Regional Electricity Market Integration
France-Belgium-Netherlands

This paper responds to the public consultation on regional integration of the electricity market by the French, Belgian and Dutch regulator, respectively CRE, CREG and DTE:
http://www.creg.be/pdf/Presse/2005/compress05072005uk.pdf

The authors congratulate the regulators with this important initiative that can become a reference for other regional developments. The paper starts by introducing European regulation, market architecture and strategy. Second, the importance of developing a regional market, spanning France, Belgium and The Netherlands is discussed. Finally, the authors give their viewpoint on the necessary conditions to allow market integration in all submarkets of the regional electricity market. It is outside the scope of this paper to study available price information and discuss the degree of market integration that already exists.

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1. Introduction

1.1 *Regulation*

The liberalization in the European Union (EU) is a top down process driven by the Directives of the European Parliament and of the Council.

The liberalization process, put into force in 1996 by Directive 96/92/EC, lead to the unbundling of activities in the electricity industry. In 2003, Directive 2003/54/EC was put into force, building on Directive 96/92/EC. The 3 major implementation aspects of the Directives are market opening, third party access and the independent system operator.

- All non-households customers are eligible from 1 July 2004 and all consumers will be eligible from 1 July 2007.
- Regulated third party access (rTPA) is imposed and it is required to appoint a regulator, who has to approve the tariffs, monitor congestion management and act as a dispute settlement authority.
- Transmission and distribution companies respectively have to apply legal unbundling from 1 July 2004 and 2007.

In other words, the Directives lay down the general conditions that should be in place to assure the creation of a single internal electricity market (IEM) in Europe, but refrain from designing a concrete market. Furthermore, the Directives do not provide any explicit provisions on the regulation of cross-border electricity trade. This has initially resulted in different kinds of bilateral cross-border access arrangements. Therefore, Regulation 1228/2003 issued together with the Directive 2003/54/EC in 2003, establishes a compensation mechanism for cross-border flows of electricity, the setting of harmonized principles on cross-border transmission charges and the allocation of available capacities on interconnections between national transmission systems.

1.2 *Market Architecture*

The entire IEM is first of all divided in submarkets according to the control zones of the different transmission system operators (TSO's), which in the case of France, Belgium and The Netherlands coincide with national borders (with a minor exception of part of Luxemburg, that is integrated in the Elia control zone). In general, the zonal Member State markets can be further divided in a wholesale, a balancing and a retail market. In what follows the wholesale and balancing markets are discussed.

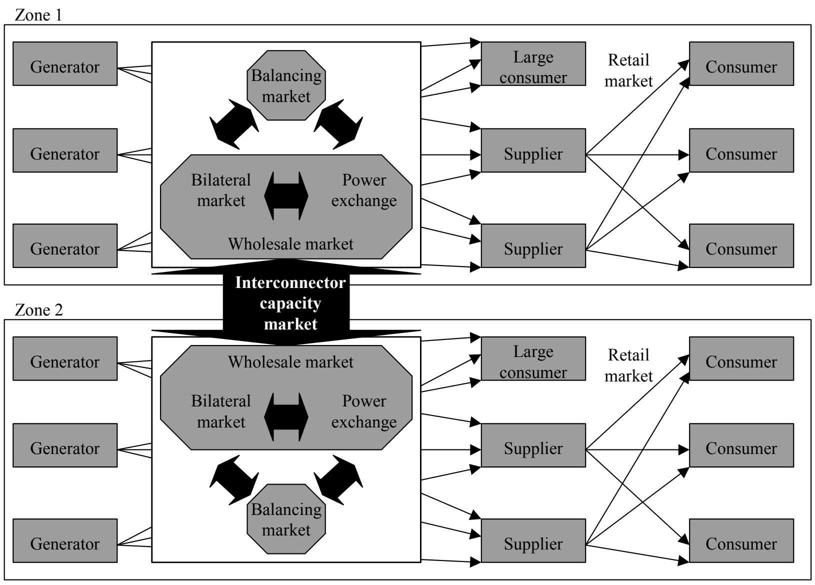

Figure 1: IEM market architecture

Most (up to over 95%) wholesale trade volume in the IEM is traded bilaterally in forward and over-the-counter (OTC) type of markets. Suppliers buy in advance using long-term and forward contracts to cover their consumption portfolio. As real consumption is not completely predictable and electric energy cannot be stored as such, there is also a need for additional daily and even hourly contracts in spot markets.

Transaction costs of fine tuning a portfolio via OTC type of spot markets are high because of the search costs of finding an adequate counter party, the bargaining costs and the problem of non-anonymity as the confidentiality of each company's position is valuable close to real time. Therefore, a mixture of private and public initiatives of generators, suppliers and transmission system operators has lead to the creation of Power Exchanges in most Member States. Power Exchanges are trading platforms operating day-ahead (one day before delivery) and facilitating anonymous trade in hourly and multi-hourly contracts called block orders. Even though Power Exchanges only attract a relative small fraction of total trade, their public hourly price index serves as a reference for the contracts negotiated in forward markets.

Wholesale trade stops at gate closure, when Access Responsible Parties (ARP's)[1] have to submit their unit commitment program to the TSO, called nominations. In some Member States, gate closure is day-ahead so that no intra-day trade is possible. In other Member States intra-day trade in so-called adjustment markets is possible. For instance, the UK Power Exchange (UKPX) offers a continuous trading platform, where blocks of energy can be exchanged between participants up to 2 hours before delivery.

After gate closure, the TSO balances demand and generation in its control zone at real time and consequently settles the costs with the unbalanced ARP's. For this purpose, the TSO procures regulating and reserve power, being dispatchable generation and interruptible demand. TSO's in Europe procure balancing power in centralized markets ranging from mandatory to purely commercial market types and from day-ahead offering to long term tendering. Payments for these balancing services are generally based on availability and utilization, as the TSO procures options or rights to call upon regulating and reserve power with a certain strike price.

Note that intra-zonal transmission constraints are only taken into account by the TSO at real time. Initially, wholesale markets can operate as if there are no intra-zonal transmission constraints. This is possible because Member States have decided to initially allow an unlimited use of the national grid for wholesale trade, and to alleviate intra-zonal congestion in real time. However, inter-zonal transmission constraints are dealt with differently as national grids in Europe are well developed, but interconnections between these grids are relatively weak so that cross-border transfers often have to be limited. On all borders, a method has been implemented to allocate cross-border transfer capacities, taking into account inter-zonal (cross-border) transmission constraints. Traders that have been allocated such capacities can trade in foreign wholesale markets. However, at this moment cross-border intra-day trade is impossible and TSO's cannot procure balancing services across borders.

1.2 *Strategy*

The strategy paper in which DGTREN communicated the medium term vision for the internal electricity market states that regional markets may be a necessary interim stage[2]. Certain countries have already

[1] Also called program responsible parties, aggregators or balancing managers.

[2] http://europa.eu.int/comm/energy/electricity/florence/doc/florence_10/strategy_paper/strategy_paper_march_2004.pdf

adopted common harmonized rules that, in some cases, go beyond those envisaged by the new regulatory package (see section 1.1). Naturally, this regionalization may only occur to the extent that integration of markets is more rapid than that required, in any case, at European Union level. Harmonization of the regulatory approaches is expected on all issues, such as the degree of market opening, determination of transmission tariffs, the rules for bilateral trading as well as congestion management, methodologies involving standardized day-ahead and intra-day markets. To some degree regulations governing balancing and ancillary services might also be harmonized, according to DGTREN.

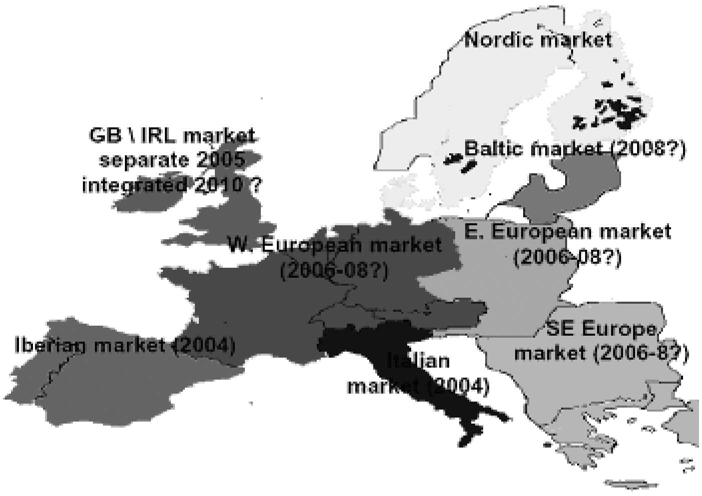

Figure 2: Potential Regional Electricity Markets within the EU (DGTREN 2004)

In line with the above strategy, the Florence mini-fora were set up at the 11th Florence forum meeting. The European Energy Regulators (ERGEG) and the European Commission have organized these Florence mini-forum meetings between December 2004 and February 2005, addressing congestion management in the European electricity transmission network on a regional basis. The mini-fora aimed to provide a plan and detailed timetable for the introduction of at least day-ahead coordinated market based mechanisms, such as auctions. Note that the French, Belgian and Dutch regional initiative is smaller than the regions spanned by the mini-fora (Figure 3). Therefore, this initiative has the potential to develop faster, going beyond the harmonization efforts that may result from future mini-fora.

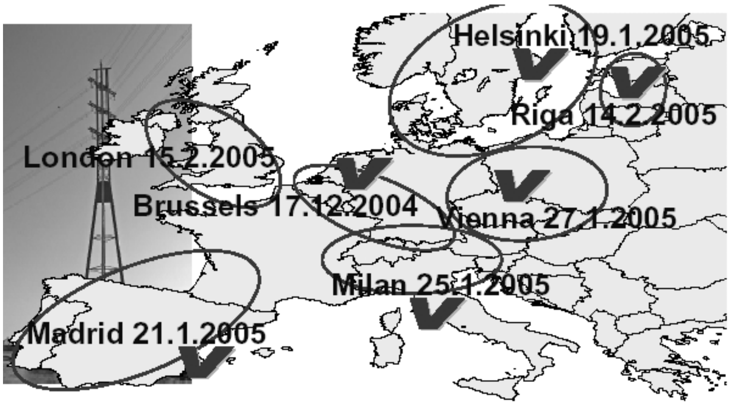

Figure 3: DGTREN mini-fora 2004-2005

2. Importance of a Regional Market F-B-NL

Belgium and the Netherlands are relatively well interconnected. Historically, the French-Belgian border was less elaborated (Figure 4), but planned and already partly executed investments will increase interconnection substantially in 2006 and 2009 (Figure 5).

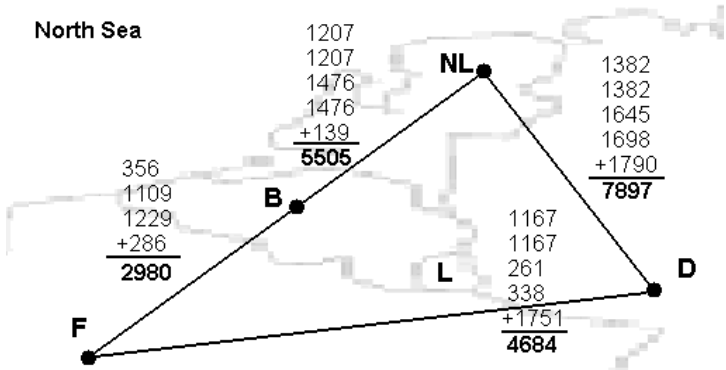

Figure 4: Thermal Capacities MVA Benelux region (UCTE)

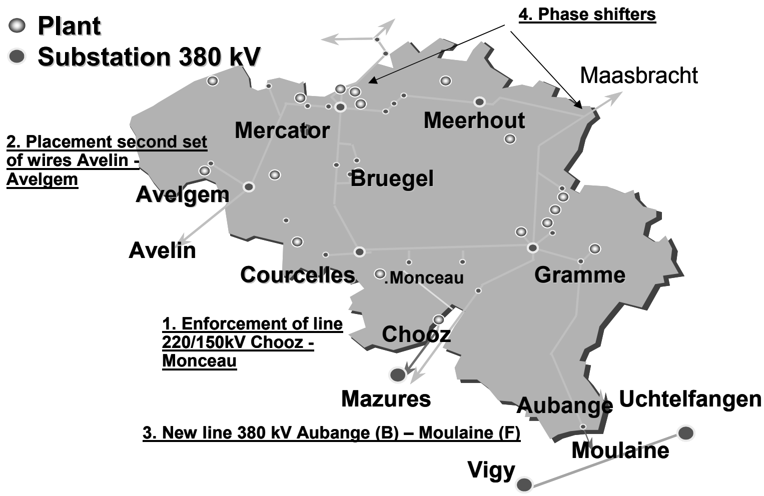

Figure 5: Grid development plan Elia

It should be underlined that transmission grids are not islands. They are actually more and more interacting to create an internal market, even going beyond the geographical area of the classical synchronized zones, by using dc links. This implies that policies from other countries and especially neighboring countries introduce competition for scarce transmission network capacity, and are often conflicting due to a lack of coordination. Increased wind power in the region makes flow in the transmission system more volatile and uncertain, which calls for a stronger coordination in the region. All aspects of future wind expansions in France, Belgium and The Netherlands, including all corresponding costs and other effects on market development should be discussed on a regional basis (Appendix).

The development of a regional market spanning France, Belgium and The Netherlands is in line with European policies and is necessary to make better use of existing and future infrastructure. Note that this is also in the interest of utilities, as it will increase the relevant market, which decreases the likelihood of intervention by competition authorities and simplifies their operation, for instance for finding balancing power. Naturally all the above is also in the advantage of consumers, as a regional market will be able to operate more cost efficiently and introduce more competition, increasing the competitiveness of the electricity industry in the region.

Figure 6 shows that prices on the Dutch and French Power Exchanges APX and Powernext are already correlated (correlation of 0.45 in 2002 and 0.7 in 2004). In 2002 the average price difference (APX-Powernext) was 9 €/MWh (APX 30 and Powernext 21) and stayed in a range of –5 and +15 for 77% of the hours. In 2003 the average price difference was 17 €/MWh (APX 46 and Powernext 29). In 2004, the average price difference was only 2 €/MWh (APX 30 and Powernext 28) and stayed in a range of –5 and +15 for 93% of the hours.

Not considering 2003 because it was an exceptional year[3], the hourly Power Exchange prices in the region converged from 2002 to 2004. Markets are often considered to be fully integrated if the relative prices are constant, i.e. when both prices seem to be determined by a common stochastic trend. However, as discussed in section 1.2, the electricity market consist of several submarkets with many other prices, such as forward, futures, interconnector capacity and balancing prices. Note also that not all submarkets are transparent or yield publicly available prices. It is outside the scoop of this contribution to study available price information to discuss the degree of market integration that already exists. This paper discusses the necessary conditions to allow market integration on all submarkets of the regional electricity market.

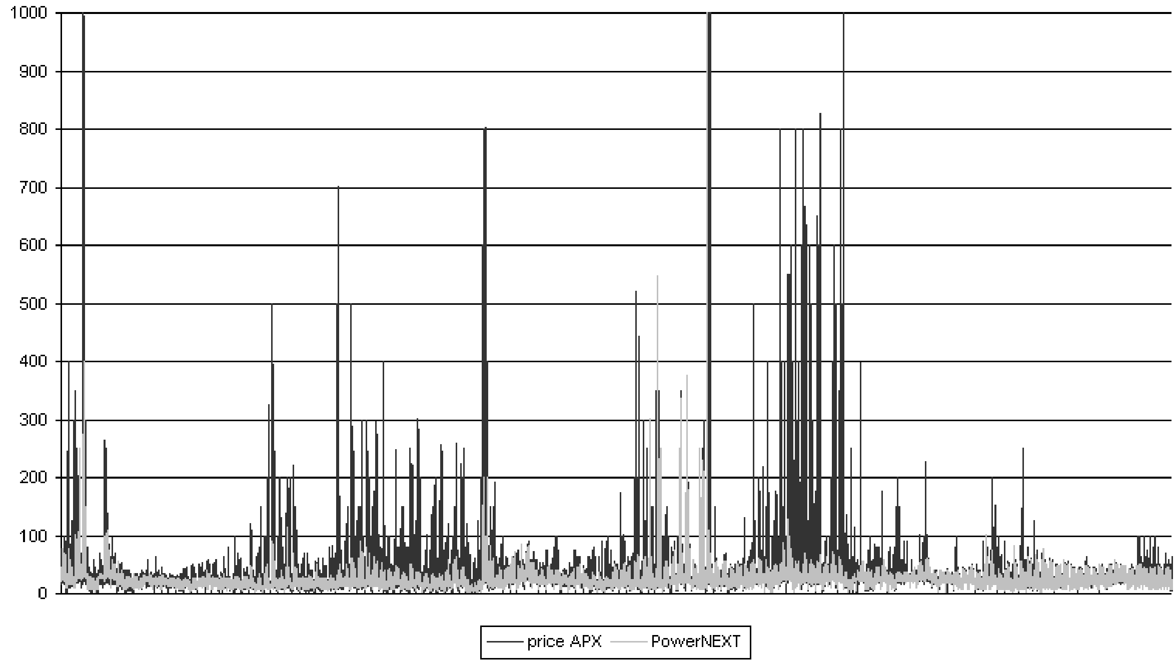

Figure 6: Price (€/MWh) on APX and Powernext 27/11/01 – 31/10/04

[3] Extreme heat in the summer caused extreme peak load to coincide with major power cuts due to cool water restrictions

3. Development Regional Market F-B-NL

The EU national diversity is a predictable result of compromises between the Member States. Diversities should diminish during the maturing phase of the reforms. Note however that complete uniformity in market design is not a necessary condition for the creation of a single European market. A regionalization of the actions of regulators will reinvigorate the construction of the internal market, but it is also necessary that TSO's, Power Exchanges and mostly market forces find their interest in building regional internal markets. In what follows measures that can be taken in cooperation with respectively Power Exchanges and TSO's are discussed.

3.1 *Power Exchanges*

According to the Directive 2003/54/EC and statements of ERGEG and the Council of European Energy Regulators (CEER), auctions, both explicit and implicit (thus including Market Coupling), are the only legally accepted methods to allocate cross-border transfer capacity. The TSO auction office already organizes explicit auctions on the Dutch-Belgian border and on the Dutch-German border on a daily, monthly and yearly time horizon. The total available transfer capacity at the French-Belgian border on the other hand, is allocated on a daily and monthly horizon according to "first come, first serve" principle and a priority list, being illegal since 1st July 2004.

The launching of the Belgian Power Exchange (Belpex), expected in 2005-2006, marks the first milestone in the development of a regional market. It is the first time that 3 European Power Exchanges will be linked with a day-ahead market coupling mechanism. The market coupling of Belpex, APX and Powernext from the start of Belpex, has been considered necessary to reach a suitable threshold of liquidity on Belpex. The coupling allows the joint handling of supply and purchase bids on the exchanges, independently of the exchange where they have been introduced. By coupling the day-ahead auctions, liquidity increases one day before delivery and the volatility of the day-ahead reference price is decreased, being important for the well functioning of the market as a whole.

The coupling implies that part of the cross-border transfer capacities on the Belgian-French and the Belgian-Dutch border are implicitly auctioned by the Power Exchanges. In other words, the currently as such illegal allocation mechanism on the Belgian-French border is about to be replaced by a legally correct one. Only daily transfer capacity could be allocated by the Power Exchanges. To avoid the worse efficiency consequences of an arbitrary fractioning of the total available transfer capacity between Power Exchanges and interconnector capacity markets, a secondary market[4] for transfer capacity could be created with an incentive of the type "use it or sell it". TSOs could also buy-back transfer capacity in this secondary market, so that they could be less prudent in calculating the total available transfer capacities. Moreover, transfer capacity not used and not sold in the secondary market, could be extra capacity for day-ahead market coupling, in which case the transfer capacity owners receive part of the congestion revenue from the implicit allocation. In this scheme, the reallocation of transfer capacity yields information to regulators and TSOs that could be used to improve the initial fractioning. Note that a secondary market is not necessarily the best solution or the only good solution[5] to an arbitrary fractioning of transfer capacity on the different time horizons, but perhaps the most sensible solution at this stage in European developments.

Market coupling implies that TSO's have to change their overall allocation mechanisms, but coordination, at this stage, should also come from Power Exchanges themselves. Once the coupling is in place, a logical and important step for participants is to harmonize trading platforms, i.e.

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[4] The idea of a secondary market for transfer capacity comes from discussions within the European Federation of Energy Traders (EFET).

[5] One alternative is to allocate all transfer capacity implicitly and to have financial instruments (e.g. the Nordic contracts for differences or the North American financial transmission rights) for market parties that want to hedge their exposure to geographic electric energy price differences before the day-ahead stage.

harmonizing standardized products, bid submission system, etc. The national regulators should stimulate and support this process.

3.2 *TSO (virtual RTO)*

European regulation requires the creation of a TSO. France, Belgium and the Netherlands each have one TSO controlling the national control zone, respectively RTE, Elia and TenneT. In what follows, measures that can be taken to improve the transmission and TSO's governance are discussed.

<u>Operations</u>

The TSO is subject to the national grid codes for its operation. The three control zones are part of the same synchronous area, being the Union for the Coordination of Transmission of Electricity (UCTE)[6]. 1 July 2005 the UCTE inter-TSO Multilateral Agreement entered into force, which is a legal instrument making the technical standards of the Operation Handbook binding among the TSOs that are a member of UCTE. The agreement is an important step in developing the security of the synchronously interconnected system of the UCTE, setting out the rights and obligations of each TSO.

Primary frequency control is an important part of the Operations Handbook. Each TSO must contribute to the correction of a disturbance in accordance with its respective contribution coefficient (such an arrangement existed also before the Handbook). These contribution coefficients are the generation capacity of a control area divided by total UCTE generation capacity and are calculated on a regular basis. Primary frequency control alone must be such that a sudden loss of 3000 MW generating capacity must be offset, without the need for load shedding in response to a frequency deviation. In other words, this arrangement includes an obligation for every TSO, which it can fulfill by procuring primary frequency control from generators in its control area. If UCTE rules would allow it, it could be interesting for RTE, Elia and Tennet to be able to procure the obligations imposed on them where it is cheapest within the regional market. In both France and the Netherlands, frequency control services are mandatory and all large generators are obliged to provide them, while in Belgium it is a commercial service. Currently no payment is made in the Netherlands to these generators.

Furthermore RTE, Elia and Tennet should harmonize operations beyond what is imposed by the Operations Handbook. First, the Handbook allows three methodologies for the calculation of cross-border transfer capacity. This still allows TSO's to calculate cross-border transfer capacities independently and consequently apply a 'veto rule' so that the minimum of both is taken. The TSO's should agree on a common transparent procedure to manage the internal interconnections of the regional market. Second, a lot of operational issues are not dealt with in the Handbook. For instance, the same situation observed on the same interconnection can be considered unsafe by one TSO, while it is considered safe by the TSO on the other side of the border. The latter is possible if the tolerated relative short-term overload in (N-1) situations is different between TSO’s, which is the case for RTE, Elia and Tennet (Figure 7).

Third, the Operations Handbook does not deal with the use of phase shifters. Traditional power flow control is realized by means of redispatching of generator outputs. In future, phase shifters will be introduced, that can control the power flow within a time period of minutes. Elia is currently installing such devices and Tennet has already installed them and plans more units. There is much to be gained by a coordinated use of the phase shifters on the Belgian-Dutch border and the Dutch-German border[7]. An ad hoc working group in UCTE is starting up to investigate which general guidelines for coordination between TSO's on the use of phase shifters are necessary. However, a regional coordination should and can be in place more rapid than at UCTE level.

[6] Nordel, GBTSO, ATSOI and IPS/UPS are other synchronous area in the European Union.
[7] A project to study this in the Benelux is being carried out (TUDelft, KULeuven).

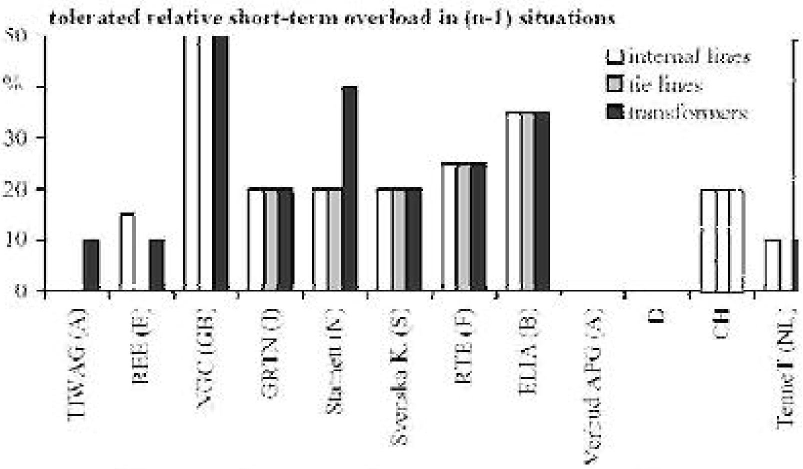

Figure 7: Tolerated relative short-term overload in (N-1) situations (IAEW)

<u>Market facilitation</u>
Gate closure in the Netherlands is 1 hour ahead, in France 3 hours ahead, and in Belgium day-ahead. It is important to have a harmonized timetable in a regional market. If an interconnector connects two systems that use different gate closure times, the earlier gate closure needs to be used for cross-border exchanges, which is day-ahead in the case of Belgium, France and the Netherlands. Therefore, there are no intra-day cross-border transactions in the region so that a lot of opportunities are left on the table. Gate closure of the regional market should allow for intra-day trade. Note also that there is always a risk that national intra-day would be illiquid so that it becomes interesting to organize these markets across borders from the start (as with Belpex).

After gate closure, the TSO balances the system and manages congestion. Balancing can be subdivided into the following activities (ETSO):

- Frequency Control (automatically delivery)
- Reserves and Energy Balancing (manually instructed delivery)
- Other services (e.g. Voltage control (Reactive power), redispatch (resolving congestion))

The possibility of a regional approach to the UCTE frequency control arrangement has already been discussed. For reserves and energy balancing (sometimes called secondary control), the TSO procures regulating and reserve power. Generally it is a commercial service, with the exception of France where secondary control is a mandatory requirement for generators exceeding a certain size, paid on a cost reflective basis. At this moment, only the Netherlands has a real balancing market. A regional balancing market providing a real time price signal should replace the balancing mechanisms, which are not always as transparent. There is a lot of potential in a regional balancing market as the regional generation park is more diverse and more flexible[8]. A regional balancing market in which the three TSO's procure harmonized balancing services can reduce balancing charges for unbalanced market parties . Especially new entrants are highly exposed to balancing charges.

Furthermore, a harmonization of nomination procedure, unbalance settlement, standardized system services, etc. can reduce transaction costs of competing abroad for market parties. Other services such as reactive power support for voltage control are typically local, so that there are fewer opportunities in exchanging these services regionally.

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[8] Note that every plant is able to delivery energy but not every plant is able to control its output or to regulate it with a fast response time.

Tariffs
The TSO is subject to the regulator to approve the transmission tariffs. France, Belgium and the Netherlands are also members of the voluntary association of European Transmission System Operators (ETSO). To stimulate cross-border exchanges, specific transaction charges associated with exchanging electric energy across most of the internal borders of the EU have been removed. Instead, an inter-TSO compensation mechanism is in place since 2002 among ETSO members to compensate TSO's for transits.

However, the national tariff systems themselves can differ widely between control areas. Issues such as the level of repartitioning in G / L, dealing with losses, etc. should be harmonized within the regional market. A situation in which a large proportion of connection costs are socialized (= integrated into the overall grid access price), in combination with a postage stamp with L=100% (and G=0%) should be abandoned. It is as if the behavior of the generators had no impact on the availability or costs of the TSO. This is important, as the transmission tariff is a major factor in the overall price of electric energy delivered.

Investments
The European transmission grid is the backbone of the Internal Electricity Market that besides serving the market has to ensure security of supply and to allow connecting renewables. Transmission grid investments are clearly needed, especially to increase the scarcely available cross-border transfer capacities. Therefore, the regulatory framework in which these investments need to take place is very important.

Since 1996, bottlenecks of common interest are listed via the Trans-European Energy Networks program (TEN-E) of the European Commission. Investment projects alleviating these bottlenecks have the first call on TEN-E funding. In the framework of the TEN-E program, an annual budget of about 20 Million € is spent mainly for supporting feasibility studies. The program generally co-finances feasibility studies – up to 50 % of their budget. In a limited number of cases (3 since 1998) it also co-finances investment projects – up to 10 % of their budget. The TEN-E financing has a relatively minor effect on the overall budget of grid investment projects, but can have a very high political value to support the investment under study.

Congestion revenues can cumulate substantially over several years so that they could be used to finance grid investment projects. However, regulation 1228/2003, Article 6 states that congestion revenue, can be used for one or more of the following purposes:

(a) guaranteeing the actual availability of the allocated capacity;
(b) network investments maintaining or increasing interconnection capacities;
(c) as an income to be taken into account by regulatory authorities when approving the methodology for calculating network tariffs, and/or in assessing whether tariffs should be modified.

Given the weak interconnectivity at the moment in Europe, it is in the benefit of market parties to use the revenue to invest in the grid (b). The problem is that grid investment projects have to be approved by regulators who could prefer a national, short-term tariff reduction. It is also true that there are no guidelines at this moment for regulators on how to approve a project.

Furthermore, national regulators have no incentives to take into account the common European interest or regional interest of a project, even if they have received TEN-E funding on that basis. Still, coordination is necessary because transmission grids are no islands and for instance an investment on the Belgian-Dutch border can easily be in the benefit of French grid users, etc. Perhaps coordination can start with a joint handling of the congestion revenue that will result from the market coupling initiative.

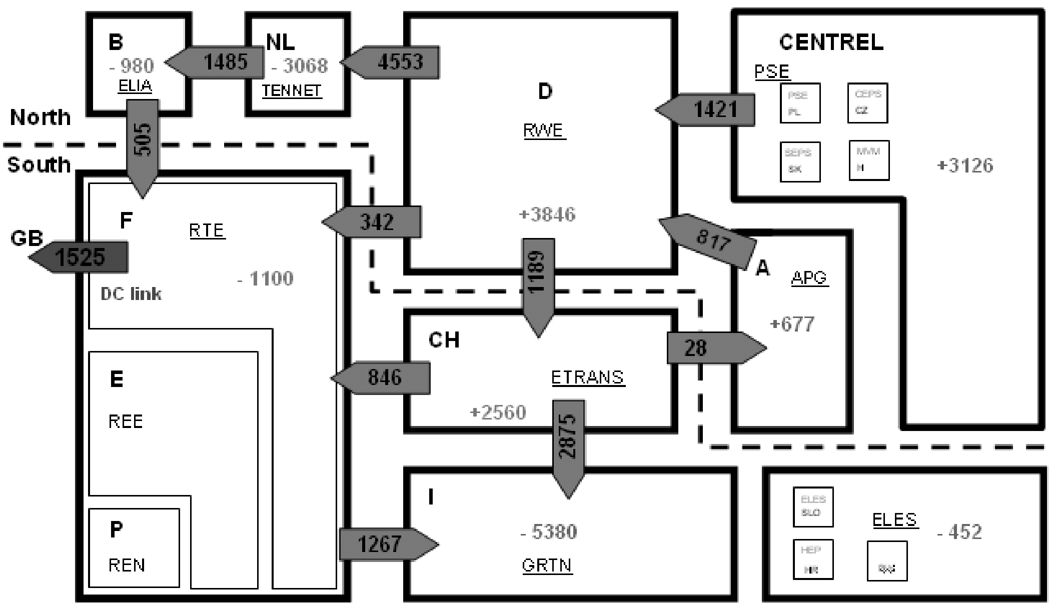
4. Appendix wind power

Wind power constitutes a significant problem for the French, Belgian and Dutch grid. The massive installation of wind energy systems in The Netherlands and Germany (more than 16 GW generating capacity installed already, foreseen to be doubled although the situation may change in Germany) is responsible for difficulties in the grid operation. Two extreme situations may be experienced in practice:

- High wind speeds in Germany leading to high power outputs from wind farms,
- Very low wind **and very high** speeds leading no power output from wind farms as the wind turbines stop due to the under-speed **and upper-speed** protection.

In case of high wind speeds and consequently high power production in North Germany, the power has to find its way to the Southern Germany where the demand centers are located. As the German grid itself is unable to carry these power flows, a significant part passes via The Netherlands, Belgium and France, back to Germany. These flows add to the usual Germany-The Netherlands exports, and stress the already often fully loaded eastern Dutch border. The often congested southern Belgian border is in its turn relieved as the flows caused by German winds generally flow in the opposite direction than the scheduled France-Belgium exports. However, in case of no or very little wind in Germany the wind turbines come to a stop (or very high winds when wind turbines halt to protect themselves) and there is no relieving effect on the southern border of Belgium. As the region where the majority of wind farms are installed covers a rather limited surface area, the increase or drop of generated power happens virtually instantaneously.

The possible installation of an off-shore wind farm for instance on the Thornton bank (up to 2000 MW) or in The Netherlands will cause a need for backup reserve power in case of wind fluctuations. One of the most significant sources of the reserve power is the Franco-Belgian border, meaning that a part of the increased capacity of the reinforced Avelin-Avelgem cross-border line would need to be withheld, limiting to a major extend import and trade possibilities needed for market opening.



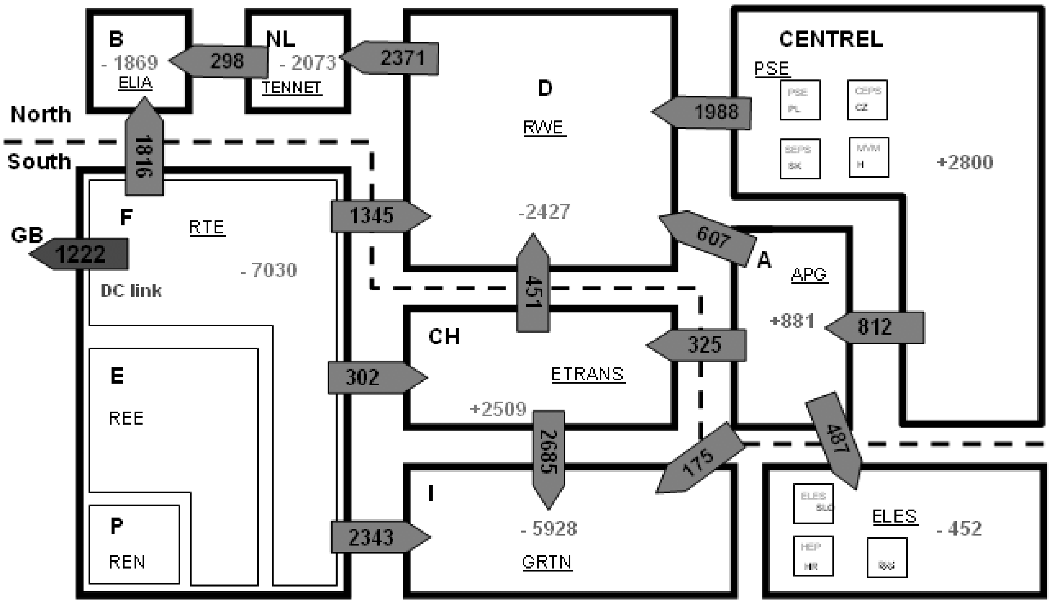


Figure 8: Changing patterns of European cross-border power flows MW as a result of wind power (Tennet)