0
France – Italy	1.2	1 668	310	0
Italy –Austria	*NA*	*NA*	*NA*	*NA*
Austria –Italy	0	*NA*	-	*NA*
Italy - Slovenia	*NA*	*NA*	*NA*	*NA*
Slovenia- Italy	*NA*	30,8	30,8	*NA*
Italy – Greece	*NA*	*NA*	*NA*	*NA*
Greece- Italy	0	13,77	0	*NA*

Methodology for sharing the redispatching costs

d. Curtailments occurred in 2008

Table 35

	Number of curtailments	Average duration (h)	Number of impacted days	Average capacity curtailed (MW)
Italy – France	0	0	0	0
France – Italy	3	50	8	644
Italy –Austria	*NA*	*NA*	12	72
Austria –Italy	*NA*	*NA*	20	1904
Italy - Slovenia	*NA*	*NA*	0	0
Slovenia- Italy	*NA*	*NA*	4	140
Italy – Greece	*NA*	*NA*	36	349
Greece- Italy	10	7,3	10	245