The relevance of cross-border transmission capacities for competition in the continental European electricity market

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Abstract: Competition in the European electricity markets is stagnating. To intensify cross-border competition, many experts and publications by the European Commission and other European organisations call for extensions of cross-border *transmission* lines. Yet, the arguments for conducting these investments are poor. The core objective of this paper is to analyse the relevance of cross-border transmission lines for competition in an integrated Continental European electricity market and to discuss future options for enhancing competition.

Keywords: Central Europe; competition; cross-border trade; electricity market; transmission capacity.

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1 Introduction

The restructuring process of the European electricity market was triggered by the European Commission(EC) Directive 96/92 "Concerning Common Rules for the Internal Market in Electricity" (EC, 1997). The major motivation for this directive was the EC's conviction that liberalisation, price deregulation and privatisation would directly lead to competition in both generation and supply, finally resulting in price cuts in entire Europe.

Yet, prevailing high price differences among countries and the low level of cross-border trade point to the conclusion that currently the market lacks liquidity and market integration remains insufficient. In its latest report on progress in creating the internal gas and electricity market (CEC, 2006),the EC again underlines that

> "all Member States therefore need to consider carefully how to … taking an active approach to ensuring the existence of adequate and available interconnection capacity. … At the same time, the Commission and national regulators will accelerate their efforts … to deal with a number of technical issues such as cross-border trading mechanisms, balancing, etc".

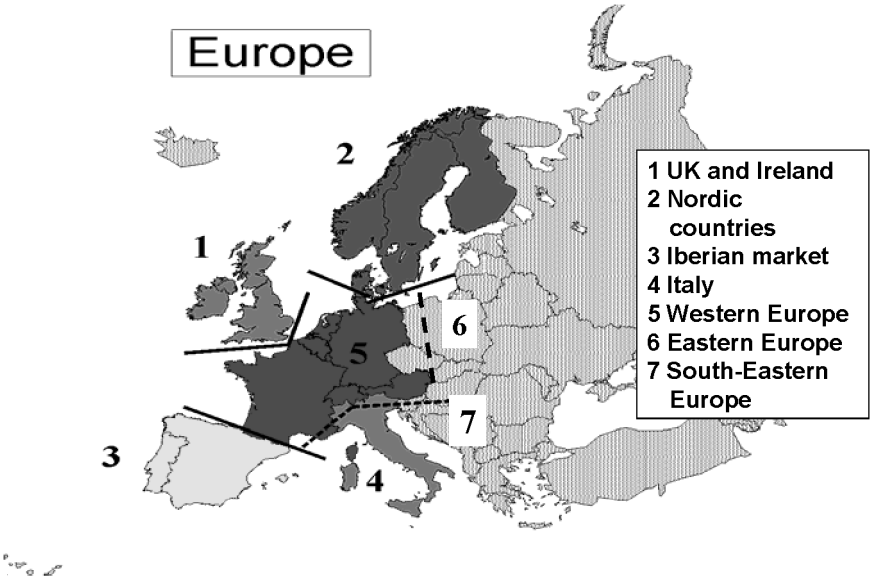
The initial intention of the EC was, and still is, the creation of one common European electricity market. But today the region still hosts at least seven different sub-markets, see Figure 1, which are separated by inadequate transmission lines and have different conditions for access to the grid.

Moreover, another major obstacle for a common market that works reasonably is a general lack of competition in virtually all local and national wholesale electricity markets. The number of competitors is too low, or barriers to entry are too high, or incentives to collude are too high. This aspect is being reinforced by two others: frequently limited transmission capacity between the sub-markets and lasting long-term contracts.

Due to the EC's Sector Inquiry (CEC, 2006), the lack of market integration mainly results from:

- insufficient interconnecting infrastructure between national electricity systems
- insufficient incentives to improve cross-border infrastructure
- inefficient allocation of existing capacities
- incompatible market design (e.g. differences between balancing regimes) between Transmission System Operators (TSOs) and/or spot market operators.

Figure 1 Electricity sub-markets in Europe in 2005



The crucial questions with respect to an economically optimal use of existing interconnectors are (CEC, 2000):

- How can the available transmission capacities be maximised in the short run?
- What are the fair rules for allocating transmission capacities?
- How should TSOs deal with long-term capacity reservations arising from long-term contracts?
- How can it be ensured that the system creates sufficient incentives for building new cross-border transmission lines?
- How can it be ensured that economically correct price signals for the use of scarce cross-border transmission capacities are provided for the users?

The core objective of this paper is to analyse the relevance of cross-border transmission lines for competition in an integrated Continental European[1] electricity market and to discuss future options for enhancing competition [see also Bergman et al. (1999), Glachant and Finon (2003), Glachant and Lévêque (2005) as well as a special issue of the *Energy Journal* (2005)].

The paper is organised as follows: In Section 2 some basic fundamentals of the role of transmission for competition are presented. Section 3 provides a survey on the development of institutional and legal aspects of restructuring. In the following section the situation of European transmission as well as the corresponding import/export figures are depicted. Section 5 examines the conditions for current cross-border transmission pricing and the impact of explicit auctions results on price differences between countries. In Section 6 the effects of transmission capacities on competition are analysed. A discussion of the future perspectives, especially the contradiction between the wishful thinking of European Union (EU) politicians and the objectives of investors in real life, is provided in Section 7. Conclusions complete this paper.

2 Some basics of cross-border electricity trade

In this Section some basic reflections on the role of cross-border transmission capacities for the magnitude/intensity of competition are presented. These fundamental thoughts are essential for the understanding of the following discussion[2].

First and foremost, the initial core motivation for constructing transmission capacities was and is to transport electricity over longer distances, e.g. from large hydro power plants to consumers (cities, large industries) far away.

The basic underlying economic condition is that the costs of the transmission line C_{TM} and the generation costs in A, C_A, are lower than the generation costs C_B in B:

$$C_{TM} + C_A < C_B$$

In addition, over time technical supply security became important and led finally to a meshed structure of the transmission grid including cross-border lines. In Central Europe, this applied especially with focus on former Western Europe and only very few lines crossed the iron curtain.

At that time of course, the full costs (including the investment costs) of the transmission line and power generation were included in the electricity price – based mainly on the so-called cost-based regulations.

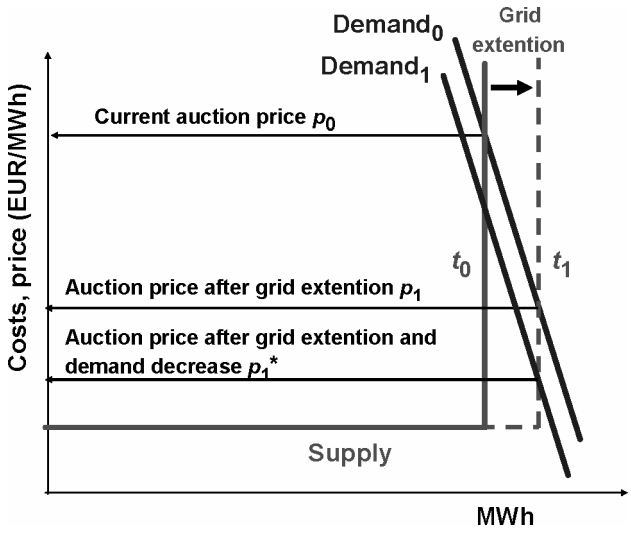
Regarding the relevance of transmission capacity for competition, the idea for a workable competitive electricity market is that the larger a market is, the more competitive it is. The generators and suppliers are exposed to competition on either side of a border through interconnectors. Hence, an important prerequisite for a sufficiently large market is that there are sufficient transmission capacities to neighbour regions. One motivation of the EU Directive (European Commission, 1997) was that cross-border electricity exchange should drive prices down to the level of the minimum required cost to serve electricity demand in Europe. That is the reason why a more effective use of respectively an extension of cross-border transmission capacities are considered to be of major relevance for fostering competition in the European electricity market.

The question is: When will these cross-border capacities contribute to competition? The answer is: trade from A to B only takes place if the sum of generation costs plus transmission fee in A is lower than the generation costs in B. Hence, a moderate grid fee is important for an intensified trade and this can only be brought about by low congestion due to excess capacities in transmission.

Second condition: sufficient excess capacities exist in market A and sufficient transmission capacities must be available between A and B, respectively, and can be provided at a price ($C_{TM} < P_B - C_A'$).

With respect to cross-border transmission pricing in a competitive environment, the core question is, of course, what the correct magnitude of the grid fee is. As Figure 2 depicts at a certain point of time, t_0, the intersection of demand and supply result in the current auction price p_0. Let us now assume that the grid is extended or an upgrade of a transmission line is conducted. What will be the effects on the price if an auction takes place now at t_1? Now, of course, a lower auction price will emerge due to two effects. First, static transmission fees for this connection will drop to p_1; second, the difference between the market prices in the two regions will decrease and hence make it less attractive to use this line for trade. So the demand goes down and, hence, the transmission price decreases further to p_1*.

Figure 2 Auction prices for cross-border transmission lines before and after a grid extension



3 Institutional issues of restructuring

In this section it is described how the legal and institutional issues regarding the role of the transmission grid for enhancing competition changed in the course of the European restructuring process. As already mentioned the restructuring of the Central European electricity market was triggered by the EU- directive (EC, 1997), which came into force in February 1999.[3] Before 1990, all electricity supply industries in Central European were – more or less – vertically integrated with a captive franchise market. Regulated area monopolies prevailed in all countries.

Although electricity networks were typically synchronised over wide areas, interconnections among different transmission systems were guided by technical supply security rather than economic considerations.

When setting up new guidelines for the transmission network, the European focus was rather different from the approach in the USA. While in the USA the focus was put on correct market prices for using the transmission grid, the European emphasis was 'to provide access to the market'. Less attention was paid to issues like restructuring of generation and supply and the design of market places, as well as ensuring adequate generation and transmission capacities.

Upon the emergence of the idea of an internal electricity market in the EU, the need for an EU-wide harmonisation of network access and conditions for usage, especially for cross-border electricity trade, was recognised. In 1999, the European Transmission System Operators Organisation (ETSO) was founded and became an international association in 2001. During the past few years there has been a growing demand in Europe for increased transparency on the data that is held and managed by TSOs. ETSO is providing market data at the European level on Net Transfer Capacity (NTC), interconnectors, grid availability, load and generation.

ETSO started to address the topic of inter-TSO compensation for cross-border trades and transits in 1999, followed by the build-up of complex cost calculation models. Finally in 2000, the member TSOs agreed to introduce a unique cross-border trade tariff to finance the ETSO compensation fund. This tariff was reduced from 1 EURO/MWh to 0.5 EURO/MWh in 2003. Since then and based on the agreements achieved at the annual Florence Forum meetings, ETSO proposes an annually modified mechanism to compensate the use of national transmission systems by Cross-Border Trade (CBT) mechanism. In 2004, CBT export fees were completely removed and the compensation fund is now financed by injection fees from perimeter countries and 'net flow' charges (charge levied on net flow in export or import directions). Since then, the market-based methods as required by the EC regulation 1228/2003 have been gradually implemented.

In November 2003, the European Regulators' Group for Electricity and Gas (ERGEG) – a body of independent national energy regulatory authorities – was set up by the EC as an Advisory Group to the Commission on energy issues. Its objective is to advise and assist the Commission in consolidating the internal energy market and, to help ensure a consistent application in all Member States of the Electricity and Gas Directives, as well as the Regulation (1228/2003) on cross-border exchanges of electricity.

In this respect, the Electricity Regulatory Forum of Florence, organised by EC, has been successful in bringing together different stakeholders to discuss and build some consensus on how to overcome problems constraining the formation of the internal electricity market. The forum convenes once or twice a year, formerly in Florence but now in Rome. The first meeting was held in 1998.

However, despite publishing a number of documents outlining technical problems and possible solutions for transmission pricing and congestion management, the progress of the Florence Forum so far has been slow, which is not surprising taking into account the number and diverse interests of its participants.

The major milestones of cross-border transmission and competition issues in Europe are summarised in Table 1. Before market opening, cross-border transmission tariffs at different magnitude were levied for electricity transfer across national borders. However, they are not compatible with the principles of a common market area approach, since they would combine countries that have progressed in market liberalisation at different paces. Thus, cross-border tariffs endanger the creation of a competitive internal market area within the EU.

Table 1 Milestones of cross-border transmission and competition issues in the European Union

February 1997	EU-15	This '*Directive concerning common rules for the internal market in electricity*' (Directive 96/92/EC) became valid while waiting up to two more years for its transposition by countries
February 1999	EU-15	Directive went into force after a 2 years transposition delay: market opening due the directive in Austria, Belgium, France, Italy, Spain, Portugal and The Netherlands between 30% and 35%
December 2001		*EC 'Report on the **implementation of the guidelines for Trans-European Energy Networks** in the period 1996-2000*'
June 2001		Formal Establishment of ETSO
2001	EU-15	Approval of the 'Directive of the European Parliament and the Council on the promotion of electricity from renewable energy sources in the internal electricity market (RES-E Directive)' (European Parliament and Council, 2001 – Directive 2001/77/EC)
2002		ETSO Model: CBT export fee set at 1 EUR/MWh
July 2003	EU-25	Approval of the '*Directive concerning common rules for the internal market in electricity*' (officially Directive 2003/54; usually named 'the Second Directive')
July 2003	EU-25	EC '*Regulation on conditions for access to the network for cross-border exchanges in electricity*' (**Regulation 1228/2003**)
July 2003		**Decision No 1229/2003/EC** '*laying down a series of **guidelines for trans-European energy networks** and repealing Decision No 1254/96/EC '*
2004	EU15+10	Extension of the EU to 25 member countries, new Continental Europe member countries to open their market with 30 % minimum.
2004		ETSO removes CBTM fee
2004	EU 25	Electricity Directive 2003/54 due to be transposed by member states
		All non domestic customers made eligible in the EU in July 2004
		An EU Regulation on cross-border electricity trade came into effect (Regulation 1228/2003) in July 2004
May/June 2005		ERGEG Public Consultation on '***Transmission Tarification Guidelines***'
May/June 2005		ERGEG Public Consultation on '***Congestion Management Guidelines***'
June 2005		The Commission launched an '***Energy sector inquiry***'. The final results of the inquiry are expected in 2006, intermediate results are discussed in the issues paper of 15 November 2005.
November 2005		**DRAFT** '***Commission Decision** amending the Annex to Regulation (EC) No 1228/2003 on conditions for access to the network for cross-border exchanges in electricity*' including guidelines for congestion management

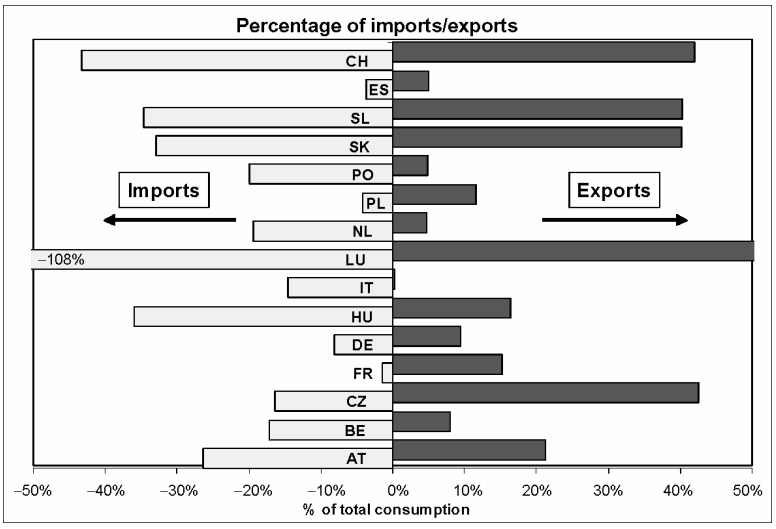
4 Development and current state of cross-border electricity flow, Transmission capacities and bottlenecks

To get an impression of the current relevance of cross-border electricity trade, it is important to analyse the state-of-the-art. This chapter investigates the recent development of physical electricity flows, transmission capacities and the major bottlenecks between different countries.

4.1 Imports and exports

The share of import and export in total electricity consumption of European countries is depicted in Figure 3. Small countries like Switzerland, Austria, the Czech Republic, Slovakia or Luxemburg – about 20% of their imports/exports relate to domestic consumption – transfer the largest proportions to and from other countries.

Figure 3 Imports/exports as percentage of electricity demand in Central European countries



Source: UCTE (2005b).

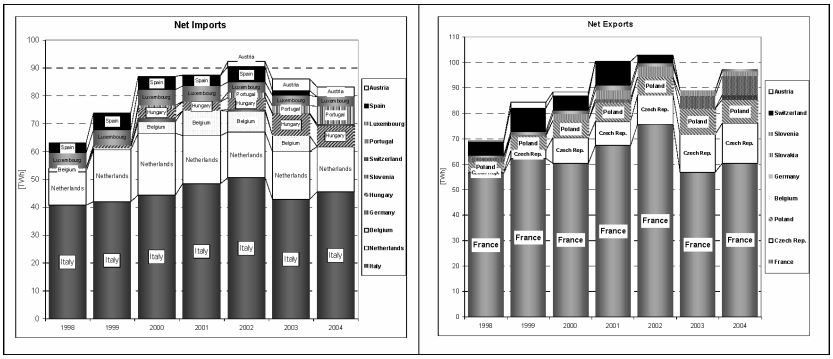
Figure 4 shows the evolution of import and export quantities since the start of the liberalisation process. There has only been a modest increase yet, all but a dramatic rise.

4.2 Development of cross-border transmission load and capacities

The bigger part of the transmission networks in Europe was built between 1950 and 1990 prior to the introduction of market liberalisation and has benefited only from few additions in the years since.

Definitions of cross-border capacities have been agreed within ETSO where two sets of transfer capacities have been defined: for commercial purposes used by market operators to set up contracts for cross-border transactions and for operational purposes, managed by system operators to check that the physical capacity of lines is not exceeded.

Figure 4 Evolution of net imports and net exports over the period 1998–2004



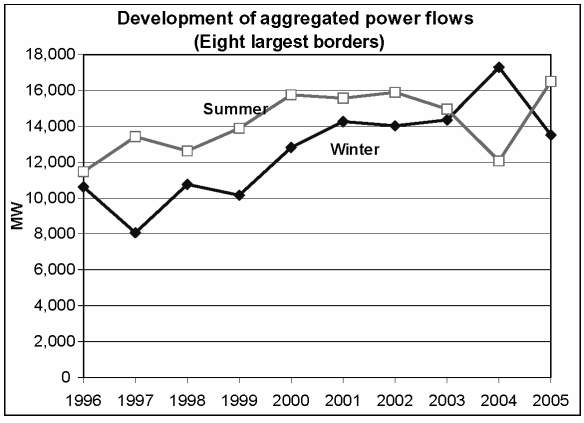
Source: UCTE (2005c).

Table A-1 in the Appendix lists the interconnections between EU countries with the highest percentage of Net Transfer Capacity (NTC) used in 2004. Due to the complexity of the tightly meshed European network, the commercially available capacity differs from the physical capacity. Hence, the net interconnection capacity is defined by ETSO as NTC being 'the maximum exchange programme between two areas compatible with security standards in both areas and taking into account the technical uncertainties on future network conditions'.

Figure 5 shows the corresponding development of load flows in winter and in summer over the past 10 years. The major perceptions of these two figures are:

- The lines with the major load flows are by and large the same in winter and summer; Only exception: AT-DE in summer.
- There is a slight tendency towards an increase in the load at these borders; yet, surprisingly, there is no continuous upward movement of the load flows.

Figure 5 Development of cross-border load flows in winter and in summer over the period 1996–2005 (only the eight largest borders with at least more than 1500 MW load flow once in the last 10 years

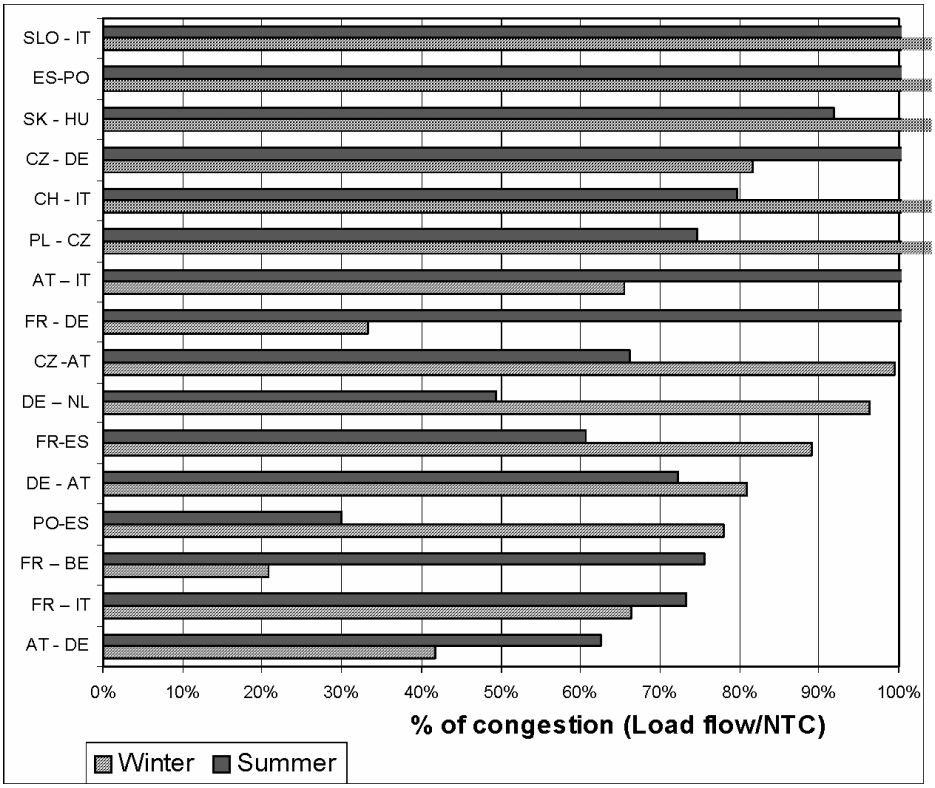


Source: UCTE (2005b).

4.3 Current state of congestion

Figure 6 depicts the major bottlenecks in the Central European transmission grid measured as the percentage of use of transmission capacity per year in 2004 (UCTE, 2005). (For details see Table A-2). Bottlenecks mainly exist in the western and southwestern part of the EU such as between northern and southern France and between France and Spain. However, as demand is growing rapidly, it is expected that further congestion points might also develop.

Figure 6 Major bottlenecks in Central European transmission grid measured as percentage of use of transmission capacity per year in 2004; (For details see Table 3)

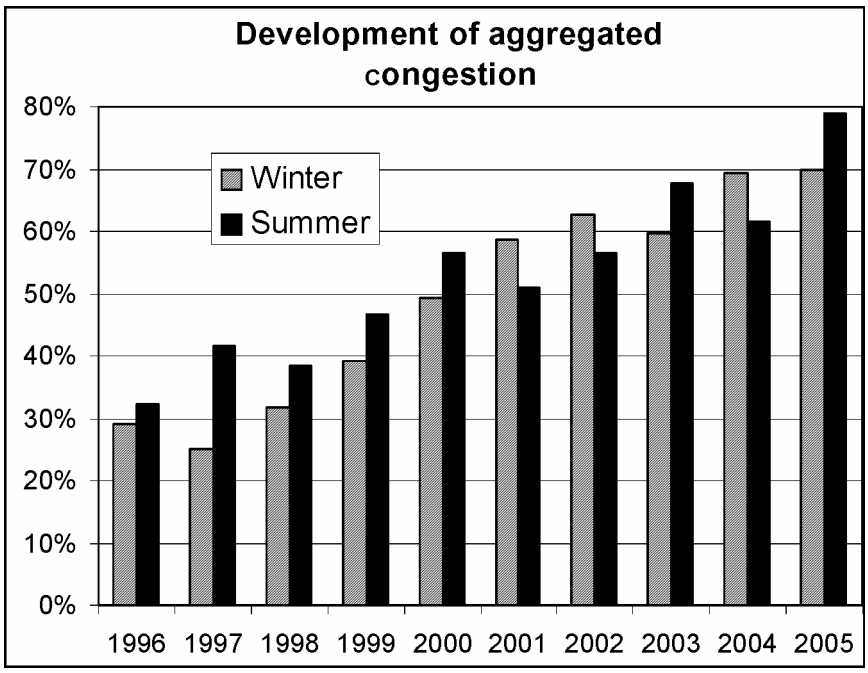


Source: UCTE (2005a).

The most congested lines are located between Italy and its neighbouring countries and between Spain and Portugal, followed by the interconnections between Germany, Austria and the Czech Republic. For a comprehensive discussion of this issue from the EC's point-of-view, see CEC (2006).

The development of cross-border congestion (load flows divided by NTC) in winter and in summer over the period 1996–2005 is shown in Figure 7. Note that only borders with more than 85% congestion in at least one of the past 10 years are considered in this figure. In principle, it can be seen that there was a continuous increase in aggregated congestion since the start of liberalisation.

Figure 7 Development of aggregated cross-border congestion (load flows divided by NTC) in winter and in summer over the period 1996–2005 (only border with more than 85% congestion in at least once in the past 10 years)



Source: UCTE (2005a).

In principle, congested lines need to be managed in a special way in order to use scarce capacity efficiently in economic terms. The existing Central European network was built to guarantee a high level of technical reliability and to give some room for managing peak load problems. Now, in a competitive system, it is supposed to produce price convergence in a single European market perspective.

Available interconnector capacity is related to the performance of TSOs who are responsible for system integrity in their control area and hence calculating the NTC for import and export. The results of the energy sector inquiry 2005/2006 carried out by the EC show that values have remained almost unchanged over the past 30 months.

The construction of additional interconnector capacity requires incentives properly set by regulators in a stable regulatory framework, since market design might change over time and new generation investments are hard to predict over a long period. TSOs, who in the past had a monopoly on building additional interconnectors, may also invest in new or additional interconnection lines and hence it is important that TSOs have correct incentives. However, in the recent past revenues from capacity auctions have mainly been used to reduce national grid tariffs. For example, as the EC points out in its preliminary report on the Energy Sector Inquiry, 'In the period 2001 to 2005 three German TSOs managing interconnectors generated congestion revenues of [400–500] million Euro. Of these revenues only [20–30] million Euro were used to reinforce/build new interconnectors'.

In addition to the investigation of the cross-border flows within Central Europe, it is also of interest to look at the transmission capacities to neighbour regions. Yet, these are very small. Due to ETSO (2005), these are: UK (2,000 MW), Sweden (1,150 MW), Denmark (1,750 MW), Morocco (400 MW), Southeastern Europe (2,100 MW) and the Eastern border to Ukraine (1,655 MW).

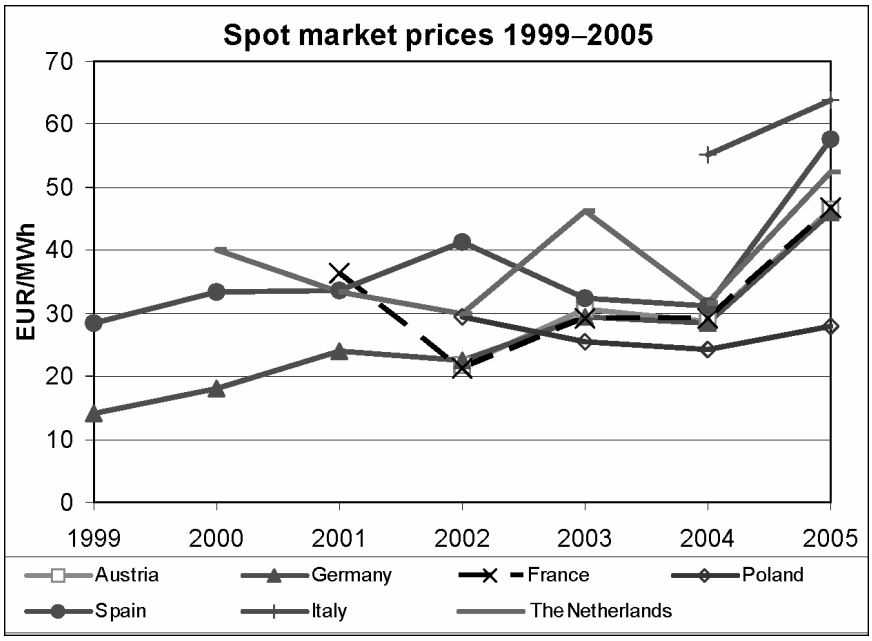
5 Impacts of cross-border transmission capacigties on wholesale electricity price development

After the documentation of the physical state-of-the-art of cross-border, it is next of interest how these physical conditions effect the wholesale electricity prices in different sub-markets. Moreover, the (economic) method allocating cross-border transmission capacities are analysed in this chapter.

5.1 Wholesale electricity prices

Figure 8 shows the evolution of spot market prices in Europe from 1999 to 2005. With the exception of Italy, a certain convergence of spot market prices is visible. Moreover, while volatility in 2002 and 2003 were rather high, it became moderate during 2004. In the first half of 2005, prices in Western markets increased, while prices in Poland have remained stable since 2004. Note that over the whole period of time, virtually no price difference could be observed between Germany, France and Austria.

Figure 8 Spot market electricity prices in Continental Europe 1999–2005



From Figure 10 we can derive the following perceptions:

1 Prices have increased since the start of liberalisation.

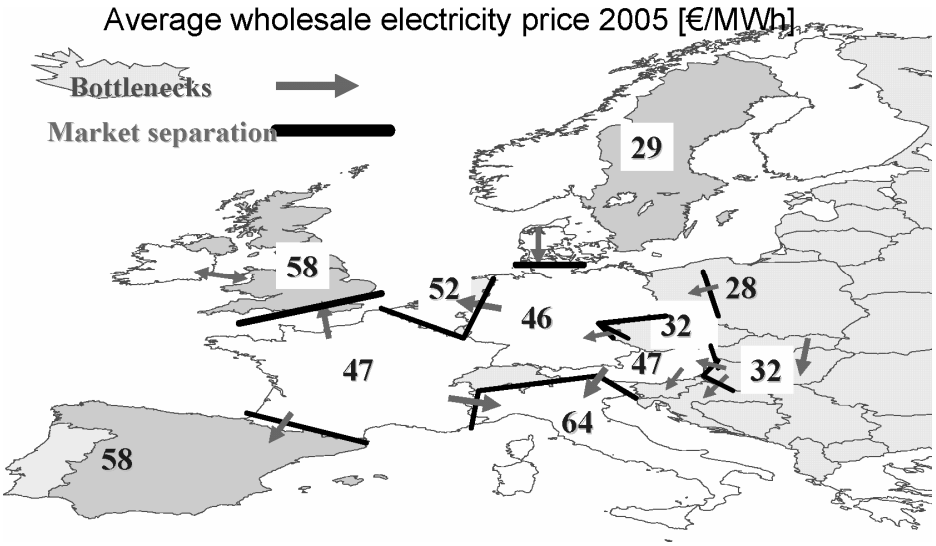
2 The highest prices are found in areas where capacity margin is low and cross-border transmission capacity is restricted (Italy, The Netherlands).

3 Prices were highest in years with low hydro or low nuclear availability.

4 Wholesale prices tend to increase and converge in markets interconnected by not congested transmission lines.

Figure 9 portrays the different wholesale spot market prices in 2004/2005 and indicates major cross-border bottlenecks. It can be seen at a glance that the major price differences exist between regions with scarce cross-border capacities.

Figure 9 Average wholesale electricity prices and transmission grid bottlenecks in Central Europe in 2005



5.2 Cross-border transmission pricing

Prior to the intended introduction of the internal electricity market in the EU, cross-border exchanges were negotiated between the incumbent producers and suppliers. Each contract was negotiated separately and tended to be for long-term capacity. In contradiction to the initial goal of the EC concerning the opening of the electricity market, the share of electricity trade carried on interconnectors remains low. The Barcelona Council 2002 set a target for (import) interconnector capacity of at least 10% of production capacity per member state by 2005. To date the gross proportion has not yet exceeded 11% (UCTE, 2005), though border-specific values differ substantially.

The main constraint to the formation of the internal electricity market is that the volume of cross-border exchanges is limited by the transmission capacity between each national grid and its neighbours. In addition, many TSO seem reluctant to significantly

improve transmission capacities and, also, regulators failed to reach a consensus on this issue in the Florence Forum 2004. Consequently, the European Regulators Group for Electricity and Gas (ERGEG) held seven mini-fora in order to at least agree on guidelines in the separate regional markets, which have emerged since the start of the liberalisation process.

As Glachant and Lévêque (2005) note, many interconnections were managed by administrative rules without economic bases. Roughly half of the interconnection between countries of Continental Europe was managed by theses mechanisms. The European Commission reacted to this situation with the Regulation 1228/03 on '*Conditions for access to the network for cross-border exchanges in electricity*', which clearly states that market-based congestion management methods are preferred. Currently, the guidelines for congestion management, as a decision amending the Annex to Regulation 1228/03, are being discussed in the member states.

The congestion mechanisms to allocate interconnector capacity play an important role in market integration. The word (congestion) mechanism refers to a set of actions and measures that are applied to handle network access in the presence of congestion. The most commonly used market-based mechanisms are explicit and implicit auctions. Non-market-based solutions comprise first-come-first-serve (priority list) and pro-rata rationing.

In explicit auctions, along with the requested capacity amount, the applicants have to declare how much they are willing to pay for this capacity. These bids are ordered by price and allocated starting from the highest one until the available capacity is used up. Usually, the price for the capacity is set to the bid price of the lowest allocated bid.

In implicit auctions, transmission capacity is managed implicitly by two or more neighbouring spot markets: network users submit purchase or sale bids for energy in the geographical zone where they wish to generate or consume, and the market clearing procedure determines the most efficient amount and direction of physical power exchange between the market zones. Hence, separate allocation of transmission capacity is not required; cross-border capacity and energy are traded together.

Although the implementation of market conform methods for congestion management, mainly explicit auctions, has already commenced, the development appears not to be in direction of the IEM as originally supposed. On the contrary, the price differences at specific borders have aggravated since, as Figure 11 shows. It should also be kept in mind that ETSO set a Cross-border Tariff at 1.0 EUR/MWh in 2000, reduced this amount to 0.5 EUR/MWh in 2003 and finally removed export fees from the cross-border trade mechanism in 2004.

Table 2 contains price-determining parameters at control area borders with relevant cross-border transmission constraints.

The highest price paid at for a base load profile for the year 2006 was 179.8 EUR/MW at the Polish/German interconnection, corresponding to 20.53 EUR/MWh, which is almost about 40% of the EEX base load future price 2006.

The figures also indicate a decline in prices south to northeast in geographical terms. It can be assumed that market prices in countries with excess production such as Poland or Czech Republic are, due to the prices increase imposed by auctions, are significantly below the market prices, e.g. in Italy.

Table 2 Explicit auction results at cross-boder interconnectors (base load, year 2006)

	Value [EUR/MWh]	*Obtained capacity [MW]*
UK → FR / FR → UK	0.48 / 22.50	800 / 800
DK → DE / DE → DK	4.77 / 0.92	350 / 200
BE → NL / NL → BE	4.70 / 0.11	328 / 327
DE → NL / NL → DE	7.14 / 0.07	572 / 572
DE → FR / FR → DE	1.01 / 0.61	1499 / 899
DE → CH / CH → DE*	11.0 / 0.15	1000 / 1000
FR → ES / ES → FR*	1.16 / 5.01	1400 / 600
FR → IT / IT → FR	7.68 / NA	400 / NA
PL → DE, CZ, SK	20.53 / 0.73	485 / 97
CZ → DE / DE → CZ	12.56 / 0.00	1053 / 685
CZ → AT / AT → CZ	13.70 / 0.00	50 / 550
HU → AT / AT → HU	8.20 / 0.13	100 / 100
SLO → AT / AT → SLO	2.24 / 0.44	96 / 145
CH → AT / AT → CH*	0.00 / 9.01	550 /250

*Monthly auction January 2006.
Source: TSOs, auction offices.

Especially, the treatment of congestions at Austrian and Swiss borders should be critically reviewed, where north–south transmission lines suffer sufficient transfer capacity. Swiss TSOs implemented a balancing group system in 2006, which caused the termination of the prevailing self-restriction. Consequently, capacity auctions have been introduced and the borders to Germany and France and, lately, Austria. This situation was aggravated by clumsy preparation and untouched long-term contracts. Swiss authorities refuse to apply European Law since its non-membership to the EU.

As competition is likely to be hampered by protecting national economies through expensive cross-border auctions, this will make the future business for international traders and suppliers more difficult

6 Effects of transmission capacities on competition

With respect to the impact of transmission capacities on competition, two issues are of core relevance:

1 Interaction between generation capacities in a market and the transmission capacities between this market and other neighbouring markets.

2 Market structures/mergers/concentration.

6.1 Interaction of generation capacities, transmission capacities and cross-border market concentration

Of core relevance for prospering competition is that there is an interaction between generation capacities in a market and the transmission capacities between this market and other neighboring markets. As already mentioned, a suitable magnitude of transmission capacities can stimulate competition in a country significantly.

Table 3 depicts the current market structure in Central European countries. In most countries, market structure is highly problematic, particularly when the national grid is poorly connected with adjacent markets. It is of specific interest that potential imports vary considerably. The small countries Luxemburg, Slovakia, Slovenia, Austria and Hungary have a potential of more than 70%. In the large countries such as Spain, France, and Italy, the potential is less than 20%.

Table 3 Market shares of largest generators in various countries 2004

	Largest (%)	*3 largest (%)*	*Import potential (TWh, %)*	*Largest generator*	*Second largest generator*	*Third largest generator*	*Fourth largest generator*
AT	53	76	37.7 (73%)	VERBUND (53%, 29.8 TWh)	TIWAG (13%, 6.7 TWh)	WIENSTROM (10%, 5.8 TWh)	EStAG (9%, 5.0 TWh)
BE	85	94	40.3 (46%)	ELECTRABEL (85%, 75 TWh)	SPE (9%, 8 TWh)		
CZ	73	82	30.7 (50%)	CEZ (73%)	Pražská teplárenská (5%)	Energotrans (4%)	Dalkia (3%)
DE	34	71	122.6 (28%)	RWE (34%)	E-ON (23%)	Vattenfall (14%)	EnBW (10%)
FR	89	94	106.9 (19%)	EdF (89%, 487 TWh)	CNR (3%, 16 TWh)	SNET (2%, 9 TWh)	
HU	46	65	27.2 (71%)	MVM (46%)			
IT	46	65	52.6 (16%)	ENEL (46%, 165 TWh)	Edison (12%, 20 TWh)	Edipower (7%, 10 TWh)	Endesa (6%, 5 TWh)
LU	65	90	8.8 (139%)	Cegedel (65%)	Sotel (25%)		
NL	25	80	41.2 (37%)	Electrabel-Ned (17.9 TWh)	ESSENT (14.65 TWh)	NUON (14.5 TWh)	E-ON Benelux (9.9 TWh)
PL	30	52	30.7 (21%)	BOT (30%)	PKE (13%)	Kozienice (9%)	PAK (9%)
PO	65	80	8.8 (19%)	SEP	SENV		
SK	84	89	26.3 (101%)	Slovenske Elektrarne (26 TWh, 84%)	PPC (3.5 %)	TEKO (1.4 %)	
SL	54	98	18.4 (150%)	HSE (7.1 TWh, 54%)	ELES/GEN (5.2 TWh, 39%)	TET (0.6 TWh, 5%)	
ES	39	78	19.3 (8%)	Endesa (39%)	Iberdrola (28%)	Union Fenosa (11%)	Hidrocantabrico (7%)
CH	26	53	74.9 (137%)	NOK (25%, 15.9 TWh)	BKW (15%, 9.4 TWh)	ATEL (13%, 8.3 TWh)	EWZ (7%, 4.3 TWh)

Source: Company reports, Power in Europe, personal information.

CEC (2006) states: 'Imports should also play a role in eroding the market shares of major generation companies in wholesale electricity markets. ('competitive fringe'). However, with few exemptions (e.g. Italy, The Netherlands, Poland) the incumbent's market shares have remained as high as before liberalisation …. The need for imports is even more important knowing that market entry by new players who started supply or generation activities in countries in which they were previously not present was hardly observed in EU member States during the liberalisation'.

To enhance competition in Eastern Europe, a deeper regional integration could be a way out of this world of currently small, segmented and distorted local markets. A regional approach to market design and restructuring would be an improved solution compared with the national individual approach taken by most countries. Companies that are large on a national basis would be small, or at most medium-sized, on a regional scale. Effective regional markets could offset the limited competition within national markets, but require suitable cross-border and balancing arrangements. The limitations of this approach are that by increasing the relevant market size all indicators would look better, without any change in competitive settings. Kaderjak (2005) argues, that '*…the finding that local competitive fringes are massive importers even in large exporting countries indicates the outstanding importance cross-border trade may play in further market integration in the region*.' Most important for such a competitive fringe are the low transaction costs for access to the grid and to the market place.

Moreover, the situation with respect to competition in the Eastern border countries is not promising. While in Poland and Hungary there are about three large generators, there is only one in the Czech Republic and Slovakia. Yet, it has to be considered that excess generation capacity exist in Poland, Czech Republic, Bulgaria, Romania and Ukraine (see Auer et al., 2005). Hence, if the transmission system is extended in and between the crucial countries' along the former EU-15 countries easterly border, there could be the chance for an extension of the current Central European market to the East.

Figure 10 shows installed gross generation capacity, NTC for transmission and import capacity as the percentage of installed generation capacity in Central European countries. It clearly shows that the import capacity as percentage of installed generation capacity is highest in the smaller countries. This figure also reveals the strategic relevance of Switzerland as a transit country. In absolute terms Switzerland has the highest NTC aside from the largest countries, Germany and France.

Moreover, Figure 10 also reveals that the overall level of interconnection capacity remain at a rather low percentage level in the large countries Spain, Poland, Italy and even France.

Another important prerequisite for a sufficiently wide market is the sufficiency of transmission capacity for neighbor regions, and the increasing number of potential competitor generators.

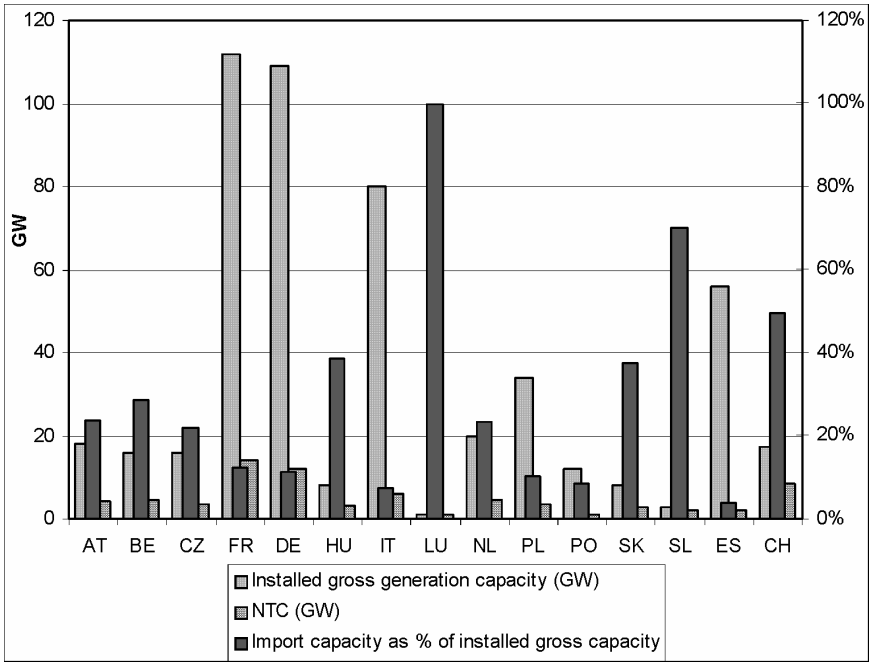
So another major impediment for cross-border trade is that similar players in the different sub-markets curb competition between these sub-markets. Currently, at many borders the large players are active on both sides of the border, see CEC (2005), Thomas (2003), Haas et al. (2006). Some examples are:

- E-ON and RWE are engaged in Germany as well as in Czech Republic, Hungary, Austria, The Netherlands.
- ENDESA and EDP are active in Spain and in Portugal.

- ELECTRABEL in Belgium, The Netherlands and France.
- EdF in France, Belgium, Germany, Poland.

It is obvious that this situation does not contribute to brighter perspectives for cross-border competition.

Figure 10 Installed gross generation capacity, net transfer capacity for transmission and import capacity as percentage of installed generation capacity in CE countries



Source: CEC (2005) and UCTE (2005).

6.2 The role of long-term contracts

In many countries many international transmission lines are currently being blocked by long-term contracts, which are taking up much of the potentially available capacity and can reduce the potentially competitive impact of market opening. Table 4 lists estimates for long-term reservations on a selection of interconnectors in 2005.

Will there be more competition due to abolishing long-term contracts?

In CEC (2006) the EU states: '*Long-term contracts should with certain exceptions be disqualified as a method for allocating scarce interconnector capacity*'. However, we think this idea of the EC is too simple and superficial. In principle, there is no argument against long-term contracts. Long-term contracts must in principle be seen as a hedging instrument and a balancing tool between long-term and short-term markets. In every liberalised market, this decision must be left to the market participants. Hence, if long-term contracts come about in the same way, as short-term capacity allocation, e.g. by auctions, there is no remaining argument against long-term contracts.

Table 4 Long-term reservations on a selection of interconnectors 2005

Border	*Current NTC value**	*Long-term contracts as % of NTC*
FR-ES	1–1000	60–70
ES-FR	1–700	70–80
FR-IT	1–2300	60–70
CZ-AT	1–600	60–70
AT-IT	1–190	50–60
CZ-DE	1–950	20–30
PL-SL	1–800	40–50
SL-HU	1–1000	30–40

*2004 values.
Source: Energy sector inquiry 2005/2006.

7 Future perspectives

The core open question is of course: how will the situation change? In the following, it is discussed which adaptations to the transmission grid are planned and expected as well as what are perspectives for regulatory interferences with respect to cross-border access to the transmission grid. Finally, it is investigated how these grid extensions might interact with generation capacity developments to enhance supply security as well as competition.

7.1 Planned extentions of the Continental European transmission grid

The UCTE publishes continuously the planned and achieved extension of the Central European transmission grid and the transmission lines to neighbour regions (UCTE, 2005). Due to these reports, the magnitude of new cross-border transmission lines up to 2010 is very small. Within Central Europe, extensions are only planned between ES and PT (in 2008), AT and IT (in 2007).

With respect to new transmission capacities to other regions (under construction/planned), there is only one relevant extension: the cable between NL and NO (NORNED, 700 MW), which should start operation in 2007.

7.2 Perspectives for the interactions of generation and transmission capacities

As argued in Section 4, the development of adequate capacity in generation is most important in this context, and the question as to how the capacity margin is distributed among generators Figure 11 depicts the currently looming developments of load and capacities for various European sub-markets and Central Europe as a whole [The figures for load forecast are taken from UCTE (2005). The figures for the trend in generation capacities are based on existing capacities, approved new capacities, decommissioning of nuclear due to IAEA and a limited lifetime of fossil plants of 40 years]. For capacities different curves are shown. We present the development of gross generation capacities as well as the trends in net available capacities. In addition, the sum of net available capacities and cross-border transmission capacities of a region to neighbour countries are

shown. This picture looks quite different for different regions. In Western Europe (FR, DE, CH, AT) the current trend implies generation capacity needs by 2007 or 2008. In Italy, load has already surpassed available net capacity. In Spain and Portugal the danger of shortages already exists (Crampes and Fabra (2005): 'With no plant entering into operation from 1998 to 2002, and a steep increase in demand … the system has indeed been operating below acceptable adequacy since 2000'). The same applies for the BENELUX countries. In Eastern Europe (PL, CZ, HU, SK, SL) the current trend implies generation capacity needs only by 2013 or 2014. The overall picture for Central Europe implies that in 2007/2008 first capacity shortages are looming.

7.3 Discussion: Are there any arguments for extending cross-border transmission capacities to enhance competition?

We have learnt that currently transmission constraints are having a substantial impact on the separation of electricity sub-markets in Continental Europe. We have learnt that theory tells us that the larger a market is, the more competitive it is, because of the principally higher number of players. Hence, it seems straightforward that the basic condition to bring about a joint European electricity market is an extension of the grid at its bottlenecks[4], and a non-discriminating, open and comparable access to the transmission grid at reasonable non-pancaked rates, see Haas/Auer (2006). Or, as Newbery (2002) puts it '... to rapidly increase transmission capacity offered at efficient prices'. For a comprehensive discussion on market-based investment in electricity transmission networks see Brunekreeft (2003).

But is this theory correct? And does it also fully apply to electricity markets?

If 'Yes', of course, the following applies: To bring about the EC's goal of effective competition in a *single* integrated European electricity market and to avoid market power with respect to the cross-border transmission grid, adequate transmission capacity for connecting the single sub-markets thus creating a larger market with more potential competing players is an undoubted need.

But extending cross-border transmission capacities faces – aside from potential acceptance problems – two major questions:

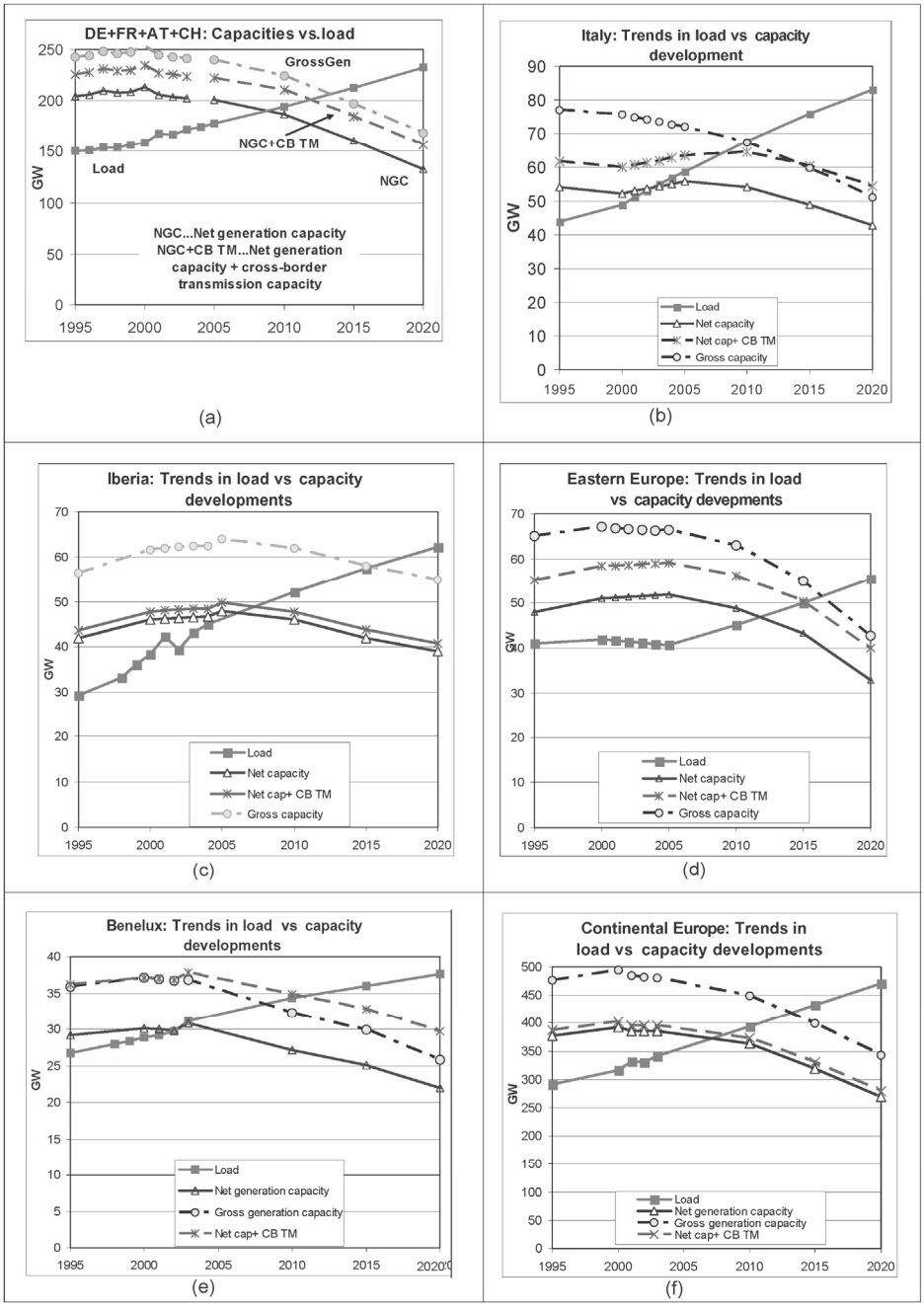
1 Who will invest? Private or public investors?

2 How can the recovery of investments be ensured in any of these cases? By regulated or by market-based approaches?

So firstly: Are there any economic incentives for investments by private profit-oriented investors in new cross-border transmission capacities significantly large to stimulate competition?

From the economic point-of-view of a company, investments in the construction of cross-border transmission capacities does only make sense if excess capacities in generation exist in at least one of the areas connected by the transmission lines. Otherwise, there is no economic reason at all for constructing transmission lines between different areas, because there is no electricity at all to be traded.

Figure 11 Past and future trends of generation and cross-border transmission capacities and load (a) in Western Europe (DE+FR+AT+CH); (b) in Italy; (c) in Iberian peninsula; (d) in Eastern Europe; (e) in Benelux and (f) in overall Central Europe



Straightforward, the next question is: What will be the effects of an upgrade of a transmission line? First, transmission fees for this connection will drop; Second, the difference between the market prices in the two regions will decrease and hence makes it less attractive to use this line.

Another issue to be considered is the ambiguity between investments in power plants vs. investments in the transmission grid. The usual argument is that if currently not sufficient transmission capacities are available investments should be made (CEC, 2000, 2005, 2006); Newbery, (2002). But this argument is not straightforward. For future investments the question remains: Where to invest? In generation capacities or cross-border transmission lines? This problem is reinforced taking into account the above-mentioned problem of the dynamics of transmission fees if the grid is extended. Also the aspect that the grids are regulated and that generation is subject to competition has to be considered.

In general there are no economic incentives for investing in cross-border transmission capacity. The only situation where incentives exist is to build transmission capacity from a country with lower prices and excess capacity (e.g. Norway) to a country with high prices short of generation capacities (e.g. The Netherlands). However, also in this case the uncertainty for any investor is very high because there is no guarantee at all that this price difference will prevail.

In any case, there is always the following question to be answered first: What is cheaper, easier and more profitable? To construct decentralised new power plants or to extend cross-border transmission capacities? Given the likely price development in wholesale markets in the next years, more secure revenues and ROI are to be expected for Investments in decentralised generation capacities than in transmission extension.

Another argument against an increasing relevance of transmission capacities is that in the long run there will be no significant difference in the marginal costs of generation. Of course, in the short term differences in the marginal generation costs exist. Yet, as can be seen from Figure 16, historical excess capacity in generation will disappear sooner (BeNeLux, Italy, Iberian Peninsula) or latter (Central/Eastern Europe). Hence, the question is which new capacity will be constructed. With respect to nuclear or renewables like hydro that could provide electricity at low short-term marginal costs, it currently appears virtually impossible that in any country such a significant potential will be constructed, which sets the system marginal costs. So coal and natural gas power plants only remain. There are four major categories of parameters that influence the generation costs of these power plants:

1 natural gas or coal price

2 efficiency

3 investment costs

4 price of CO_2 emission certificate.

We argue, that for all these parameter categories, there will be no significant difference between the CE countries and, hence, no incentives to construct new transmission lines between the countries.

Moreover, there is at least one additional major argument against extensive investments in cross-border transmission capacities: low public acceptance. The practical effect of this issue for private investors are potential high transaction costs (long

lead-time, environmental approval negotiations, etc.), which makes it lower attractive for private investments.

So, if there are no incentives for private investors, the question is: Are there any arguments that justify regulatory interferences for investments in new cross-border transmission capacities significantly large to stimulate competition? Is it justified that a national or an EU regulator interferes? Or is it just a random manipulation/intervention in the market?

Summing up from our point-of-view the answer is: in the medium to long term there are no convincing arguments for public interference in constructing cross-border transmission lines due to expected benefits from increased electricity trade .

An argument could be to reduce transmission fees at bottlenecks to publicly support the import of electricity from countries with huge excess capacities in generation at very low costs. But such a situation does not at all exist in Central Europe.

Another principal regulatory argument for building new transmission lines would be to connect new power producers, e.g. off-shore wind farms. Of course, the costs of these grid extensions has to be borne by the public to avoid discrimination in favor of the incumbents. Yet, this argument does currently not apply to cross-border transmission lines.

Finally, the open question remains: What happens to the revenues of the auctions? The widely accepted idea is that it should be spent for investments in the grid. But as argued above this should rather be done with focus on technical issues. A looming solution is to collect the revenues of the auctions in a common fund and to finance new cross-border transmission with money from this fund. If competition is to be fostered, we think that European-wide a very complex optimisation problem emerges with respect to where to invest first and to what extent. However, we have to bear in mind that there is no guarantee at all that this money will really be spent in the economically most efficient way. So the core problem with respect to public interference is: a lot of public money would be wasted for investments in cross-border transmission infrastructure, which will, not eventually contribute to social welfare.

8 Conclusions

The major conclusions of this analysis are:

In the short-term the relevance of cross-border transmission capacities for competition could be enhanced by:

1 Enhancing transparency of available interconnector capacity

2 Harmonising allocation rules: Of course, most ideally would be a harmonised system which provides the same market-based or regulated conditions for national and cross-border electricity exchanges

3 Stimulating competition by abolishing long-term contracts which have not been signed under market conditions.

Yet, in the long term there are no convincing signs that cross-border transmission could stimulate more competition. The major reasons therefore are:

- There are no economic incentives for investments in significantly large new transmission capacities that foster competition mainly, because of uncertainty of recovering investments.
- Another argument, which also dilutes the idea of a competitive fringe, is the problem of continuing cross-border mergers: if on both sides of a border the same company dominates this will hardly stimulate competition.
- Another core conclusion is that if excess capacities in generation disappear (on both sides of a border), the arguments for the contribution of cross-border transmission to competition gradually becomes weaker.
- In the long run there is also no remaining argument against long-term contracts if they come about in the same way as short-term capacity allocation, e.g. by auctions.
- And also with respect to new corridors to outside areas – e.g. Nordic countries, Russia, North Africa, South-Eastern Europe – currently no significant activities exist that point to an achievement of these options before 2020.

The major final conclusion of this analysis is that due to these perceptions it is virtually impossible that cross-border transmission will ever contribute to a more lively competition in the Central European electricity market. But this leads straightforward to the conclusion that it is very unlikely that one integrated European electricity market will ever emerge.

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Appendix

Table A-1 Current Transmission capacities (NTC) and maximum physical load flows 2004/2005 for selected connections/directions

	NTC winter [MW in 2005]	*NTC summer [MW in 2005]*	*Winter power flow maximum [MW]*	*Summer power flow maximum [MW]*	*% used winter*	*% used summer*
FR – DE	2,550	2,100	767	2,393	30	114
DE – CH	3,000	4,000	1,194	1,296	40	32
AT – DE	1,400	1,400	585	876	42	63
DE – AT	1,600	1,600	1,295	1,156	81	72
DE – NL	3,800	3,900	3,664	1,874	96	48
FR – IT	2,650	2,400	1,758	1,944	66	81
FR – BE	2,250	1,900	466	1,701	21	90
CH – IT	2,800	3,120	3,341	2,232	119	72
AT – CH	1,200	1,200	642	571	54	48
AT – IT	220	2,00	144	271	65	136
PL – CZ	1,650	1,620	1,733	1,233	105	76
DE – PL	2,000	1,000	383	254	19	25
CZ – DE	2,300	2,300	1,387	1,731	60	75
CZ –AT	1,100	1,122	1,095	728	100	65
AT – SL	650	650	220	304	34	47
CZ – SK	2,330	2,125	795	480	34	23
SK – HU	1,100	1,100	1,161	1,010	106	92
SL – IT	380	330	889	640	234	194
FR – ES	1,400	1,200	1,246	849	89	71
ES – PO	850	850	1,263	1,114	149	131

*http://www.etso-net.org/NTC_Info/library/e_default.asp

Source: ETSO*, UCTE (2006).

Table A-2 Countries' acronyms

Acronym Country	*Country*
AT	Austria
BE	Belgium
CZ	Czech Republic
FR	France
DE	Germany
HU	Hungary
IT	Italy
LU	Luxemburg
NL	The Netherlands
PL	Poland
PO	Portugal
SK	Slovakia
SL	Slovenia
ES	Spain
CH	Switzerland

Notes

[1]'Continental Europe': Austria, Belgium, Czech Republic, France, Germany, Hungary, Poland, Portugal, Slovenia, Slovakia, Spain and Switzerland (markets 3, 4, 5, 6, and parts of 7 in Figure 1).

[2]For a more comprehensive discussion of the economics of interconnectors, see Turvey (2006).

[3]As already mentioned in some countries in Continental Europe (Germany, Poland, and Spain), steps towards liberalisation were set already before the EU Directive went into force.

[4]In principle there are (at least) two arguments for extending or upgrading transmission capacities: technical reasons: e.g. strengthening the network because of increasing load; economic reasons: connecting two markets to one. In this paper only the latter is discussed.