An overview from the electricity transmission system operator's perspective

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1. Introduction to ETSO

ETSO is an international organization established in 1999 with three main objectives:

- to ensure the development of the EU Internal Electricity Market while maintaining the security of supply;
- to co-operate with organizations and institutions having similar objects: European Commission and Associations of European Energy Regulators, ERGEG[69]/CEER[70];
- the investigation and solution of regulatory issues of common interest for TSOs.

ETSO is the only EU wide organization specifically for TSOs based on direct membership of all independent TSOs. In 2005, ETSO has 37 members from EU member States and associated countries and continues to grow.

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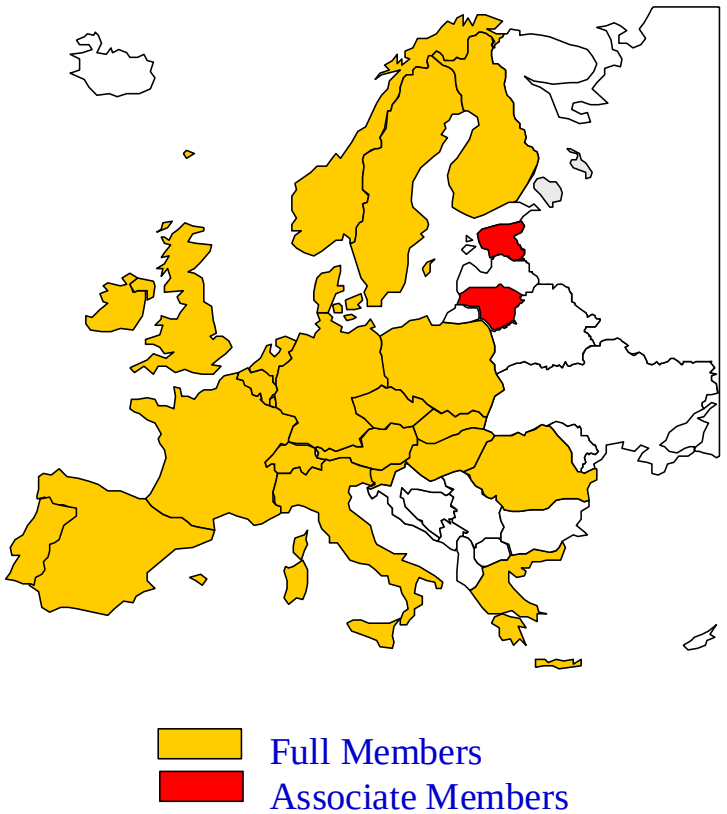


Figure 1 ETSO membership

2. European electricity markets' integration: an ongoing harmonization process in a decentralised way

TSOs are at crossroads of the building of a single European internal electricity market.

ETSO pointed out many times since the enforcement of the EU 96/92 Directive in December 1999 that the transposition process had led to the emergence of fifteen open markets rather than to the building of a single integrated market at once. The latter is actually currently being built with the progressive emergence of regional submarkets. Directive EC/2003/54 and Cross-border Regulation n° 2003/1228 organise further this integration through their core prescriptions:

- legal unbundling of TSOs,

- strong regulatory authorities in each Member State,
- full opening of the market by July 2007,
- integration of the markets through inter-TSO compensation mechanisms and co-ordinated market based congestion management mechanisms

National and regional submarkets have resulted from geography, various generation mixes in each country, the organizational features of the electricity supply industry in each country and the history of European interconnected power systems.

They share typical characteristics of zonal models, generally presented as « hubs »: on a given control area, TSOs have implemented imbalance settlement mechanisms, underpinned by balancing mechanisms used for the constitution of operational reserves and the pricing of imbalances invoiced to balancing responsible entities. This architecture has been complemented by various arrangements for wholesale bilateral trading, cross-border commercial exchanges, along with the setting up of power exchanges able to deliver reference prices for wholesale trade.

It is now widely admitted that the emergence of a single European electricity market will inevitably need to accommodate an intermediate stage of emergence of interconnected regional markets such as western continental Europe, Centrel and other peninsular markets such as the UK, Scandinavia, Italy and the Iberian Peninsula.

This European market, which is now in the process of aggregation, has been characterised by a consumption growth rate from 1,5% to 2%/year, accompanied by a growth of prices since 2003 with a context of globalisation of energy markets (especially gas markets) and driving prices oriented to pikes with an oil barrel at 60 $ and above. The wholesale electricity market however seems to reach the so-called level of 35 – 40 €/MWh, above which it normally becomes interesting to build new power plants. Continental European prices seem driven by German prices and balancing prices are less volatile.

The drivers for this snapshot mainly are:
- the maturity of markets which have become able to deliver prices reflecting costs;
- the progressive disappearance of overcapacity which used to be a

feature of the European system adequacy in the 1990's; marginal prices seem to tend to long term generation marginal costs (including investment);
- the anticipation of costs induced by mitigation of CO_2 emissions; in this respect, the forthcoming organization of CO_2 markets, should contribute to delivering price signals from the generation refurbishment and investments required.

The future of the European electricity market will largely depend on its ability to consolidate its strengths and to compensate its weak points.

Among the strengths, one can include:
- the simplicity and generality of the "hub" concept,
- the liquidity it involves for wholesale trading,
- its ability to deliver price signals able to help the convergence of electricity prices towards the lowest ones.

On the contrary, among the weak points, one can note:
- the insufficient harmonization of various arrangements of each "hub", making life complex for traders present on each sub-market,
- the progress still to be achieved in the field of cross-border network access.

The axes of action which, with this background are for the TSOs, have been pointed out a number of times by ETSO:

- to increase TSO's role and independence in order to guarantee a better liquidity in interzonal exchanges;
- to address the issues related to security of supply which is the basement of the market and the key point in any TSOs' action;
- to continue the cancellation of all kind of barriers at borders through the EU and the improvement of the Inter TSO Compensation (ITC) scheme;
- to manage the congestion on the interconnections in order to build more integrated electricity markets; this of course involves investments on new interconnection but also the implementation of market based capacity allocation mechanisms compliant with the EU 1228/2003 Regulation;
- to ensure an appropriate integration of renewable energy sources

according to the 2001 EU Directive, while respecting the power system security requirements. The challenge is to integrate wind turbines in each power system without jeopardising the operational security of the European power system.

These would be the key issues covered in the following chapters and the outcome of which will largely feature the 2010 European electricity market. Of course, such issues should always be regarded as truly "cross-border" issues and not only as mere local ones.

Market Power has been considered as a horizontal question yet to be fully addressed in the coming years. The possible future roles of the TSOs (monitoring the market, exchange of information, adapting the market rules…) in this regard will be left out of the scope of this paper.

3. Consolidating the role of TSOs as market designers

Through ETSO, the European TSOs have been key partners in the process of developing the Internal Electricity Market (IEM) while maintaining the security of supply.

As requested by stakeholders participating in the Florence Forum process, ETSO has made robust and pragmatic proposals that have been successfully put into practice after the final agreement of the European Commission and of the Regulators. For example, the European Inter-TSO Compensation (ITC) fund (which has cancelled any fee paid for cross-border transactions), the innovative market-based congestion management proposals (e.g. flow-based market coupling) and the standardization of data interchanges between TSOs and market participants are clear evidence of ETSO contribution to the European market design.

Power systems are extraordinarily complex. For an efficient trade of electricity, market arrangements must be set up that are compatible both with market participant needs and the technical and economical requirements of power systems.

Transmission System Operators are the only ones to have the full understanding and knowledge necessary to propose sound measures, and this is why, in most EU countries as well as at the pan-European level, they have a prominent role in the design of key tools for an efficient internal electricity market.

TSOs are not market players; their action is based on non discrimination of market players and continuous good performance of their power system. They are neutral bodies, whose independence is established by the IEM Directive. TSOs are the ones that ensure that any changes in the regulations can be effectively implemented on a day-to-day practical basis, without jeopardising the secure operation of the interconnected power systems.

One of the main challenges for the development of the IEM in the next years is to avoid misconception of the market design. The market design should actually be done on the basis also of proposals by the TSOs since they are the link between the trade and the physical dimensions. However, TSOs should make the European interconnected power system work in a secure and efficient manner but, at this stage, no sound TSO project is likely to be achieved without a sound regulatory framework.

Every European TSO (except in Greece, Switzerland, Hungary, Poland and Ireland) owns the transmission assets and at the same time operates the Power System. This standard organization is indeed recognized as crucial in order for the TSO to provide neutral, adequate and efficient grid access services. This common European choice is a decisive advantage over other forms of organization (for example the US), both in terms of system security and market efficiency.

Accordingly, all European TSOs are deeply involved in the process of market design in close co-operation with users, the EC and with the regulatory authorities. TSOs have the pre-requisite knowledge to provide the necessary services to market participants that allow free trading on a given play-field under secure operation of the interconnected power system. Such services often include the scheduling of trading and generation, balancing arrangements and settlement of imbalances and are the basic elements necessary to the development of other facilities such as organized markets and financial products.

ETSO considers that there is no room for a sustainable European electricity market unless TSOs' role is fully recognized and exercised at EU level as well as in each country as market designer in charge of reconciling various stakeholders' requirements:

- security of supply, in addressing as well long term system adequacy as a secure real time operation ;
- regulatory requirements in terms of transparency, non discrimination,

economic efficiency ;
- users requirements in terms of efficiency of market mechanisms ;
- environmental constraints in terms of maintenance and network development policy.

4. Cancelling charges on cross-border trade through the ITC scheme

Among ETSO actions for the building of an integrated EU electricity market, one of the most remarkable one has been the European Inter-TSO Compensation (ITC) fund.

In 2001, before ETSO action, every country had enforced its own cross-border transmission tariff. As a consequence, all imports, exports or transits of energy through a power system used to be charged for the use of every national network. This resulted in a pan caking effect, which was breaching the postage stamp principle: instead of paying access to the grid for physical injections/withdrawals of energy, users were faced to a number of grid access bills corresponding to the number of transited countries.

ETSO implemented a first compensation mechanism in 2002 with nine participating countries, handling a transit of 87 TWh and involving an ITC fund of 200 M Euros. With this solution, importing and exporting countries financed a compensation fund, allowing transited countries to be remunerated for the use of their networks through transits resulting from the commercial exchanges organized by the former. With this mechanism, transited systems such as the Belgian or the Swiss system are remunerated while net exporters like France or net importers like Italy are contributors to the compensation fund.

The area covered by the mechanism has been further progressively extended to nineteen countries (handling a transit of 162 TWh and involving an ITC fund of 370 M Euro) until 2004, with the notable exception of the UK and Ireland.

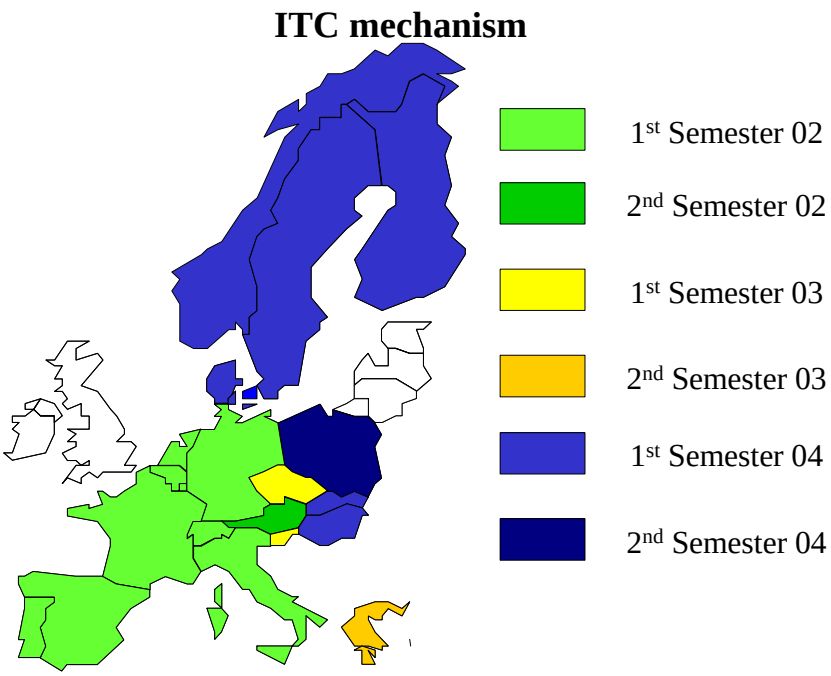


Figure 2: countries participating in the ITC mechanism since 2002

This mechanism has been enforced by the EU 1228/2003 Regulation which defines the main principles of the future ITC. The ITC mechanism will have to be compliant to the Regulation, which allows the European Commission to propose guidelines applicable for present EU non-participating countries: UK, Ireland and the Baltic States.

The main issues in this domain will be to:

- make sure that the mechanism is really extended to all the European market,
- orientate the fund towards transmission tariffs harmonization and efficient network development: for example, the contributors should charge the generating companies in exporting countries and consumers in importing countries, so as to incentives economical generation investments located in importing countries rather than in overcapacity countries ; likewise, the transited countries should be incentivised to develop their networks ;

- find an EU standard value for the involved horizontal network[71] while reflecting the costs of its elements;
- integrate the work on ITC with the work on congestion management issues with the aim of encouraging appropriate investments (be they transmission or generation related) in the EU playing field

5. Integrating the markets through efficient cross-border network access and congestion management schemes

5.1. The importance of sound modelling for the physical constraints in the transmission system

ETSO has since its creation identified that the opening of the electricity markets creates economic opportunities but is also a source of technical challenges because of the split between players choice on wholesale markets, and TSOs' decisions about transmission capacity limits needed to guarantee network security.

TSOs' guarantee relies on physical flow analysis, which depends itself on clients appreciation of their generation and consumption value and is part of their core business activities. In order to set up transmission capacity limits, TSOs have to make assumptions on the results of market participants' choices and vice versa (figure 3): this is the well-known "chicken and egg"dilemma.

The uncertainty related to this interdependence is often - wrongly - presented as "resulting from a simple lack of co-ordination between TSOs". Actually it is inherently bound to the new organization of the market.

[71] horizontal network is the network used for cross border flows

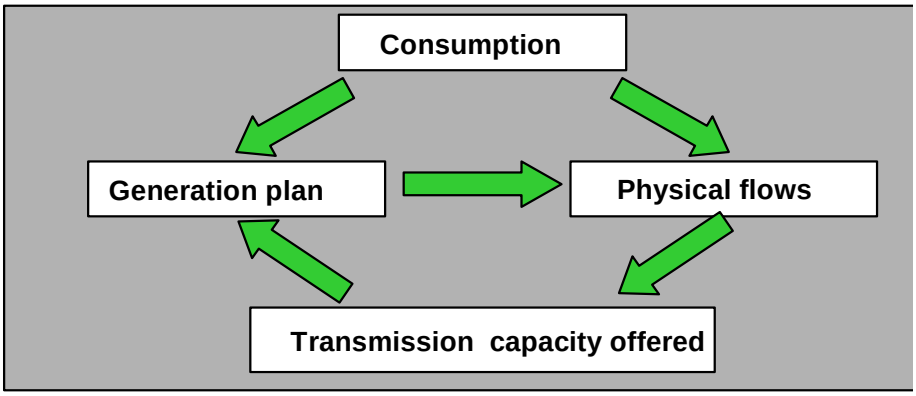


Figure 3: Diagram of restrictions in the balancing of the market. Transmission capacity and generation plan, in fact interdependent, are produced separately

This uncertainty results in increased risk for both parties: on the one hand, generators and marketers may be refused authorisation to transmit the quantities of electricity exchanged; and on the other hand, system operators may manage poorly the system access they authorise when they grant such authorisation. This question concerns firstly cross-border transfers due to their specific volatility in the European context.

Where transmission systems are substantial and trade is organized between neighboring zones, these risks are very low; this is because system access is relatively unrestricted. Also, the system operator himself is able to assume internally the risks attached to the proper physical transmission of electricity bought or sold on the markets. This is a case of temporary congestion, and when looked at from the point of view of the market, the system can be compared to a "copper plate".

On the other hand, if systems have structural weak spots where physical flows of electrical power must be restricted to a limited value, access to the system needs to be controlled in order to ensure that the physical restrictions are respected. This involves evaluating and then allocating rights to transmit electricity from one zone of the system to another. This is the case with Europe, where the internal electricity market introduced by the 1996 EU Directive has resulted in the formation of regional sub-markets, whose price levels can differ quite significantly.

Interconnections capacities between countries have historically been too small to allow the level of cross-border exchanges required for equalising prices (this problem could be raised for each of the 8760 hours in the year).

Since the European system is fairly dense and meshed, each cross-border exchange has an influence on physical flows, not just on the border directly concerned, but to varying extents on all the other interconnections, and even on internal electric links within the various countries. Combined with the differences in prices between countries, these reciprocal influences mean that every cross-border exchange in continental Europe is currently limited by one or more instances of structural congestion.

Given this situation, TSOs have been proceeding pragmatically by enhancing their co-ordination and refining their transmission modelling processes as volatility increases. Starting from quite simple processes based on a quantitative control of bilateral cross-border transmission capacities, they move progressively towards more sophisticated ones where values given by market participants for cross-border transfers, neighboring or not, determine which market direction is to be favored. Flow-based transmission modelling as proposed by ETSO, the use of coordinated implicit and explicit auctions and the development of intraday and balancing arrangements will inevitably reduce the negative effects of this "chicken and egg" problem.

5.2. Flow-based Market Coupling by ETSO-EuroPEX and the integration of electricity markets in Europe

The 11th Florence Regulatory Forum held in Rome in September 2004 welcomed the ETSO-EuroPEX joint proposal "Flow-based Marked Coupling" (FMC). FMC consists in a model for cross-border congestion management and integration of electricity markets across Europe with regional price areas and inter-regional trading facilitated by market coupling subject to simplified transmission constraints. Moreover, the model describes detailed arrangements for day-ahead trading as well as different options for forward markets.

The visions offered in the past by ETSO on Coordinated Congestion Management and EuroPEX on Decentralised Market Coupling were consistent and complementary in most respects. In particular, both organizations agree that market-based congestion mechanisms should be used at all borders wherever possible, and that they should be coordinated to take into account the interdependence of physical flows.

The major innovation introduced in the joint proposed method is the combination of a system modelling based on physical flows, which provides

the means to maximise the inter-regional transmission capacity that can be made available without compromising system security, and market coupling, which provides the efficiency advantages of competition across regions, subject to the availability of inter-regional transmission capacity.

The method, in particular, has as its priority the focus on market co-ordination at the day-ahead stage. If the day-ahead markets are sufficiently comprehensive and compatible, they should provide the minimum facilities necessary for market participants to trade their energy and access the transmission system.

FMC is proposed as a means of providing such facilities for inter-regional trade. It is also intended to bring the benefits by coupling the regional day-ahead markets using flow-based modelling in order to represent the effects of cross-border transmission constraints.

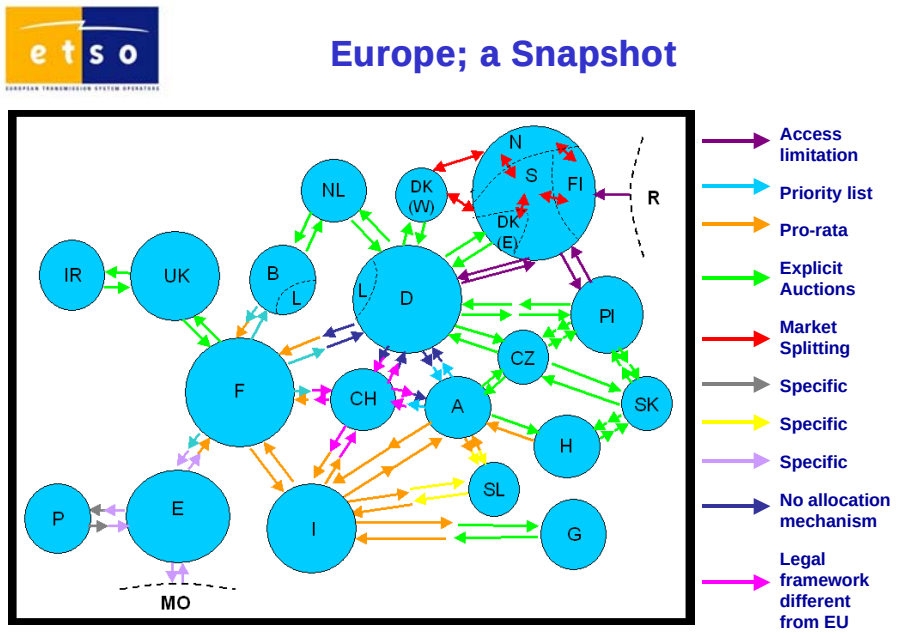
FMC can also coexist with several forms of forward market arrangements. These provide opportunities for users to hedge cross-border price risk that they would otherwise face in the day-ahead market. Possibilities could include participation in electricity related financial markets and/or participation in explicit auctions of forward transmission rights. These arrangements would operate independently from the day-ahead FMC.

In ETSO and EuroPEX views, this approach on cross-border congestion management meets the needs of both the market and system operation. Regional projects have been launched and the integration of electricity markets by the coupling of Power Exchanges will become increasingly important in the coming years.

5.3. But the starting point is far from the target

Figure 4 shows a snapshot of the congestion management mechanisms in use in Europe at the end of 2004; one can see that there is still much to do not only in terms of replacing administrative mechanisms by market based ones but also in terms of improving co-ordination of allocation mechanisms. In addition the diagram shows that the mechanisms rely most often on bilateral co-ordination between two neighbors rather than on a (sub)-regional multilateral co-ordination procedure, covering at the same time the capacity assessment procedures and the capacity allocation mechanisms.

Figure 4: interconnection access mechanisms in Europe at the end of 2004



6. Security of supply

In 2003 and 2004, increase in wholesale prices and the blackouts experienced in Europe have shown that electricity is a very unusual product. Nearer to us, the very low temperatures in March 2005 in Europe showed that electricity cannot be missed or even interrupted for a few seconds while it cannot be stored at a reasonable price.

TSOs have the major obligation of safeguarding the interests of consumers by first of all helping to keep the lights on.

At the same time the achievement of the European electricity internal market is a major objective for the efficiency of the European industry, economic development and efficient use of primary energy resources, in line with the Lisbon Agenda and Kyoto protocol. Billions of euros are at stake.

Due to their unique position at the crossing of electricity physical flows and market mechanisms, TSOs have a specific responsibility for keeping the balance between market facilitation and security of supply.

ETSO has always supported the idea of having a directive on security of electricity supply which will be another step forward in building the electricity market by not leaving for granted the issue of security of supply.

The requirement for a high level security of supply comprises in ETSO's view two main concerns:

- on the one hand, the Operational Power System Security which is the ability to achieve a continuous operation of power systems without large disturbances (i.e. to avoid blackouts);
- on the other hand the Power System Adequacy which means to avoid load shedding arising from limitations at any point of the power supply chain, including fuel supply of power plants or the ability of the transmission system to carry the generated power at any bulk delivery point.

Key requirements therefore to provide a secured power supply are:

- adequate generation resources in terms of quantity and quality to meet demand; and,
- adequate transmission capacity, availability and reliability.

Without these, no amount of short-term or real time operator actions will be able to maintain a reliable supply.

Security of supply in the electricity business is a very complex issue where market structure, availability and price of primary resources, industry requirements, global competition, environmental objectives and, last but not least, severe technical requirements interact with each other. Clarifying the role and responsibilities of each stakeholder in ensuring the security of supply is therefore a first objective that the new coming directive on security of supply should help achieving.

As regards what should be the role of TSOs, when looking at the operational time scale, ETSO considers that TSOs should be given the role to define binding standards on how the power system should be operated in Europe. These standards should then be binding not only for TSOs but to all users connected to the high voltage grid. Moreover, it should be precisely defined how TSOs can ensure sufficient short-term operational reserves and peak power availability to maintain the system security. However, it should be noted that the methods used by TSOs to secure the generation-demand balance will have an effect on the market and will be part of the economic

signals given to ensure a proper mid/long term generation adequacy. In this period of market building it is important to ensure that these methods will not lead to distort the market by influencing the commodity prices or to discourage investment in new generation units.

TSO's have also a specific role to play in order to help the industry to provide adequate generation and transmission resources. These medium/long term issues should at least cover two items :

First, ETSO has been asking for sometime that TSOs are required formally to set up a pan European mid-long term generation load balance forecast, taking into account cross-border exchanges. Assessing long term generation and transmission adequacy is the mean to give early warning signals to stakeholders to let them be able to take the appropriate measures and decisions to invest.

Secondly, TSOs should be the only entities responsible for proposing to Member States and Regulators the developments of new interconnectors. In order to do so, a consultation process has to be ensured between TSOs of border countries so that new transmission facilities in each Member State contribute to the EU global security of supply and to a better functioning of the internal electricity market.

However, that role will be difficult or impossible to achieve unless specific procedures for faster administrative authorisation to build new interconnectors when necessary in the EU in due time, are not put in place. For the last ten to twenty years, a continuous increase in the difficulty to build or upgrade new transmission capacity in the EU has been observed. Authorisation procedures leading to nothing or taking up more than 15 years have been witnessed in each Member State. Present procedures focus on local considerations while ignoring potential negative influences on the global security of supply. It is the responsibility of the European Institutions and Member States to come up with some pragmatic and efficient proposals to reduce these negative evolutions with due consideration for local populations and environment.

European citizens ask for security of supply and energy at the best price; it is of primary importance to find the right way to meet their expectations.

7. Renewable energy sources

The support of renewable energy sources is one of the key issues in European energy policies. One of the most relevant milestones was established in September 2001, with the adoption of the directive on the promotion of electricity generated from renewable energy sources in the internal Electricity Market (RES Directive). This Directive contains indicative targets, which have resulted in the distribution of the global EU goal (22% renewable electricity supply in 2010) between the individual Member States, along with the recommendation to Member States to take appropriate measures to achieve them.

These measures consist, basically, of ensuring the issuing of guarantees of origin, implementing support mechanisms and providing grid access to stimulate the production of electricity from renewable resources.

Long term sustainability of the electricity sector requires an adequate consideration of the cross-effects of the measures to be implemented. Some envisaged options considered for environmental protection require special attention so as to the impact on competition and security of supply.

The guarantee of origin proves that a certain amount of energy has been generated by a defined renewable energy source. To meet the requirements of the RES Directive, a transparent and flexible system of mutually recognised guarantee of origin has to be established. ETSO recommends to use a certificate-based system, because this best meets the requirements of the market. This would mean that the electricity and the environmental benefit of the renewables would be handled and traded separately. TSOs are currently considering an appropriate body for issuing the guarantees of origins, providing that the costs and risks are properly compensated.

As for the impact on competition and security of supply, this is becoming a real issue. In some countries, the level of installed wind generation starts to reach the same level as exports, which clearly raises the problem of equal footing competition between all kinds of generating units. Moreover, these types of generation induce significant balancing costs due to their intermittence characteristics. The integration of new renewable plants with several thousand Megawatts of installed capacity involved makes it necessary to adapt connecting rules in order to avoid negative effects on the European system security of supply.

8. Conclusions

This contribution to the first issue of the *European Review of Energy Markets* has tried to give an overview of the challenges of the European electricity market in 2010 from Electricity Transmission System Operators' Perspective. The challenge could be summarised as:

achieving a sustainable integration of the European electricity market

This involves:

- succeeding in market integration through, among others, the consolidation of the role of TSOs as market designers, the implementation of market based mechanisms of cross-border exchange capacities and relevant frameworks for the integration of cross-border intraday and balancing trade;
- organising the European security of supply through a specific directive ; this would allow the clarification of roles and responsibilities of each stakeholder while allow empowering TSOs to assess long term generation and transmission adequacy, which is the means to give early warning signals to stakeholders to let them be able to take the appropriate measures and decisions;
- integrate renewables and especially wind generation units in power systems both from the market and the security of supply points of view.

In order to achieve these goals and to maximise the benefits for European citizens and companies, ETSO has proposed to strengthen the regulatory framework through a Directive on Security of Supply that promote concrete actions:

- to guarantee the independence of TSOs in a liberalised market where every player has a well defined role;
- to involve TSOs in the drawing up of a European forecast report on the generation and transmission adequacy of the EU;
- to create an European Group of TSOs as an independent advisory body to assist the European Commission and the Regulators in all the questions related to the internal electricity market.