

EUSUSTEL WP4

Regulatory Framework of Energy Markets

SUMMARY

In the full report on this workpackage, provided as an annex to this summary, firstly the current legislation and regulation of energy markets are discussed. In this first section, the content of the main European Directives and Regulations establishing the current energy market in Europe are discussed. Next, a state of affairs of the internal energy market is presented. Finally, boundary conditions and guidelines for the proper functioning of future energy markets are provided.

4.1 Analysis of the current legislation & regulation

The Directives

Firstly, the two founding Directives 96/92/EC and 2003/54/EC concerning common rules for the internal market in electricity [3, 4] are being looked at. These Directives establish common rules for generation, transmission, distribution and supply of electric energy. Generally, the first Directive allowed nearly everything, except an integrated internal market [5]. The second Directive 2003/54/EC is characterized by shorter-term deadlines and less freedom [6]. This is reflected among others in the rules on market opening. Where the first Directive aimed at a slow, gradual and partial opening of the Member States' markets, the new Directive 2003/54/EC dramatically accelerated this process: all non-households customers are eligible from 1 July 2004 and all consumers will be eligible from 1 July 2007. Also the access to the grid is regulated more strictly in the 2003 Directive. Under the first Directive, Member States could choose between negotiated or regulated third party access or the single buyer procedure when organising the access to the transmission and the distribution networks. Directive 2003/54/EC limits the options to one regime, being regulated third party access, and requires the appointment of a regulator, having to approve tariffs, monitor congestion management, and act as a dispute settlement authority. Under both Directives, Member States must designate one or more transmission and distribution system operators. While the first Directive required only an administrative unbundling of these network operators, the second goes a step further requiring legal unbundling. Both directives allow Member States to impose public service obligations on electricity undertakings in their market within one of the following five categories: security of supply, regularity, quality and price of supply and environmental protection, including energy efficiency and climate protection. Regarding the stimulation of investment in new capacity, the main instrument under the second Directive is the authorisation procedure. In case of insufficient investments in generation capacity when using such a procedure, Member States must stimulate investments in new capacity through a tendering procedure.

Florence Forum and ERGEG

The Directives set out the general framework and principles for the introduction of competition in the electric energy industry. However, in line with the principle of subsidiarity, much of the practical and technical details of implementation are left open to national interpretation. Nevertheless, while creating an internal market, co-operation and co-ordination between Member States are of vital importance. Therefore, the Electricity Regulatory Forum of Florence ("*Florence Forum*") [8] was set up as consultative body to discuss the creation of a true internal electricity market. Participants are national regulatory authorities, Member States, the European Commission, transmission system operators, electricity traders, consumers, network users, and power exchanges. Another advisory group established to assist the European Commission in consolidating the internal market is the European Regulators Group for Electricity and Gas (ERGEG) [9]. Its members are all regulators from the EU, with regulators from new Member States and the European Economic Area acting as observers. Also the Commission is represented and will keep the European Parliament informed on the Group's activities on an annual basis. With the establishment of ERGEG, regulatory co-operation and co-

ordination have been given a formal structure. ERGEG's primary responsibility is to help ensure a consistent application in all Member States of the most recently adopted Directives and Regulations and to coordinate the preparation of the progress reports national electric energy regulators must publish yearly under the 2003 Electricity Directive.

Congestion management and cross-border exchanges of electric energy

Several initiatives have been taken to increase the amount of cross-border electricity trade. The European Union co-finances electricity and gas transmission infrastructure projects of European interest under the Trans-European Energy Networks program (TEN-E) [13]. A annual budget of about 25 M€ is spent mainly for supporting feasibility studies. Also, Regulation 1228/2003 on conditions for access to the network for cross-border exchanges in electricity was issued. In this Regulation, a compensation mechanism for cross border flows is established and harmonised principles on cross-border transmission charges and on the allocation of available interconnection capacities between national transmission systems are introduced.

Security of energy supply

In 2000, the European Commission adopted a Green Paper on Security of Energy Supply [15]. The main incentive of this Green Paper was Europe's constantly increasing external dependence for energy. The Green Paper outlines a long-term energy strategy with an emphasis on controlling demand by, for example, promoting more energy efficiency. Also, an analysis of the contribution of nuclear energy in the middle term is recommended, as well as a stronger mechanism to build up strategic stocks and to foresee new import routes for increasing amounts of oil and gas.

The debate on the Green Paper resulted in 2003 in a Proposal for a Directive [17]. The proposed Directive establishes measures aimed at ensuring the proper functioning of the EU internal market for electric energy by safeguarding adequacy of supply and by ensuring a sufficient level of interconnection capacity between Member States to ensure competition at European and national level. According to the Proposal, Member States have the duty to ensure that network operators comply with co-operation such as the UCTE's operational handbook [18]. The Proposal repeats that Member States are obliged to take appropriate measures, including supporting efficient use of energy as well as encouraging new generation companies to enter the market, to ensure that there is a balance between the supply of electric energy and the availability of generation capacity. It adds that Member States in particular have to require TSO's to ensure an appropriate level of reserve capacity. In addition, Member States may take additional measures to achieve these objectives, including but not limited to:

- Promotion of demand management
- Interruptible customers
- Obligations on suppliers and/or generators
- The establishment of a wholesale market framework with a sufficient number of competitors that provides suitable price signals for investment and consumption.

Both for the transmission and distribution networks, investments in demand side management measures should be given priority in so far as they can replace the need for network or generation investments. Under the Proposal, TSO's regularly have to submit a document setting out their investment intentions for the provision of an adequate level of cross-border interconnection capacity to the regulatory authority. After having approved investment plans, the regulatory authority has to take the TSO's investment strategy into account when approving the methodology for network access tariffs and needs to ensure that TSOs are adequately rewarded for investments made. In the event that, for whatever reason, the TSO fails to make sufficient progress in important infrastructure projects, the regulatory authority is given certain rights to ensure that progress on the approved investment strategy is satisfactory, in particular by one of the three following measures:

- Imposing financial penalties on TSO's whose projects fall behind schedule.
- Issuing an instruction to the TSO to undertake work by a certain date.
- Arranging for work to be undertaken by a contractor through a tender process.

Sustainable energy

In 2001, a Directive on RES [21] was issued aiming at increasing the contribution of RES to electric energy generation up to 12% of gross inland energy consumption from RES for the Community as a whole by 2010, of which electric energy would represent 22.1%. It concerns electric energy generated from non-fossil energy sources such as wind, solar, geothermal, wave, tidal, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases. In the Directive, national indicative targets for the share of electric energy generated from renewable energy sources in gross electric energy consumption for 2010 are published. In order to attain these targets Member States can apply mechanisms according to which a generator of electric energy receives direct or indirect support. According to the Directive, by the end of 2005 the Commission should present a report on the experience gained concerning the application and coexistence of the different support schemes in the Member States. If necessary, this report will be accompanied by a proposal for a Community framework for support schemes for RES-E. Also according to the Directive, Member States should issue guarantees of origin to enable RES-E generators to prove that the electric energy they sell is generated from RES. These guarantees of origin are to be mutually recognized by the Member States, exclusively as proof of electrical energy's origin. One major barrier to the further development of RES-E is the administrative and planning procedures that potential generators must respect, which is particularly a problem for small and medium-sized companies (SMEs), making up a significant share of companies in this sector. With this in mind, Member States are required to review their existing legislative and regulatory frameworks concerning authorization procedures in order to reduce obstacles. Moreover, connection to the grid can be expensive for generators of RES-E. To this end, Member States are to require network operators among other things:

- To guarantee the transmission and distribution of RES-E. Member States may agree on priority access for RES-E. When dispatching generation installations, priority shall be given to installations using RES insofar as the operation of the national electricity system permits.
- To define and publish standard rules on responsibility for the costs of technical adaptations needed to enable a new RES-E generator to feed its electric energy into the grid. The Member States may require network operators to bear some or all of these costs.

Member States must ensure that transmission and distribution costs do not in any way discriminate against RES-E. Member States are also required to examine measures to be taken to facilitate the access of RES-E to the grid, considering in particular the need to introduce two-way metering.

In 2004, a Directive has been issued on the promotion of cogeneration [22], employing similar principles regarding support schemes, guarantees of origin, grid connection issues and so on. However, for cogeneration no national indicative targets are published. Member States must analyze the national potential for the application of high-efficiency cogeneration. In the Directive, "high efficiency cogeneration" is defined as combined generation of heat and electric energy resulting in energy savings of at least 10%, compared to separate production. The Directive aims at establishing a harmonized method for calculation of energy savings by CHP. The Commission must by 21 February 2006 establish harmonized efficiency reference values for separate production of electric energy and heat for the purpose of determining the efficiency of CHP. The Commission will review these harmonized values every four years, to take account of technological developments and changes in the distribution of energy sources.

Climate Change

In 2002, the European Union ratified the Kyoto Protocol to the United Nations Framework Convention on Climate Change [23, 24]. By this, the EU-15 committed themselves to reduce their collective emissions of the six key greenhouse gases by at least 8% during the period 2008 to 2012 compared to 1990-levels. The Member States distributed this target among themselves using a so-called "bubble". Equally New Member States are assigned individual targets under the Kyoto Protocol. In order to achieve the emission reduction objectives in the most cost-effective way, the Kyoto Protocol allows 3 flexible mechanisms: Joint Implementation (JI), Emission Trading (ET) and the Clean Development Mechanism (CDM). As of 1 January 2005, an emission trading scheme is in operation in the European Union [26]. Initially it is limited to CO₂ and to the energy sector, iron and steel production and processing, the mineral industry and the wood pulp, paper and card industry, but it can easily be

expanded to other greenhouse gases and sectors. It starts with an initial three-year commitment period, followed by subsequent five-year periods as of 2008. In this context, "allowance" means the entitlement to emit a ton of CO₂ or an amount of any other greenhouse gas with an equivalent global warming potential during a specified period.

The Directive stipulates that from 1 January 2005, all installations in the sectors mentioned that are emitting the greenhouse gases included must be in possession of an appropriate permit issued by the competent authorities. Each Member State draws up a national plan, indicating the allowances it intends to allocate for the relevant period and how it proposes to allocate them to each installation. At least 95% of the allowances for the initial three-year period are allocated to the installations free of charge. For the five-year period beginning 1 January 2008, Member States must allocate 90% of the allowances free of charge. Allowances issued by a competent authority of another Member State must be recognized for the purpose of meeting an operator's obligations. Any operator failing to surrender the required quantity of allowances is obliged to pay an excess emissions penalty. The penalty is €100 for each ton of CO₂ equivalent (€40 during the first three-year period starting on 1 January 2005) and does not release the operator from the obligation to surrender an amount of allowances equal to the excess emissions the following year. Member States shall provide for the establishment and maintenance of a registry in order to ensure accurate accounting of the issue, transfer and cancellation of allowances.

The so-called "Linking Directive" [31] of 2004 reinforces the link between the Union's emission allowance trading scheme and the Kyoto Protocol by making the latter's "project-based" mechanisms (JI and CDM) compatible with the scheme. This linking enables operators as of the five-year period starting 1 January 2008 to use allowances obtained by both mechanisms in the allowance trading scheme to fulfill their obligations. During the first three-year period, only credits from projects under CDM can be used in the Community scheme. According to the Kyoto Protocol, the project-based mechanisms should be supplemental to domestic action. Therefore, Member States should decide on limits for the use of credits from CDM/JI.

Current state of affairs on electricity markets

To what extent the regulatory framework described above has resulted in a true European internal energy market can be evaluated based on the overall progress reports issued yearly by the Commission. Besides these annual progress reports, the European Commission publishes annual benchmarking reports, providing an overview of market opening, third party access, unbundling, etc. per Member State. Also, the Commission has recently published a detailed report outlining the progress made on creating the internal electricity market requested by the 2003 Directive.

In this report, the lack of integration between national markets is identified as the most important and persistent shortcoming of the internal market. Two key indicators are mentioned in this respect: the absence of price convergence across the EU and the low level of cross-border trade. These are said to be generally due to the existence of barriers to entry, inadequate use of existing infrastructure and insufficient interconnection capacity between many Member States, leading to congestion. Moreover, according to Regulation 1228/2003 non-discriminatory market based mechanisms have to be applied for the allocation of capacity on congested interconnectors from 1 July 2004 onwards. This has not happened in all cases. Many delays have been recorded and not all Member States have complied with this deadline.

Moreover, it is reported that many national markets display a high degree of concentration and industry has been further consolidating since market opening started, impeding the development of effective competition. In addition, an increasing number of cross-border acquisitions and a tendency towards vertical integration between generation and supply in some Member States are observed. Another indicator of the lack of real competition raised is the fact that switching by customers remains limited in most Member States, and that choosing a new supplier from another Member State remains the exception.

Full, complete and effective implementation of the second Directives is said to be the main immediate action necessary. Most Member States missed the deadline of 1 July 2004 for their transposition, some not yet having them implemented at all. On top of that, many have taken a rather “minimalist” approach in implementing the Directives, which needs to be re-considered. The Commission states they will continue to insist on compliance, and already opened infringement procedures against Member States for failure to implement the Directives.

4.2 Specification of boundary conditions and guidelines for proper functioning of future energy markets

In March 2004, the European Commission’s DG for Energy and Transport proposed a practical way forward in its medium term Strategy Paper [33], which sets out the Commission’s vision on the development towards an internal electric energy market. Moreover, there is a broad consensus within the industry regarding its content since this document has been compiled in response to the request and with the co-operation of the participants in the Florence Forum. Also academics have expressed their view on the development of the electric energy market in Europe. The “Sustainable Energy Specific Support Assessment” project (SESSA project), funded by the Sixth EU RTD Framework Programme and grouping researchers as well as energy stakeholders, was closed in September 2005 by the conference “Implementing the Internal Market of Electric energy: Proposals and Time-Tables” [34]. From the SESSA research program, 20 priorities on what to do next were derived [35]. In the second part of this fourth work package, seven key action areas are discussed based on the Commission’s view on the main issues presented in its Strategy Paper, supplemented with positions of various industry groups. Finally, a section is added on the technical consequences and implications of regulatory decisions.

Increasing role of regional markets

The reality of today’s electric energy network is that Member States are electrically not particularly well interconnected. In addition, certain countries have already adopted common harmonised rules that, in some cases, go beyond those envisaged by the 2003 Directive and the Regulation on cross-border trade. Therefore, the development of regional markets, not defined according to mere geographical criteria but containing Member States between which interconnection is reasonably strong, may be a necessary interim stage. The proposed approach is that a pan-European market should evolve through the development of these regional markets which should then be linked together to form the internal electric energy market. Within these regional markets, a more developed harmonisation of the regulatory approach taken to most or all issues, is expected, including degree of market opening, determination of transmission tariffs, rules for bilateral trading and congestion management methodologies involving standardised day ahead and intraday markets. In some cases, regulations governing balancing and ancillary services might also be harmonised to some degree. However, any such effort needs to take into account, for example, the different generation plant characteristics in Member States and the costs involved in implementing such measures.

Integrating markets

Increasing coupling between member state submarkets is another step to be taken in the development of the European internal electric energy market. In its road map to a pan-European market [38], Eurelectric declares that a series of strongly interlinked wholesale markets resulting in as large price areas as possible and ultimately – if possible – in one single pan-European price area is the way towards a well functioning pan-European market for electric energy. Therefore, participants of different national or regional wholesale markets must be able to act in different markets and consequently a high level of compatibility in structures, market rules and the regulatory framework is needed, although full harmonisation is not required. According to Eurelectric, it is essential that marketplaces fulfil at least the following criteria:

- Have a sufficient number of market participants in the day-ahead and forward markets, in particular more large consumers from the demand side;

- Provide transparent access to common sets of market information;
- Have market-based mechanisms for congestion management;
- Have liquid day-ahead and forward markets and open balancing and intra-day markets with trustworthy prices.

The need for a balancing market is also stressed in [35] and [6]. Also at the Florence mini-for a, the further integration of European electric energy markets through regional intra-day and balancing markets is said to be beneficial and feasible [8].

Developing cross border trade: transmission tariffication and congestion management

According to the Commission's Strategy Paper, the following specific objectives should be pursued in the medium term in the context of cross-border trade:

- Inter TSO compensation should allow for suitable compensation between Member States for, as a minimum, transit flows and other cross border flows in some cases;
- Transmission charges on generators should be harmonised within a fairly narrow range with, if appropriate, some locational signals introduced at EU level;
- Interconnection capacity should be allocated by non-discriminatory, market based mechanisms consisting of either:
 - within regional markets, a single common co-ordinated market-based mechanism which allows for both "market coupling" encompassing existing day-ahead and possibly intra-day spot markets via the adoption of a common timetable, as well as long term financial hedging;
 - between regional markets, specific market based mechanisms which as far as possible allow for coupling of wholesale markets;
- A high degree of transparency should be provided to network users, including publication of necessary data relating to transport capabilities of interconnector lines.

Finally, in this context it is important to review the rules used by TSOs to deal with internal transmission congestion. TSOs should not, in general, be permitted to systematically transform internal constraints into constraints at borders. This is for example done in Nordel, where it is the rule that all internal problems are shifted as much as possible to the borders, after which the market is splitted. Reasonable balance must be drawn between the needs of national network users and those from other Member States.

Congestion management was also the topic of a separate round of regional Florence mini-fora organised end of 2004 and the beginning of 2005. Resulting from the mini-fora, there are plans now for all interconnectors with non-market based capacity allocation methods to move to market based methods by the beginning of 2006. ERGEG stated in its overall assessment of the mini-fora [8] that a compatible congestion management method for Europe must be able to accommodate both implicit and explicit auctions, with explicit auctioning being the minimum requirement for congested interconnectors in Europe.

Reduction of market concentration

According to the Strategy Paper, Member States should seek to dilute the market power of dominant generating companies and/or to prevent the abuse of dominant positions as follows:

- Investment and capacity release could be used in some cases to reduce the level of concentration, with reciprocal measures between two or more Member States with similar concentration problems;
- Appropriate design of mechanisms to allocate interconnector capacity should mitigate and not add to market power problems within certain Member States and regions;
- Market design should encourage an appropriate mix of both short term trading and longer term bilateral arrangements in order to avoid encouraging collusion;
- The relevant authorities should, on the basis of the necessary information provided by TSOs and power exchanges, monitor the behaviour of market participants closely and should act, using, inter alia, existing competition law and other relevant legislation, to protect consumers from manipulation: ad-hoc intervention in the market should be avoided and this points to the embedment of appropriate market rules designed to prevent undesired manipulations;

- Generators should be required to make transparent, in a consistent manner at European level, their decisions on the availability of generation plants and, where appropriate provide forecasts of availability;
- Demand side participation in wholesale and balancing markets should be encouraged in order to significantly increase the elasticity of demand for electric energy within individual settlement periods and thus reduce the scope for abuse of dominant positions.

Despite the need for some measures to reduce market dominance, it is also important to acknowledge that some of the expected benefits of competition are likely to arise from consolidation to take advantage of economies of scale and scope that exist in this capital intensive industry. Companies should not, in principle, be prevented from taking such actions to improve their performance provided that customers are protected from monopolistic or oligopolistic practices and that new entrants and smaller companies are not unduly disadvantaged. This comment is also made by Eurelectric, that underlines the fact that big players should not be considered responsible for the fact that their size is already of a European dimension whereas the market dimension is lagging behind. Eurelectric notes that the electric energy sector is a capital intensive industry and that the critical mass therefore is rather large. In their opinion, calling for divestment and related measures merely because of the size of market players would constitute unfair discrimination inconsistent with competition law. There, it is a consistent principle that dominant players in a market do not raise any concern as long as these players do not abuse their dominant position: according to Eurelectric, behaviour and not size should be the criterion.

Adequacy of supply

It is necessary for Member States and Regulators to decide what approach they intend to take to the issue of maintaining the balance between supply and demand and stick to it. The Commission's Strategy paper stated that ad-hoc intervention in electric energy markets should be avoided. The proposed Directive on Infrastructure and Security of Supply therefore requires Member States to publish their approach to this issue. A clearly stated approach is vitally important to obtain a stable "market design" at national level in order to encourage the appropriate investments. The proposal also seeks to clarify the responsibilities, in particular, of transmission system operators in ensuring the ongoing balance between supply and demand in real time. The proposed Directive does not, at this stage, explore a more fundamental question about whether the issue of adequacy of supply should be dealt with at national or regional level. From the point of view of economic efficiency, it is clearly of benefit if Member States can share reserve capacity since it means a lower level of reserve is needed in each individual Member State. However at the very least, in an integrated market, a strong unilateral approach to adequacy of supply would not be appropriate. This has implications for treatment of interconnection capacity if one country is relying on another to provide reserve capacity. It also means that there needs to be a clear code of conduct on TSOs wishing to take action to restrict cross border flows in emergency situations.

A different issue relating to generation investments are the procedures required in terms of authorisation and planning approval. The process may be unnecessarily heavy in some Member States and be an unnecessary obstacle to investment. A more streamlined and harmonised process would remove such obstacles. It may be that a comparison of the authorisation and planning process between Member States would allow for the spread of a best practice approach.

Consistent support framework for sustainable energy

Although this is not a requirement of the Directive, Member States are encouraged to develop schemes to promote RES and CHP being the least interfering with competition and consistent in terms of the basic framework and include mutual recognition of energy generated from RES/CHP. This would have the advantage of establishing competition at two levels: in the generation market for conventional fuels as well as, separately, in the green market and this would be expected to increase the cost effectiveness of support. Existing support schemes should therefore be reviewed with a view to bringing them further in line with market mechanisms. Due attention must be given to avoid disproportionate distortions of the market, in particular through Member States adopting different and potentially incompatible policies.

The different support schemes for RES, CHP, energy efficiency and the ETS will interact and have an important impact on the functioning of the electric energy market. Because of the different goals these different programmes pursue they might reduce each others efficiency. Therefore, interactions between these different programmes should be carefully monitored to guarantee that one programme's targets do not counteract another. In a recent report published by the European Commissions DG for Environment [40], the interactions between the EU ETS and certificate systems are discussed. This report illustrates that the presence of these different programmes on one hand influence key variables of the electric energy market such as the wholesale and retail electric energy price, the demand for electric energy and so on. On the other hand, it is shown that one programme might affect the goals of the others and that these programmes interact in complicated ways, with interactions transmitted through wholesale and retail electric energy markets, through markets for the various commodities created by the programmes (i.e., CO₂ allowances, green certificates, and white certificates), and through other markets (e.g., fuel, labour).

Besides the different goals and interactions of the different support schemes, another issue to consider is a possible European harmonization of support schemes for RES and CHP. On 7 December 2005, the Commission published a report on the support for RES [47]. The currently implemented support schemes were assessed based on their level, effectiveness and investor's profit per technology. As expected, the Commission did not regard it as appropriate to present at this stage a harmonized European support scheme. Instead, it calls for a coordinated approach based on two pillars: cooperation between countries and optimization of the impact of national schemes.

Consistent regulation

Interactions between Directives and Regulations do not only occur in the field of sustainable energy. Eurelectric showed in [47] that in the energy field, a number of Directives reinforce and support each other, but that there is also evidence of conflicting effects among a number of Directives. Such inconsistencies have the potential to create confusion and uncertainty and, in the case of the electric energy industry, tend to increase the industry's risks and costs. They could in some cases even undermine the ability of the industry to deliver efficiently on energy policy goals. In the EU regulatory and law-making process the single energy market, security of supply and environmental sustainability are on a separate agenda. This could result in failures instead of synergies [35]. For instance, renewable energy policies often raise new obstacles to competition on wholesale markets and to availability of interconnections. The regulatory framework in the energy field, as in all other areas, should be coherent and consistent with the general framework of a single European market.

Technical consequences and implications of regulatory decisions

The European Internal Electricity Market is not only governed by legislation, but also by the laws of physics. Therefore, the legislative and regulatory framework has to comply with the technical boundary conditions. This is vitally important when considering the representation of the electricity grid, where a choice has to be made between simplicity and correctness.

The European electricity grid is quite well interconnected. Especially in the UCTE area, power flows in virtually any region influence the remainder of the synchronous area. However, the general grid management philosophy applied in Europe is that the internal networks of each country are strong enough to accommodate any possible internal load and generation dispatch: the control zones are considered to be copper plates. The main constraints are assumed to be located on the international interconnections. This makes Europe a zonal market, with the control areas (generally countries) treated as copper-plates connected with thin threads representing the constraints on cross-border flows. The consequence of this zonal approach to grid management is the treatment of cross-border capacity. As in a zonal model each country is represented by its equivalent node, it is impossible to capture the influence of the internal dispatch on individual cross-border lines. Moreover, due to the highly meshed nature of the European grid, even in the presence of balanced control areas (no imports/exports) there are significant power flows on the cross-border lines.

Zonal models are the easiest to implement and are most commonly used in market models, where in each country there is one price, and where a market between neighbouring countries can exist. This model however disregards the difference between transmission capacity and transfer capacity,

introducing difficulties. Physically, the electrical grid consists of nodes connected by lines and/or transformers. However, in a zonal model, clusters of nodes (typically belonging to the same control area or a country) are aggregated into zones. Such zones are considered as copper-plates, i.e. internal transmission constraints are ignored. Zones are connected to other areas by means of virtual links, which in some way aggregate the transmission capacity of individual, physical lines linking nodes belonging to both zones. The capacity of these virtual links is designated as transfer capacity.

Since the TSO's must ensure that the power flows always comply with security limits, some restrictions might be put on the cross-border flows. These limits are expressed in terms of cross-border transfer capacities, giving the maximum power exchange between the zones concerned. However, the latter is not equal to the sum of the physical capacities, but is a result of existing or forecasted network conditions, strongly depending on nodal power injections and power flow patterns.

Aggregated transfer capacities in a zonal network model can also be affected by the shifts of generation within a control zone, as they influence the power flows on the interconnections. Depending on network topology and predictability of the internal dispatch pattern, variations of nodal power injections can have a significant influence on the variation of cross-border flows. Therefore, these capacities are very sensitive not only to the investments (reinforcement of cross-border interconnection, new transmission lines, FACTS and other flow control devices), but also to the changing load and generation pattern. However, both investment decisions and changing power flow patterns are difficult to forecast. Additionally, increased penetration of unpredictable wind energy systems leads to less predictability of the load generation dispatch, negatively influencing the accuracy of the zonal network representation and the capacity available for trade.

Distribution of power flows in the grid can be simulated using either full AC power flow or a simplified DC approximation. The DC method introduces a number of simplifications in the way the grid is studied (i.e. neglects line resistances and reactive power management), but, provided certain criteria are met, it proves to be sufficient to model active power flows [55]-[59]. Thanks to its robustness and simplicity the method is very often employed for techno-economic studies [60].

EUSUSTEL WP4

Regulatory Framework of Energy Markets

4.1 Analysis of the current legislation & regulation¹

4.1.1 Directives 96/92/EC and 2003/54/EC concerning common rules for the internal market in electricity

The EU Treaties of Rome (1957) and Maastricht (1993) laid the foundation of the creation of an internal market in the European Union with free movement of people, goods and capital. At the European Council of Lisbon (2000), the European Union revealed its ambition to become the most competitive and dynamic economy in the world. Both tendencies provoked/reinforced the liberalization of the energy sector, initiated in 1996 by Directive 96/92/EC [3] replaced by Directive 2003/54/EC in 2003 [4]. These Directives establish common rules for generation, transmission, distribution and supply of electric energy. Generally, the first Directive allowed nearly everything, except an integrated internal market [5]. The second Directive 2003/54/EC can be characterized by shorter-term deadlines and less freedom [6]. In what follows, the major aspects of these Directives are discussed.

Market opening

Directive 96/92/EC introduced the concept of eligible consumers, being consumers having the legal capacity to contract volumes of electric energy from any supplier. The Directive aimed at a slow, gradual and partial opening of the Member States' electric energy markets so that more and more generators and consumers have the opportunity to freely negotiate purchase and sales of electric energy. With the new Directive 2003/54/EC, this process is dramatically accelerated: all non-households customers are eligible from 1 July 2004 and all consumers will be eligible from 1 July 2007.

Access to the grid

Under the first Directive, Member States could choose between negotiated or regulated third party access or the single buyer procedure when organising the access to the transmission and the distribution networks. The single buyer model allows the creation of a mandatory power pool for generators with, for instance, the system operator acting as a "single buyer" in the pool. In the regulated third party access model, prices for access to the network are regulated and published beforehand, while in the negotiated procedure they may be subject to negotiations with the network operator. Directive 2003/54/EC limits the options to one regime, being regulated third party access, and requires the appointment of a regulator, having to approve tariffs, monitor congestion management, and act as a dispute settlement authority.

Designation of transmission and distribution system operators

Member States must designate one or more transmission and distribution system operators responsible for operating, ensuring maintenance and when and where necessary developing the network in a given area and its interconnections with other systems in order to guarantee a high quality and adequacy of supply. The transmission system operator (TSO) is responsible for dispatching the generating installations in its area and for determining the use of interconnectors with other systems. The criteria for dispatching must be objective, published and applied in a non-discriminatory manner. System operators must ensure non-discrimination between system users and

¹ This analysis is mainly based upon the summaries of legislation found on the website of the European Union [1] and on the webpage on the opening of the electricity market of the European Commission [2].

provide information needed for efficient access to the system. For environmental reasons a Member State may, however, require the system operator to give priority in the dispatching to electric energy produced from renewables, waste or from combined heat and power.

Unbundling of accounts

The aim of unbundling is to avoid discrimination, cross-subsidization and distortion of competition. Therefore, electricity undertakings must keep separate internal accounts for each of their generation, transmission, distribution and supply activities, as they would be required to do if the activities in question were carried out by separate undertakings. While the first Directive required an administrative unbundling, only obliging companies to present a separate balance sheet for each activity, the second goes a step further requiring legal unbundling. Transmission and distribution companies respectively have to apply legal unbundling from 1 July 2004 and 2007 onwards. Until 1 July 2007 they must keep separate accounts for the supply of eligible and non-eligible customers.

Public service obligations and customer protection

Member States may impose public service obligations on electricity undertakings in their market in order to balance competition with public services where this is necessary in the general interest of society. These obligations must be clearly defined, transparent, non-discriminatory, verifiable and published. They must be notified to the Commission which will check them against Community law. The obligations must fall into one of the following five categories: security of supply, regularity, quality and price of supply and environmental protection, including energy efficiency and climate protection.

By imposing public service obligations, Member States must ensure that all household customers and small enterprises enjoy the right to be supplied with electric energy of a specified quality within their territory at reasonable, easily and clearly comparable and transparent prices. Also, appropriate measures must be taken to protect end-users and vulnerable customers, including measures to help them avoid disconnection. Examples of such obligations could be that a distribution system operator has to supply vulnerable customers in its area with a minimum amount of electric energy or an obligation for suppliers to sell a certain percentage of electric energy coming from renewable energy sources.

Tendering for new capacity

The main instrument for new investment in capacity is the authorisation procedure. In case of insufficient investments in generation capacity when using such a procedure, Member States must stimulate investments in new capacity through a tendering procedure, or any procedure equivalent in terms of transparency and non-discrimination on the basis of published criteria. In the tendering procedure the Member State sets up an inventory of the needs for future generating capacity, including the demand for electric energy, based on estimations carried out by the transmission system operator or any other competent authority designated by the Member State. This allows Member States to plan the construction of new capacity.

Reporting

According to the 2003 Directive, the Commission has to monitor and review its application. Therefore, an overall progress report has to be submitted to the European Parliament and the Council before the end of the first year following the entry into force of the Directive and, thereafter, on an annual basis. Moreover, by the end of 2005 the Commission must submit a detailed report outlining the progress made on creating the internal electric energy market. For a discussion of the contents of these reports, see section 0 below.

4.1.2 Florence Forum [8]

The Directives set out the general framework and principles for the introduction of competition in the electric energy industry. However, in line with the principle of subsidiarity, much of the practical and technical details of implementation are left open to national interpretation. Nevertheless, while creating an internal market, co-operation and co-ordination between Member States are of vital importance. Therefore, in 1998 the European Commission set up a consultative body to discuss the creation of a true internal electricity market: the Electricity Regulatory Forum of Florence ("*Florence Forum*").

Next to the formal structure for official meetings between national authorities already established in Brussels, the Florence Forum provides a platform allowing a broader participation for more informal discussion and the open exchange of experience. Participants are national regulatory authorities, Member States, the European Commission, transmission system operators, electricity traders, consumers, network users, and power exchanges. The Forum convenes once or twice a year, formerly in Florence, but now in Rome. Since this is an informal process, their decisions are not binding.

Besides the progress made in creating a true internal market, the main topics discussed at the Florence Forum are cross border trade of electric energy, in particular tariffication of cross border electric energy exchanges, rules for allocation and management of scarce interconnection capacity (congestion management), quality and adequacy of supply and where economically justified, the increase of existing physical interconnection capacity.

Congestion management was even treated in a separate round of Florence mini-forum meetings held between December 2004 and February 2005. These meetings, set up by the 11th Florence forum, were organised by the European Energy Regulators (section 4.1.3) and the European Commission and attended by regulators, transmission system operators, power exchanges and the European Commission. The mini-fora addressed congestion management in the European transmission network on a regional basis. They aimed at providing a plan and detailed timetable for the introduction of at least day-ahead coordinated market based mechanisms, such as auctions.

More detailed information on the contents of the various Florence Fora can be found in the corresponding chapters later in this text:

- Congestion management and cross-border exchanges of electricity: section 4.1.4
- Security of supply: section 4.1.5
- Position papers of the various stakeholders on the creation of the internal market: section 4.2

4.1.3 European Regulators Group [9, 10]

Another advisory group established to assist the European Commission in consolidating the internal market is the European Regulators Group for Electricity and Gas (EREG), set up on 11 November 2003 by Commission Decision 2003/796/EC [11]. Its members are all regulators from the EU. Regulators from new Members States and the European Economic Area are observers. Also the Commission is represented and will keep the European Parliament informed on the Group's activities on an annual basis. The creation of the Regulators Group was strongly advocated by the Parliament in the course of the legislative procedure leading to the adoption of the 2003 Directive. On cross-border transactions issues, the Florence Forum has made important contributions and will remain important as discussion platform involving all players from government, regulators and industry. However, with the establishment of EREG, regulatory co-operation and co-ordination have been given a formal structure.

EREG's primary responsibility is to help ensure a consistent application in all Member States of the most recently adopted Directives as well as the new Regulation on cross-border exchanges of electric energy (section 4.1.4.2). Moreover, the Regulators Group coordinates the preparation of the reports

national electric energy regulators must publish yearly under the 2003 Electricity Directive, regarding the outcome of their monitoring activities related to the functioning of electric energy and natural gas markets. In order to ensure appropriate coherence and consistency among these different reports, the European Commission invited ERGEG to agree on a common structure for them. Moreover, ERGEG cooperates with the EC in the analysis of the individual reports in order to enable an overall assessment of the functioning of the internal energy market, due by the end of 2005 (section 0). All market participants, consumers and end-users will be able to provide input to ERGEG's activities.

So far, ERGEG's most important contributions have been in the area of monitoring the creation of the internal electric energy market, discussing amongst others the creation of regional electricity markets, and providing guidelines on congestion management and transmission tariffication. These contributions will also be discussed in the relevant chapters later in this text.

4.1.4 Congestion management and cross-border exchanges of electric energy

As a result of the creation of a European internal market, the amount of cross-border electricity trade should be increasing. However, up until today the level of trade in electric energy is much lower than in other sectors that have gained much from the internal market, such as the telecommunications sector [7] (section 0). The second Directive does not provide any explicit provisions on the regulation of cross-border trade. However, together with the 2003 Directive, a Regulation has been issued on this topic, discussed in this section. Next, the Florence mini-fora discussing congestion management and the position papers on this topic by ERGEG and CEER, will be looked at. First, a European measure to stimulate regulated cross-border transmission investments will be described, being the Trans-European Energy Networks Program (TEN-E).

4.1.4.1 Trans-European Energy Networks Program TEN-E²

In order to encourage effective operation of the internal electric energy market, strengthen economic and social cohesion by reducing the isolation of less favoured and island regions, and to reinforce the security of energy supply, the European Union co-finances electricity and gas transmission infrastructure projects of European interest under the Trans-European Energy Networks program³ (TEN-E). A yearly budget of about 25 M€ is spent mainly for supporting feasibility studies. In the electricity field, projects concerned are investments in

- High voltage lines, excluding those of distribution networks, and submarine links, provided that this infrastructure is used for inter regional or international transmission/connection.
- Any equipment or installations essential for the system in question to operate properly, including protection, monitoring and control systems.

Most of the projects cross national borders and/or have an influence on several EU Member States. Member States have to approve projects of common interest concerning their territory. Priority is given to projects

- displaying potential economic viability;
- solving the problems of bottlenecks and missing links, especially cross-border, and dealing with congestion;
- taking account of the needs of the internal market in the light of enlargement;

² This analysis is mainly based upon previous work done at the University of Leuven [6, 12] and the EU's webpage on Trans-European Energy Networks [13, 14].

³ Note that this fund also includes gas projects.

- establishing energy networks in island, isolated, peripheral and ultra peripheral regions while promoting the use of renewable energy sources;
- interoperability of networks within the European Union with those in the accession countries and with other countries in Europe and the Mediterranean and Black Sea basins.

The program started in 1996, when bottlenecks of common interest were listed for the first time. Investment projects alleviating these bottlenecks have been included in the first call on TEN-E funding. The list has been revised three times, (1997, 1999 and 2003). In 2003, the list was updated to take into account the EU enlargement in May 2004. Nine axes, being clusters of priority projects, have been determined (Figure 1) (for detailed information on the priority projects objectives and main elements, see [13]). From 1995 to 2003, 285 proposals have been submitted, of which only 18 have been declared not eligible because they were not corresponding to a project of common interest. Of the eligible proposals, 168 were accepted for funding. 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. A survey conducted by EC concludes that the TEN-E financing has a relatively minor effect on the overall budget of the project, but can act as an important stimulator at an early and risky stage of the project.

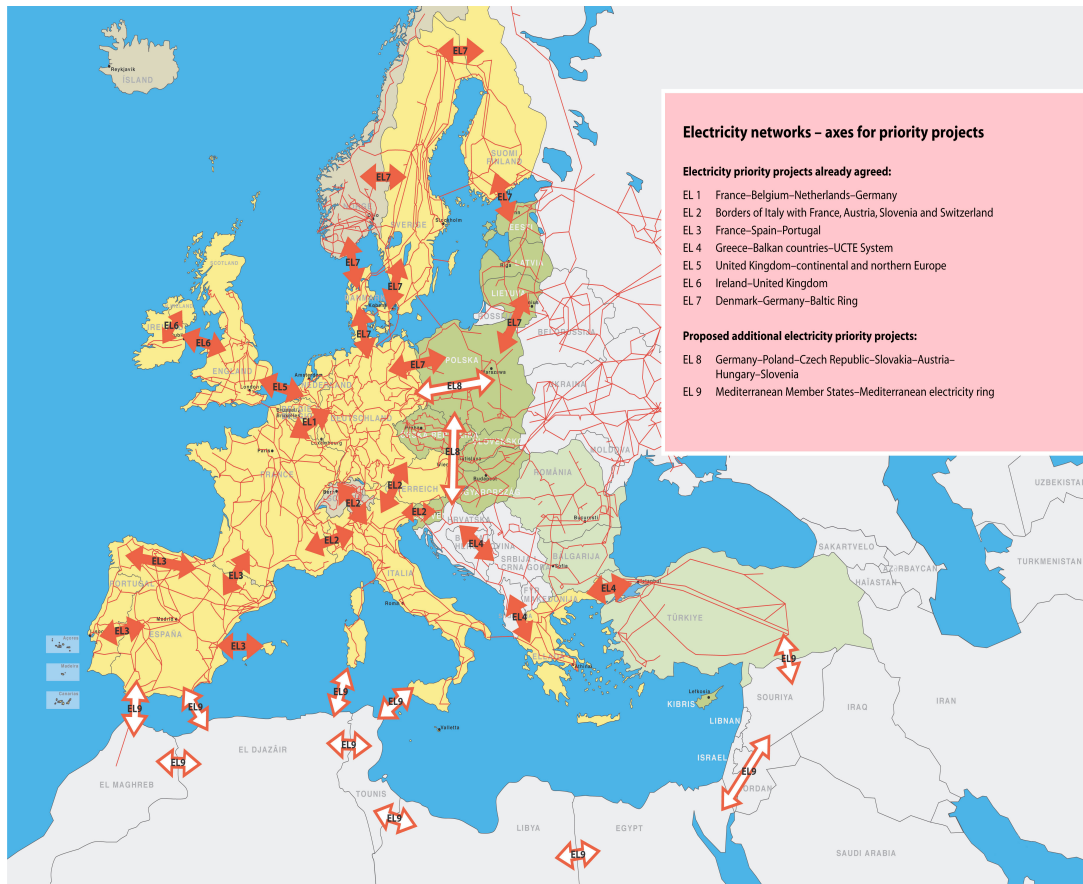


Figure 1: Priority axes identified under the TEN-E program (EL1 to EL9)

4.1.4.2 Regulation 1228/2003 on conditions for access to the network for cross-border exchanges in electricity

This Regulation lays down fair rules for cross-border exchanges of electric energy, thus enhancing competition within the internal market. Its aim is to promote cross-border trade in electric energy by laying down basic rules regarding access to networks for cross-border transactions. This is done by

establishing a compensation mechanism for cross border flows and by introducing harmonised principles on cross-border transmission charges and on the allocation of available interconnection capacities between national transmission systems. The content of this Regulation, applicable since 1 July 2004, is being discussed in what follows.

Compensation mechanism between transmission system operators

The Regulation stipulates that transmission system operators (TSO's) should receive compensation for costs incurred as a result of hosting cross-border flows of electric energy on their network. This compensation is paid by the operators of national transmission systems from which the cross-border flows originate and the systems where those flows end. Compensation received by TSO's for hosting cross-border flows is calculated based on costs of infrastructure "used" for the flows. By applying such a compensation mechanism, "pancaking" of national transmission tariffs is avoided. Pancaking occurs when for cross-border transactions involving multiple transmission networks, the customer has to pay the full capacity value to each TSO involved.

Charges for network access

Charges applied by network-operators for access to networks should be transparent, take into account the need for network security and reflect actual costs incurred. Charges may not be distance-related and should be applied regardless of the country of destination and origin of the electric energy as specified in the underlying commercial arrangement. Both generators and consumers ('load') may be charged for access to the network. Where appropriate, the level of the tariffs should provide locational signals at a European level, taking into account the amount of network losses and congestion induced, and investment costs for infrastructure. Payments resulting from the inter-TSO compensation mechanism should be taken into account when setting charges for network access. No specific network charge should be applied to declared transits of electric energy.

Information on interconnection capacities

TSO's are obliged to install coordination and information exchange mechanisms to ensure secure operation of the networks in the context of congestion management. They have to publish estimates of the available transfer capacity for each day, indicating any available transfer capacity already reserved, at specified intervals before the day of transmission.

General principles of congestion management

Network congestion problems should be addressed with non-discriminatory market-based solutions giving efficient economic signals to the market participants and TSO's involved. Such problems shall preferentially be solved by non transaction based methods, i.e. methods that do not involve a selection between contracts of individual market participants.

Market participants must inform the transmission system operators concerned, a reasonable time ahead of the relevant operational period, whether they intend to use the allocated capacity or not. Any allocated capacity that will not be used is reattributed to the market.

Revenues resulting from the market-based allocation of interconnection capacity have to be used for one of the following purposes:

- Guaranteeing the actual availability of allocated capacity.
- Network investments maintaining or increasing interconnection capacities.
- 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.

New interconnectors

New interconnectors or significant capacity increases in existing connectors may, upon request, be exempted from these conditions regarding the usage of revenues from the allocation of interconnection under the following conditions:

- The investment must enhance competition in electricity supply.
- The level of risk attached to the investment must be such that the investment would not take place unless an exemption is granted.
- The interconnector must be owned by a natural or legal person who is separate at least in terms of its legal form from the system operators in whose systems the interconnector will be built.
- Charges must be levied on the users of that interconnector.
- Since the opening of the market, no part of the (capital or operating) costs of the interconnector has been recovered from any component of distribution/transmission charges of the systems linked by the interconnector.
- The exemption is not to the detriment of competition or the effective functioning of the internal electricity market, or the efficient functioning of the regulated system to which the interconnector is linked.

The Commission has to monitor Member States' decisions regarding exemptions and the restrictive way these measures are to be interpreted.

Guidelines

When appropriate, the Commission shall adopt and amend guidelines relating to the inter-TSO compensation mechanism, in accordance with the principles listed above. These guidelines shall specify in particular:

- details of the procedure for determining which TSO's are liable to pay compensation for cross-border flows;
- details of the payment procedure to be followed;
- details of methods for determining the quantity of cross-border flows hosted and the magnitudes of such flows;
- details of the methodology for determining the costs and benefits as a result of hosting cross-border flows;
- details of the treatment in the context of the inter-TSO compensation mechanism of electric energy flows originating or ending in countries outside the European Economic Area;
- participation of national systems interconnected through direct current lines.

Three years after the entry into force of this Regulation, the Commission shall publish a report on the experience gained in its application.

4.1.5 Security of energy supply

4.1.5.1 Green Paper: Towards a European strategy for the security of energy supply

On 29 November 2000, the European Commission adopted a Green Paper⁴ on Security of Energy Supply [15]. Comments and proposals by stakeholders had to be provided before 30 November 2001. The main incentive of this Green Paper was Europe's constantly increasing external dependence for energy. The EU imported 50% of its energy requirements and if no measures were taken within the next 20 to 30 years this figure would rise to 70%. Energy imports represented 6% of total imports, which means in geopolitical terms that 45% of oil imports would come from the Middle East and 40% of natural gas from Russia. The EU did not yet have all the means possible to change the international market and consequently tackled this problem by introducing a strategy of security of energy supply. This strategy aimed at reducing the risks linked to this external dependence and was initiated by the Green Paper of 2000. In tackling this problem, the EU will have to face many challenges which must be taken into account in the development of such a strategy. The two major new challenges are:

- environmental concerns influencing energy choices, most significantly the combat against climate change;
- development of the internal market that has given a new role to energy demand which could lead to political tension, e.g. the fall in prices could thwart the action to combat climate change.

According to the Green Paper, the main objective of an energy strategy should be to ensure, for the well-being of its citizens and for the proper functioning of the economy, the uninterrupted physical availability of energy products on the market at an affordable price for all consumers, whilst respecting environmental concerns and looking towards sustainable development. It is not a question of maximising energy self-sufficiency or of minimising dependency, but one of aiming to reduce the risks linked to such dependency. The European Union has very limited scope to influence energy supply conditions. Therefore, it is essentially on the demand side that the EU can intervene, mainly by promoting energy savings.

The Green Paper outlines a long-term energy strategy of which the main points are the following.

- The EU must rebalance its supply policy by clear actions in favor of a demand policy. The margins for manoeuvring for any increase in Community supply are weak in view of its requirements, while the scope for actions to address demand appears more promising. An attempt at controlling the growth of demand ought to be made, notably by encouraging a real change in consumer behaviour through, for example, taxation measures.
- An analysis of the contribution of nuclear energy in the middle term should be undertaken. Without action, the contribution of nuclear energy will become even weaker in future. Whilst examining nuclear energy in terms of its future contribution, issues such as global warming, security of supply and lasting development should be debated. Whatever the conclusions of this reflection, research in the area of security of nuclear waste management must be actively pursued.
- A stronger mechanism should be provided to build up strategic stocks and to foresee new import routes for increasing amounts of oil and gas.

The Green Paper opened up a wide debate in the EU on security of supply. In its final report [16], the points raised in this discussion were summarized. Most of the stakeholders who gave their opinion on

⁴ Green papers are discussion papers published by the Commission on a specific policy area. Primarily they are documents addressed to interested parties - organisations and individuals - who are invited to participate in a process of consultation and debate. In some cases they provide an impetus for subsequent legislation.

the proposals in the Green Paper were in favour of the main thrust of the strategy proposed, namely emphasis on controlling demand by, for example, promoting more energy efficiency. Given that there was almost unanimous agreement on this approach, the Commission already took several initiatives, such as the

- Directive 2001/77/EC on electric energy generation from renewable energy sources (section 4.1.6);
- Directive 2004/8/EC on promotion of cogeneration (section 4.1.7)
- Directive 2002/91/EC on energy saving in buildings ;
- Directive 2003/30/EC on promotion of biofuels ;
- Directive 2003/96/EC restructuring the Community framework for taxation of energy products and electric energy;
- Proposal COM(2003)739 for a directive on energy end-use efficiency and energy services;
- Transport policy White Paper⁵ to improve management of this sector which represents 32% of energy consumption and 28% of total CO₂ emissions.

Recently, stimulated by Europe's increasing energy imports dependence, the British Prime Minister Tony Blair at the start of the British presidency, pleaded on 27 September 2005 for better co-ordination to tackle climate change and to improve security of supply at EU level. With this statement, Blair moved away from the traditional British skepticism about a common EU energy policy. In particular, Blair's initiative suggested better interconnection between the EU's power grids in order to establish one single grid and exchange of information on security of supply

4.1.5.2 Proposal COM(2003)740 for a Directive concerning measures to safeguard security of electric energy supply and infrastructure investments

The main result of the Green Paper is the Proposal for a Directive concerning measures to safeguard security of electricity supply and infrastructure investment, issued on 10 December 2003 [17]. The proposed Directive establishes measures aimed at ensuring the proper functioning of the EU internal market for electricity by safeguarding adequacy of electric energy supply and by ensuring a sufficient level of interconnection capacity between Member States to ensure competition at European and national level. This is necessary in order to reach the target set at the Barcelona summit in March 2002 of an interconnection level equivalent to 10% of installed generation capacity. Moreover, a large proportion of new generation investment is expected to come from generation based on renewable energy sources and CHP. This also requires new investments to allow electricity networks to be reconfigured. The main provisions of this Proposal will now be discussed.

Network Security

Network operators adopt rules to ensure that the network has enough spare capacity so that the grid can be operated safely under a variety of extreme circumstances. These rules, as well as other requirements on information provision and scheduling timetables, are currently dealt with through voluntary guidelines between the Members of TSO organisations such as UCTE and Nordel. UCTE is currently finishing off an update of their operational handbook which they intend to make contractually binding on their Members [18]. According to the Proposal, Member States have the duty to ensure that transmission and distribution companies comply with co-operation such as the UCTE initiative.

⁵ White papers are documents containing proposals for Community action in a specific area. They sometimes follow a green paper published to launch a consultation process at European level. While green papers set out a range of ideas presented for public discussion and debate, white papers contain an official set of proposals in specific policy areas and are used as vehicles for their development.

Member States should, in consultation with their neighbouring countries, ensure that minimum operational standards on network security are observed by the TSO's. The national regulatory authorities have to set performance standards for TSO's and DSO's in terms of occurrence of interruptions of final customers as a result of network incidents.

Maintaining Balance between Generation and Supply

In the coming years, both demand management and generation capacity will require investments in order to maintain the balance between generation and supply. However, regulatory uncertainty may prevent adequate investments taking place. Moreover, it is improbable that investors are prepared to invest in peak capacity that is only used to cover the very highest periods of demand or incidents where a large proportion of other generation is not available. Thus, there may be a case for governments to provide further measures to ensure adequate generation capacity is available, such as tendering procedures and capacity payments or markets.

Already in Articles 4 and 7 of the 2003 Directive, Member States are asked to supervise adequacy of supply and in case of insufficient investment in generation capacity, use a tendering procedure to stimulate investments. The Proposal repeats that Member States are obliged to take appropriate measures, including the support for efficient use of energy as well as the encouragement of new generation companies to enter the market, to ensure that there is a balance between the supply for electric energy and the availability of generation capacity. It adds that Member States in particular have to require TSO's to ensure an appropriate level of reserve capacity. In addition, Member States may take additional measures to achieve these objectives, including but not limited to:

- Promotion of demand management
- Interruptible customers
- Obligations on suppliers and/or generators
- The establishment of a wholesale market framework with a sufficient number of competitors that provides suitable price signals for investment and consumption.

Network Investment

Both for the transmission and distribution network, investment in demand side management measures should be given priority in so far as they can replace the need for network or generation investment.

Interconnector Construction

Without new investments in interconnection between Member States, the internal market will not function properly and both security of supply and the efficiency of the industry will be affected. New interconnections within Europe are needed to foster competition, particularly where existing companies have a dominant position. Moreover, increased interconnection allows for the possibility of Member States to share reserve capacity since it is unlikely that peak levels of demand will occur at the same time in all Member States at the same instant in time. This will improve the level of security of supply and potentially lead to reduced costs. Finally, also accommodation of wind energy requires new investments in interconnection.

Under the Proposal, TSO's regularly have to submit a document setting out their investment intentions for the provision of an adequate level of cross-border interconnection capacity to the regulatory authority. The latter has to consult with the Commission, which will next consult on the aggregate effect of the proposed investments with the European Regulators group. After having approved the investment plans, the regulatory authority has to take the TSO's investment strategy into account when approving the methodology for network access tariffs under Article 23(2) of the 2003 Directive. In particular, the regulatory authority needs to ensure that TSOs are adequately rewarded for the investments made and should provide positive incentives for investment by allowing a rate of return on investment that compares to the average cost of capital (WACC) for investment with similar risks.

In the event that, for whatever reason, the TSO fails to make sufficiently rapid progress on important infrastructure projects, the regulatory authority is given certain rights to ensure that progress on the approved investment strategy is satisfactory, in particular by one of the three following measures:

- Imposing financial penalties on TSO's whose projects fall behind schedule.
- Issuing an instruction to the TSO to undertake work by a certain date.
- Arranging for work to be undertaken by a contractor through a tender process.

Transposition

Compliance is required before 1 January 2006.

4.1.6 Directive 2001/77/EC on promotion of electric energy produced from renewable energy sources

In order to increase the share of RES in Europe's energy balance, the Green Paper of 1996 [19] for the first time fixed an ambitious objective: to almost double the contribution of RES to gross inland energy consumption to 12% by 2010. This target was repeated in the White Paper of 1997 [20]. In 2001, the White Paper resulted in a Directive on RES [21], which will be discussed in detail in the next section. The Directive aims at promoting an increase in the contribution of RES to electric energy generation and confirmed the target of 12% of gross inland energy consumption from RES for the Community as a whole by 2010, of which electric energy would represent 22.1%. This target was reduced to 21% after the accession of the 10 new Member States. It concerns electric energy generated from non-fossil energy sources such as wind, solar, geothermal, wave, tidal, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases.

National indicative targets

Every five years Member States must adopt and publish national indicative targets for the following ten years for future consumption of electric energy generated from renewable energy sources (RES-E) in terms of a percentage of electric energy consumption, and show what measures have or are to be taken to meet those targets. The Member State targets must account for the reference values set out in the Annex of the Directive, being indicative targets per Member State concerning the share of electric energy generated from renewable energy sources in gross electric energy consumption in 2010. They must also be compatible with all the national commitments entered into as part of the commitments accepted by the Community at Kyoto.

Support schemes

In order to attain these targets Member States can apply mechanisms according to which a generator of electric energy receives direct or indirect support. According to the Directive, the Commission should have presented by 27 October 2005 at the latest, a report on the experience gained concerning the application and coexistence of the different support schemes in the Member States. This report is still in the pipeline and will evaluate the success, including the cost-effectiveness, of the support schemes for the promotion of RES-E consumption. If necessary, this report will be accompanied by a proposal for a Community framework for support schemes for RES-E.

Any proposal for a framework should:

- contribute to the achievement of the national indicative targets;
- be compatible with the principles of the internal electric energy market;
- take into account the characteristics of different sources of renewable energy, together with different technologies and geographical differences;
- promote the use of renewable energy sources in an effective way, be simple and, at the same time, as efficient as possible, particularly in terms of cost;
- include sufficient transitional periods for national support systems of at least seven years and maintain investor confidence.

Guarantee of origin of RES-E

Since October 2003, Member States should be able to guarantee the origin of RES-E by issuing guarantees of origin. These guarantees serve to enable generators of RES-E to demonstrate that the electric energy they sell is generated from renewable energy sources. Such a system facilitates exchanges of RES-E and increases transparency while facilitating consumer choice. The guarantees of origin indicate both the renewable energy source from which the electric energy is generated and the date and place of generation and, in the case of hydroelectric installations, also the capacity. Their issuing must be supervised by a competent body independent of generation and supply activities and based on objective and non-discriminatory criteria. In addition, accounting for the principles of the internal market, the guarantees of origin are to be mutually recognized by the Member States, exclusively as proof of electrical energy's origin.

Administrative procedures

One major barrier to the further development of RES-E is the administrative and planning procedures that potential generators must respect, which is particularly a problem for small and medium-sized companies (SMEs), making up a significant proportion of companies in this sector.

With this in mind, Member States are required to review their existing legislative and regulatory frameworks concerning authorisation procedures in order to reduce regulatory and non-regulatory obstacles to the increase in electric energy generation from RES-E. Administrative procedures have to be streamlined and expedited at the appropriate administrative level and the rules have to be transparent and non-discriminatory. What is more, it is important for the rules to take account of the particular characteristics of the different renewable energy source technologies.

Grid connection issues

Connection to the grid can be expensive for generators using RES-E. Care must be taken to ensure that the high costs of connection do not hamper either the development of RES-E or the functioning of the internal market, which must guarantee fair conditions to all generators and suppliers.

To this end, Member States are to put in place a legal framework or are to require transmission and distribution system operators:

- To guarantee the transmission and distribution of RES-E. Member States may agree on priority access for RES-E. When dispatching generation installations, priority has to be given to installations using RES to the extent feasible by the electric power system;
- To define and publish standard rules on responsibility for the costs of technical adaptations needed to enable a new RES-E generator to feed his electric energy into the grid. The Member States may require network operators to bear some or all of the costs;
- To define and publish standard rules on sharing the costs of the system installations among all the generators benefiting from it, such as for the strengthening of the grid;
- To supply new generators who wish to be connected to the grid with a complete and detailed estimate of the connection costs. The Member States may allow generators to call for tenders for connection work.

Member States must ensure that transmission and distribution costs do not in any way discriminate against RES-E, including in particular RES-E generated in island regions or regions of low population density. Member States are also required to examine measures to be taken to facilitate the access of RES-E to the grid, considering in particular the need to introduce two-way metering (i.e. possibility of purchasing electric energy from the grid when RES-E generation is insufficient).

Summary report

By 31 December 2005 and every 5 years thereafter, the Commission must present a report on the implementation of the Directive.

4.1.7 Directive 2004/8/EC on the promotion of cogeneration

The energy-saving potential of combined heat and power (CHP) is currently under-utilized in the Community. Electric energy generation from cogeneration accounted for 11% of total electric energy generation in the EU in 1998. In 2004 a directive on cogeneration was issued [22] that has to be transposed into national law by 21 February 2006. The Directive aims at increasing the share of CHP in Europe's energy balance.

The purpose of this Directive is to establish a transparent common framework in order to promote and facilitate the installation of high efficiency cogeneration plants where demand for useful heat exists or is anticipated. "High efficiency cogeneration" is defined as combined generation of heat and electric energy resulting in energy savings of at least 10%, compared to separate production. Also, the Directive aims at establishing a harmonized method for calculation of energy savings by CHP.

According to the Directive, the Commission must by 21 February 2006 establish harmonized efficiency reference values for separate production of electric energy and heat for the purpose of determining the efficiency of CHP. The Commission will review these harmonized values for the first time on 21 February 2011, and every four years thereafter, to take account of technological developments and changes in the distribution of energy sources.

Based on these harmonized efficiency reference values and within six months after their adoption, Member States must ensure that the origin of electric energy produced from high-efficiency cogeneration can be proved by issuing guarantees of origin. Member States must ensure that the guarantee of origin enables generators to demonstrate that the electric energy they sell is coming from high efficiency cogeneration. Guarantees of origin should be mutually recognized by Member States and must:

- Specify the lower calorific value of the fuel source from which the electric energy was generated, specify the use of the heat generated together with the electric energy and the dates and places of generation;
- Specify the quantity of electric energy from high efficiency cogeneration that the guarantee represents. This calculation should be done in accordance to Annex II of the Directive, in which guidelines for the calculation of electric energy from CHP are given;
- Specify the primary energy savings, calculated in accordance to the methodology provided in Annex III: methodology for determining the efficiency of the cogeneration process.

Member States must analyze the national potential for the application of high-efficiency cogeneration. Following a request by the Commission at least six months before the due date, Member States must evaluate progress towards increasing the share of high-efficiency cogeneration for the first time by 21 February 2007 and thereafter every four years. Support schemes for CHP may be established on a national level and support must be based on the useful heat demand and primary energy savings. In order to ensure the transmission and distribution of electric energy generated by CHP-units, the provisions of the 2001 Directive on RES apply.

Also similar to the Directive on RES, Member States must evaluate the existing legislative and regulatory framework with regard to authorization procedures. Such an evaluation is carried out in view of:

- Encouraging the design of cogeneration units to match economically justifiable demands for useful heat output and avoiding production of more heat than useful heat;
- Reducing the regulatory and non-regulatory barriers to an increase in cogeneration;
- Streamlining and expediting procedures at the appropriate administrative level;
- Ensuring that the rules are objective, transparent and non-discriminatory, and take full account of the available cogeneration technologies.

The Commission shall review the application of this Directive one year after having received the progress reports from the Member States, thus for the first time by 21 February 2008 and thereafter

every four years. As in the case of RES, this report shall examine the experience gained with the coexistence of different support mechanisms for CHP. Moreover, the efficiency reference values for separate production shall be reviewed based on current technologies, together with the progress towards attaining the national potential.

4.1.8 Climate Change

In 2002, the European Union ratified the Kyoto Protocol to the United Nations Framework Convention on Climate Change [23, 24]. By this, the EU-15 committed themselves to reduce their collective emissions of the six key greenhouse gases by at least 8% during the period 2008 to 2012 compared to 1990-levels. The Member States distributed this target among themselves using a so-called "bubble". Equally the New Member States are assigned individual targets under the Kyoto Protocol. This commitment led to several measures in the energy and transport field aiming at reducing emissions, such as the Directives on the promotion of RES and cogeneration, and on taxation of energy products (Directive 2003/96/EC).

In order to achieve the emission reduction objectives in the most cost-effective way, the Kyoto Protocol allows 3 flexible mechanisms:

- **Joint Implementation (JI):** This mechanism allows developed countries listed in Annex I to implement projects that reduce emissions, or remove carbon from the atmosphere, in other Annex I Parties, in return for emission reduction units (ERUs). The ERUs generated by JI projects can be used by them to meet the emissions targets under the Protocol. A JI project might involve, for example, replacing a coal-fired power plant with a more efficient combined heat and power plant.
- **Emission Trading (ET):** Emission trading allows Annex I parties who reduce emissions below their assigned amount to sell part of their emission allowance to other Annex I parties. This enables countries to make use of lower cost opportunities to reduce emissions, irrespective of the place where those opportunities exist.
- **Clean Development Mechanism (CDM):** This mechanism provides for Annex I Parties to implement project activities that reduce emissions in developing countries (non-Annex I Parties), in return for certified emission reductions (CERs). CERs can also be used by Annex I Parties to help meet their emissions targets under the Kyoto Protocol. CDM projects have to assist the developing country hosting the project in achieving sustainable development.

In June 2000, the European Climate Change Program ECCP [25] was established to help identify the most environmental and cost-effective measures enabling the EU to meet its target under the Kyoto Protocol. As one of the results of the ECCP, a European scheme for greenhouse gas emission allowance trading was established. Therefore, a Directive was issued in 2003 [26], which will now be discussed.

4.1.8.1 Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading

As of 1 January 2005, an emission trading scheme is in operation in the European Union. Initially it is limited to CO₂ and to the energy sector, iron and steel production and processing, the mineral industry and the wood pulp, paper and card industry, but it can easily be expanded to other greenhouse gases and sectors. It starts with an initial three-year commitment period, followed by subsequent five-year periods as of 2008. In this context, "allowance" means the entitlement to emit a ton of CO₂ or an amount of any other greenhouse gas with an equivalent global warming potential during a specified period. The details of the Directive establishing this emission allowance scheme will now be discussed.

Greenhouse gas emission permits

The Directive stipulates that from 1 January 2005, all installations carrying out activities in the energy sector, iron and steel production and processing, the mineral industry and the wood pulp, paper and card industry that are emitting the specific greenhouse gases associated with that activity must be in possession of an appropriate permit issued by the competent authorities.

The authorities issue a permit when they are satisfied that the operator of the installation is capable of monitoring and reporting the emissions. A permit may cover one or more installations on the same site operated by the same operator. The permit contains details of:

- name and address of the operator;
- installation's activities and emissions;
- monitoring methodology and frequency;
- reporting requirements with respect of emissions;
- obligation to surrender, during the first four months of each year, a quantity of allowances equal to the total emissions over the previous year.

Management of allowances

Each Member State draws up a national plan complying with the criteria set out in Annex III of this Directive, indicating the allowances it intends to allocate for the relevant period and how it proposes to allocate them to each installation. The plans covering the initial three-year period from 1 January 2005 to 1 January 2008 should have been published by 31 March 2004 at the latest, and those relating to subsequent five-year periods should be published at least eighteen months before the beginning of the relevant period. When drawing up plans, Member States should take due account of comments from the public. If a plan does not comply with the criteria in Article 10 or Annex III of this Directive, the Commission may reject it within three months of notification.

At least 95% of the allowances for the initial three-year period are allocated to the installations free of charge. For the five-year period beginning 1 January 2008, Member States must allocate 90% of the allowances free of charge.

Member States ensure the free circulation of allowances within the European Community. Allowances issued by a competent authority of another Member State must be recognized for the purpose of meeting an operator's obligations. Each year, on 30 April at the latest, Member States also make sure that operators of the installations surrender the correct quantity of allowances proportional to the total emissions over the previous year. The surrendered allowances are subsequently cancelled.

Monitoring and reporting of emissions

At the end of each year, an operator must submit a report to the competent authority detailing the greenhouse gas emissions produced by the installation during that year. These reports must comply with the "guidelines for the monitoring and reporting of emissions" laid down in Annex IV of this Directive and with the Commission Decision 2004/156/EC establishing guidelines for monitoring and reporting greenhouse gas emissions [27, 28].

When verifying reports submitted by operators, due account must be taken of the criteria for verification set out in Annex V to this Directive. If a report is not judged to be satisfactory, the operator must cease trading allowances until the report is deemed to be so.

Penalties

Any operator failing to surrender, by 30 April at the latest, the quantity of allowances equal to the emissions from his installation during the previous year is required to pay an excess emissions penalty. The penalty is € 100 for each ton of CO₂ equivalent (€ 40 during the first three-year period starting on 1 January 2005) and does not release the operator from the obligation to surrender an

amount of allowances equal to the excess emissions the following year. The names of operators in breach of requirements to surrender sufficient allowances are published. Moreover, each Member State determines its own sanctions regime covering infringements of this proposal and notifies the Commission accordingly by 31 December 2003 at the latest.

Kyoto Protocol project mechanisms

This Directive recognizes that it is important and desirable to link Kyoto's project-based mechanisms joint implementation (JI) and clean development mechanism (CDM) to the Community emission allowance trading scheme in order to achieve the goals of reducing greenhouse gas emissions while increasing the cost-effectiveness of the Community scheme. This is institutionalized in Directive 2004/101/EC.

Registries, reports and agreements

Member States shall provide for the establishment and maintenance of a registry in order to ensure accurate accounting of the issue, transfer and cancellation of allowances. The Commission adopted a regulation on the establishment of a standardized and secured system of registries in the form of an electronic database for this purpose [29]. These registries also guarantee public access to information, confidentiality and conformity with the provisions of the Kyoto Protocol.

The Commission will nominate a Central Administrator to maintain an independent transaction log recording the issue, transfer and cancellation of allowances at Community level. The Central Administrator will conduct an automated check on each transaction relating to allowances. If irregularities are identified, the transactions in question will be suspended until the irregularities have been corrected.

Each year, the Member States will submit to the Commission a report on the application of this Directive and the Directive amending it. The Commission will publish an annual report based on these reports.

With a view to ensure mutual recognition of allowances between the Community scheme and other greenhouse gas emission trading schemes in order to promote JI and CDM, the Community may conclude agreements with third countries that have ratified the Kyoto Protocol and are listed in its Annex B.

Characteristics of the application of the emission allowance trading scheme

If the Commission agrees, from 2008, Member States may apply the emission allowance trading scheme to activities, installations and greenhouse gases other than those listed in the Annexes to this Directive, after studying its consequences on the internal market, competition and the emission allowance trading scheme. From 2005, Member States may also apply the scheme to Annex I installations not reaching the emissions thresholds specified in the Annex.

Member States may apply to the Commission for certain installations to be temporarily excluded from the scheme (until 31 December 2007 at the latest).

Member States may allow operators of installations listed in Annex I to form a pool carrying out the same activity (for the three-year period starting on 1 January 2005 and the five-year period starting on 1 January 2008). Operators wishing to form a pool must nominate a trustee to manage the installations' allowances and be responsible for surrendering allowances equal to the total emissions from the installations in the pool.

During the three-year period starting on 1 January 2005, Member States may apply to the Commission for certain installations to be issued with additional allowances in cases of force majeure, being circumstances beyond the control of the installation operator and the Member State in question. The Commission has described which situations constitute force majeure in Communication COM(2003)830 [30]. Besides, this Communication assists Member States in drawing up their national

allocation plans and supports the Commission assessment of national allocation plans drawn up by the Member States.

4.1.8.2 Directive 2004/101/EC amending Directive 2003/87/EC with respect to the Kyoto Protocol's project mechanisms

This so-called "Linking Directive" [31] reinforces the link between the Union's emission allowance trading scheme and the Kyoto Protocol by making the latter's "project-based" mechanisms (JI and CDM) compatible with the scheme. This results in more compliance options for companies and thus a reduction in the allowance price and compliance costs, increased liquidity of the EU emission trading market and a stimulated demand for JI and CDM credits, in case of the latter contributing to the host countries' sustainable development.

This linking enables operators as of the five-year period starting 1 January 2008 to use allowances obtained by both mechanisms in the allowance trading scheme to fulfill their obligations. During the first three-year period started 1 January 2005, only credits from projects under CDM can be used in the Community scheme. Credits from JI projects are called "emission reduction units" (ERU), while credits from CDM projects are called "certified emission reductions" (CER). The result are lower compliance costs for installations in the scheme.

One allowance of the Community scheme is issued in exchange for one ERU or CER, except for those from land use, land use change and forestry activities, and nuclear facilities.

According to the Kyoto Protocol, the project-based mechanisms should be supplemental to domestic action. Therefore, Member States should decide on limits for the use of CERs and ERUs from project activities. In their national allocation plans, Member States may allow operators to use CERs and ERUs in the Community scheme up to a percentage of the allocation of allowances to each installation.

The Directive also takes steps to prevent ERUs and CERs being counted twice. To this goal, it stipulates that Member States hosting project activities must ensure that no ERUs or CERs are issued for reductions or limitations of greenhouse gas emissions from installations covered by Directive 2003/87/EC. ERUs or CERs may be issued only if an equal number of allowances are canceled by the operator of that installation and from the national registry of the Member State of the ERU's or CER's origin.

Current state of affairs on electricity markets

To what extent the regulatory framework described above has resulted in a true European internal energy market is the topic of this section. The state of affairs of the internal energy market can be evaluated based on the overall progress reports issued yearly by the Commission. Besides these annual progress reports, the European Commission publishes annual benchmarking reports, providing an overview of market opening, third party access, unbundling, etc. per Member State. These benchmarking reports and their accompanying documents can be found on http://europa.eu.int/comm/energy/electricity/benchmarking/index_en.htm. Besides, the Commission has recently, on 15 November 2005, published the detailed report outlining the progress made on creating the internal electricity market requested by the 2003 Directive.

COM(2004)863 - Annual Report on the Implementation of the Gas and Electricity Internal Market

In its last years' overall annual progress report on the implementation of the gas and electricity internal market [32] the Commission points out that the transposition of many aspects of the European directives remains disappointing. Although many of the necessary measures to implement competition have been taken, or are in process, several main obstacles to competition appear in many Member States, as summarized in table 1.

Table 1: Summary of main obstacles to competition⁶

		Customer switching: Large Users
a. No major issues	SE, FI, DK, NO, UK,	>50%
b. Unbundling \ Regulation	LU, AT, DE	range 10% (LU) -35% (DE)
c. Market Structure or Lack of Integration	FR, BE, GR, IE, ES, NL, LT, IT, SI, CZ, SK, LV	range 0%(GR) - 35%(NL)
d. Long term PPAs\ Regulated end-user prices	PT, EE, PL, HU,	range 0% (EE) - 25% (HU)

Fewer than 50% of large users have switched suppliers in most Member States. Moreover, in many cases customers have only been able to change to another domestic supplier. Consequently, also penetration of national markets by foreign companies is disappointing in many cases, reflecting a lack of integration of markets and missing infrastructure links. On top of that, the Commission mentions market structure as a severe problem since markets in too many Member States are dominated by one or two companies, and there is often inadequate capacity for cross-border competition. According to the report, security of supply in the EU is in general satisfactory. However, Member States are advised to invest more in interconnections and infrastructure in the interest of security of supply, and to provide regulators with sufficient resources and powers.

⁶ In this table the most important obstacle for each Member State is identified. However this does not mean that other obstacles do not exist.

COM(2005)yyy - Report on progress in creating the internal gas and electricity market

Also in its most recent report of 15 November 2005, the lack of integration between national market is identified as the most important and persistent shortcoming of the internal market. Two key indicators are mentioned in this respect:

- The absence of price convergence across the EU: For the very large industrial users (up to 50 MW maximum demand), the price range was relatively narrow in 2005: between €40 - €55/MWh. Whereas the range for the moderate group (24GWh/year) is €40-80MWh and for the small commercial group (50MWh/year) prices ranged from is €60 – 150/MWh in the different Member States. Consequently, the price paid in the most expensive Member States is more than twice the level of the lowest price group.
- The low level of cross-border trade shows only a modest increase since market opening (Table 2).

Table 2: Extent of cross border electricity flows (UCTE)

	cross border flows - actual as % of consumption
1995	7%
2000	8%
2005	10.7%

Moreover, according to Regulation 1228/2003 non-discriminatory market based mechanisms have to be applied for the allocation of capacity on congested interconnectors from 1 July 2004 onwards. This has not happened in all cases. Many delays have been recorded and not all Member States have complied with this deadline.

The absence of price convergence and the low level of cross-border trade are said to be generally due to the existence of barriers to entry, inadequate use of existing infrastructure and insufficient interconnection capacity between many Member States, leading to congestion (Table 3).

Table 3: Member States with low level of interconnection (ETSO)

	Installed generation capacity (GW) ⁴¹	Import capacity NTC ⁴² (GW)	Import capacity as % of installed capacity	Projects to improve interconnection	Current Status
Italy	80	6.0	8%	San Fierano- Robbia	complete
Portugal	12	0.8	8%	Balboa-Sines Duroro internacional Minho	complete in progress proposed
Spain	56	2.2	4%	Algarve Balboa-Sines Baixas-Bescano	proposed complete delayed
UK	80	2.3	3%	UK-NL DC link	proposed
Ireland	5	0.3	6%	second ROI-NI GB-ROI DC link	agreed proposed
Poland	34	3.4	10%	Poland - Lithuania	no progress
Baltic States (collectively)		0.0	0%	Estlink Poland - Lithuania	in progress no progress

Moreover, it is reported that many national markets display a high degree of concentration and industry has been further consolidating since market opening started, impeding the development of effective competition. In addition, an increasing number of cross-border acquisitions and a tendency towards vertical integration between generation and supply in some Member States are observed. The latter has a negative impact on the liquidity of wholesale markets, already problematic in many cases. Another indicator of the lack of real competition raised is the fact that switching by customers remains limited in most Member States, as can be seen in the Table 4, and that choosing a new supplier from another Member State remains the exception.

Table 4: Volume of electricity consumption having switched by group – cumulative since market opening (Regulators data)⁷

	large and very large industrial	small-medium industrial and business	very small business and household
Austria	29%	29%	4%
Belgium	c. 20%	10%	
Denmark	>50%	c. 15%	
Finland	>50%	82%	30%
France	15%		0%
Germany	41%	7%	5%
Greece	2%	0%	0%
Ireland	56%	15%	9%
Italy	60%		-
Luxembourg	25%	3%	0%
Netherlands	-	-	11%
Portugal	16%		
Spain	25%	22%	19%
Sweden	>50%	-	29%
UK	>50%	>50%	48%
Norway	>50%	>50%	44%
Estonia	0%	0%	0%
Latvia	0%	0%	0%
Lithuania	15%	0%	0%
Poland	19%	0%	0%
Czech Rep.	5%	1%	0%
Slovakia	-	0%	0%
Hungary	32%		0%
Slovenia	8%	2%	0%
Cyprus	0%	0%	0%
Malta	0%	0%	0%

The Report shows that in economic terms, with very few exceptions, electric energy and gas markets in the EU remain national in economic scope. Sufficient cross-border competition has not yet developed to provide a fully effective constraining influence on the economic power of companies in each national market.

Full, complete and effective implementation of the second Directives is said to be the main immediate action necessary. Most Member States missed the deadline of 1 July 2004 for their transposition, some not yet having them implemented at all. On top of that, many have taken a rather “minimalist” approach in implementing the Directives, which needs to be re-considered. The Directives provide a common minimum set of principles and measures applicable to all Member States. However,

⁷ Notes:

1. The data for Belgium refer to the Flemish region only (customers leaving regulated tariff: 40% industrial, 53% small commercial/household)
2. Ireland, includes switching to ESB (independent).
3. Italy, Spain includes all customers having left regulated tariffs (i.e. incl. renegotiation).

additional measures may well be necessary in certain areas, to account for the specific characteristics existing in certain countries. Member States need to make sure that in their implementation of the Directives in practice; they pursue their spirit and not only their letter. The Commission states they will continue to insist on compliance, and already opened infringement procedures against Member States for failure to implement the Directives. In 2005, six Member States were taken to the European Court of Justice for failing to fully apply the Directive.

Given that in many Member States the legislation implementing the Directives was only recently adopted, the report does not draw definitive conclusions on the need for additional measures at EU level. The Commission will carry-out detailed country-by-country reviews of the effectiveness in practice of legislative and regulatory measures in connection with market opening, including specific additional national measures. This will lead to a report by the end of 2006 and, if necessary, proposals to redress any remaining requirements.

4.2 Specification of boundary conditions and guidelines for proper functioning of future energy markets

In March 2004, the European Commission's DG for Energy and Transport proposed a practical way forward in its medium term Strategy Paper [33], which sets out the Commission's vision on the development towards an internal electric energy market. Moreover, there is a broad consensus within the industry regarding its content since this document has been compiled in response to the request and with the co-operation of the participants in the Florence Forum. The Commission's Strategy Paper addresses a large range of issues hindering the proper functioning of today's energy market that need to be considered in monitoring and developing the internal electric energy market over time. Also academics have expressed their view on the development of the electric energy market in Europe. The "Sustainable Energy Specific Support Assessment" project (SESSA project), funded by the Sixth EU RTD Framework Programme and grouping researchers as well as energy stakeholders, was closed in September 2005 by the conference "Implementing the Internal Market of Electric energy: Proposals and Time-Tables" [34]. From the SESSA research program, 20 priorities on what to do next were derived, of which the following were identified as being priority actions in the electric energy field [35]:

- Ensuring better access to, and improvement of, balancing services
- Improving efficiency of the management of interconnections
- Setting up a European Market Surveillance Committee Network
- Encouraging the negotiation of reinforced regional cooperation agreements between TSOs
- Seeking objective criteria for evaluating Europe's interest in grid interconnections
- Encouraging bilateral and regional harmonisation agreements between regulators
- Developing a pan-European regulatory knowledge and training in the EU

In the second part of this fourth work package, seven key action areas are discussed based on the Commission's view on the main issues presented in its Strategy Paper, supplemented with positions of various industry groups:

- Increasing role of regional markets
- Integrating markets
- Developing cross border trade: transmission tariffication and congestion management
- Reduction of market concentration
- Security of supply
- Consistent support framework for sustainable energy
- Consistent regulation

Finally, a section is added on the technical consequences and implications of regulatory decisions.

4.2.1 Increasing role of regional markets

The reality of today's electric energy network is that Member States are electrically not particularly well interconnected. In addition, certain countries have already adopted common harmonised rules that, in some cases, go beyond those envisaged by the 2003 Directive and the Regulation on cross-border trade. Therefore, the development of regional markets, not defined according to mere geographical criteria but containing Member States between which interconnection is reasonably strong, may be a necessary interim stage. The proposed approach is that a pan-European market should evolve through the development of these regional markets which should then be linked together to form the internal electric energy market. Within these regional markets, a more developed harmonisation of the regulatory approach taken to most or all issues, is expected, including degree of market opening, determination of transmission tariffs, rules for bilateral trading and congestion management methodologies involving standardised day ahead and intraday markets. In some cases, regulations

governing balancing and ancillary services might also be harmonised to some degree. However, any such effort needs to take into account, for example, the different generation plant characteristics in Member States and the costs involved in implementing such measures.

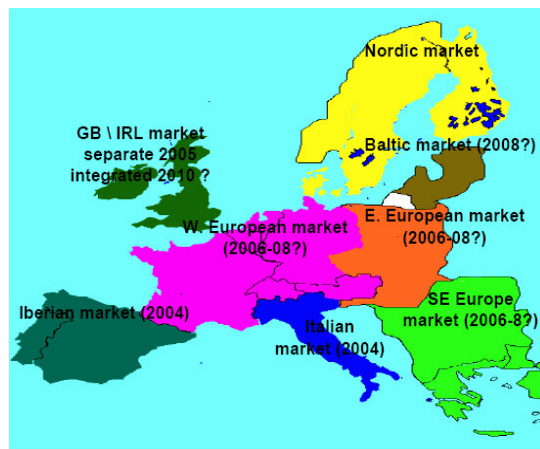


Figure 2: Potential Regional Electric energy Markets within the EU [33]

Regulators support the Commission's view and consider that the concept of regional markets is a practical and achievable way of delivering progress on the move towards a single electric energy market. On 9 June 2005, the European Energy Regulators (EREG) launched a public consultation in publishing their views, for discussing, on how regional electric energy markets within Europe might be created [10]. This consultation document was discussed and commented by several industry groups at the twelfth Florence Forum of September 2005 [8]. The Forum stressed the need for accelerated harmonisation or compatibility of rules, as well as national legislation, and involvement of and cooperation between governments and between governments and regulators in the development of regional markets. Taking into account the inputs received at the Forum as well as other comments received in the course of the consultation round, EREG will further develop the paper on regional markets. A concluding paper will be issued by EREG by the end of 2005, after which case studies will be commenced in early 2006.

The Forum confirmed the importance of different regional activities and Mini-Fora, and welcomed the results achieved thus far. While praising single and pragmatic approaches on a case by case basis, the Forum underlined the need to monitor progress and compatibility of regional solutions, in the perspective of a single EU market. In line with this strategy aiming at the development of regional markets, Florence mini-fora were set up already at the 11th Florence forum meeting. EREG and the European Commission organized these Florence mini-fora between December 2004 and February 2005, addressing congestion management in the European electric energy transmission network on a regional basis.

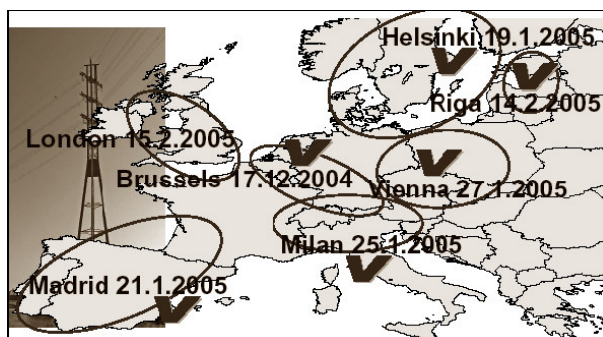


Figure 3: DGTREN mini-fora 2004-2005

Nordel, the body for co-operation between the TSOs in the Nordic countries (part of Denmark, Finland, Iceland, Norway and Sweden), agrees in its position paper added to the Commission's Strategy paper that the development of regional markets is a necessary interim stage towards the overall goal of the single internal electric energy market. However, it stresses that it is important to keep focus on how different regional markets can coexist and allow for non-discriminatory trade between market players in adjacent regional markets. Developing regional markets as a pragmatic intermediary step towards the internal electric energy market is an approach also supported by Eurelectric, provided that they do not diverge in different directions [38]. Regional markets should not develop too rigid, but should allow for some flexibility, with borders that are not always obvious and can change over time.

According to [35], TSOs should be encouraged to take the initiative in creating reinforced regional cooperation, leading to a "virtual RTO" by firmer voluntary cooperation. Some initiatives are already in the pipeline on a regional scale. In December 2005, the French, Belgian and Dutch regulators published a joint road map for regional market integration between the wholesale electric energy markets of Belgium, France and the Netherlands, after a consultation of all stakeholders [34]. This roadmap aims to implement various steps towards the regional integration in the three countries, of which the main ones are:

- Establishing coordinated and harmonised explicit auction methods on the borders between Belgium, France and the Netherlands
- Improvements in the wholesale market and TSO transparency
- Establishing a cross-border intraday and balancing market
- Improved co-operation between regulators
- A clear set of issues for the regulators to examine the efficient and secure functioning of the market coupling concept.

4.2.2 Integrating markets

Increasing the coupling between member state submarkets is another step to be taken in the development of the European internal electric energy market. In its road map to a pan-European market [38], Eurelectric declares that a series of strongly interlinked wholesale markets resulting in as large price areas as possible and ultimately – if possible – in one single pan-European price area is the way towards a well functioning pan-European market for electric energy. Therefore, participants of different national or regional wholesale markets must be able to act in different markets and consequently a high level of compatibility in structures, market rules and the regulatory framework is needed, although full harmonisation is not required. Eurelectric proposes the following road map with four overlapping stages as a guideline, which is in line with the development of regional markets as an interim stage:

- Continued liberalisation of national markets (2005-2007)
- Development within regions (2005-2009)
- Coordination between regions (2005-2010)
- Integration at European level (2007-2012)

In [38], the actions needed and the parties involved while progressing on this road map are set out. According to Eurelectric, it is essential that marketplaces fulfil at least the following criteria:

- Have a sufficient number of market participants in the day-ahead and forward markets, in particular more large consumers from the demand side;
- Provide transparent access to common sets of market information;
- Have market-based mechanisms for congestion management;
- Have liquid day-ahead and forward markets and open balancing and intra-day markets with trustworthy prices.

The need for a balancing market is also stressed in [35]. Balancing arrangements should be transparent, simple and robust to allow all other energy markets to rely on a solid foundation of energy trading in the very short term and to facilitate the appearance of new entrants. When there are no

other markets on which operators can trade energy amongst themselves and when the electric energy systems of the Member States primarily consist of large, vertically integrated concerns, it would be truly unfortunate to adulterate or “close” the only energy market that can be open to all, the balancing market.

Moving towards a European electric energy market by increasing the linkage between member state submarkets is also proposed in [6], in which 2 stages are foreseen. Regulation 1228/2003 forces the allocation of interconnector transfer capacity to be market based, meaning that the situation should be as illustrated in Figure 4 (“Current Situation”). In Stage 1 in Figure 4, links between member state submarkets should be improved by implicitly allocating at least part of the available transfer capacities via power exchanges so that their day-ahead energy auctions are directly coupled. By coupling the day-ahead auctions, liquidity increases and price volatility decreases one day before delivery. By eliminating the information lag between interconnector transfer capacity markets and wholesale energy markets, some possibilities for exercising market power are mitigated and energy markets are better coordinated. Another benefit is that Stage 1 implies that at least part of the transfer capacities are coordinated over several borders.

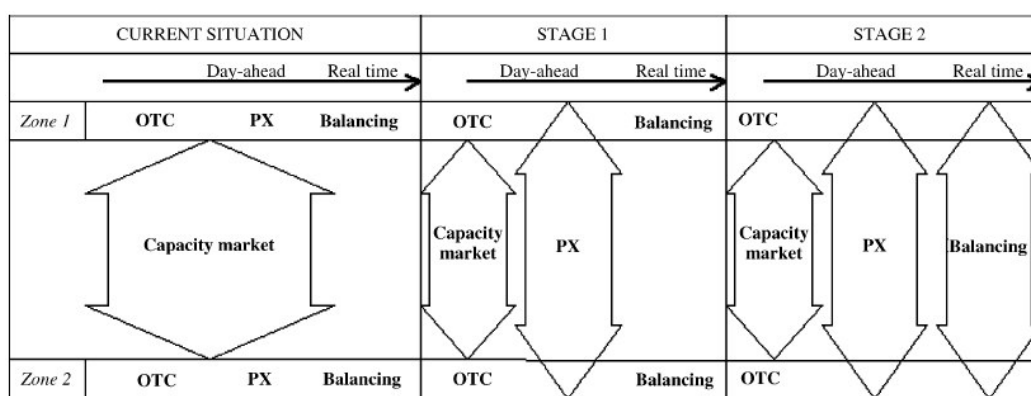


Figure 4: Two stages towards improved linkage of Member States wholesale markets and balancing markets

In Stage 2 of Figure 4, links between member state submarkets should be further improved by organizing both the procurement of balancing power and the real-time balancing across borders. Stage 2 has great potential because the market for standardized balancing products is tighter than for electric energy. All generation units are able to deliver electric energy, but not all of them are dispatchable and only some of them have a quick enough response time. Therefore, pooling these units in a crossborder balancing market has great potential, even if transmission constraints have to be taken into account. Stage 2 could initially be implemented by using the transfer capacity, which has not been used by the wholesale markets. Consequently, a fraction of the available transfer capacity could be reserved for balancing purposes, similar to the UCTE arrangement for primary frequency control. Note that TSOs procure options on balancing power, so that transfer capacity reserved for the balancing market is not necessarily used. However, reserving transfer capacity for balancing can be interesting if zonal balancing prices are less stable and deviate more extremely across borders than the day ahead electric energy prices.

In Stage 2, coordination and harmonization are mostly on the shoulders of transmission system operators. This stage is more difficult to implement for several reasons. First, balancing arrangements differ widely among member states and are not always as transparent. Second, unbalance settlement periods differ widely from one hour in some member states to 15 minutes in others. Third, gate closure in some member states is day-ahead, while in other member states trade is possible up to one hour before delivery. Note that the possibility of intraday trade should become standard so that market parties have more opportunities to avoid unbalances. In other words, Stage 2 offers the opportunity to consolidate best balancing practices to the European level. Also at the Florence mini-fora, the further integration of European electric energy markets through regional intra-day and balancing markets is said to be beneficial and feasible [8].

4.2.3 Developing cross border trade: transmission tariffication and congestion management

The issues to be considered when developing cross-border trade are mainly compensation between Member States' TSOs for hosting cross border flows, the introduction of harmonised transmission tariffs with locational signals, and finally non-discriminatory congestion management. These objectives are pursued through the Regulation on cross border electric energy exchanges. The overall goal is for the EU and wider market to function in the same way as a national market. Greater cooperation between TSOs forms a key element for the achievement of this objective.

Regarding tariffs, it is clear that for the medium term, an approach whereby tariffs for cross border trade are a combination of different national tariffs schemes and where TSOs are compensated for transit and/or other cost inducing flows is the most sensible. However in the longer term, a pan-European tariffication mechanism, may contribute to the further integration of markets.

For congestion management, and system operation more generally, methods for allocating capacity should be market based and designed to give correct locational signals to producers and consumers. Such price signals may also help regulators and/or investors to identify appropriate interconnection projects, depending for example on the volatility of the signals. Congestion management methods should also be non-discriminatory so that all participants should have an equal chance of obtaining capacity, whether it is for long term or short term transactions or for large or small customers. Finally there should also be an automatically functioning use-it-or-lose-it rule. These objectives imply co-ordination of the congestion management process with that of day-ahead OTC and power exchanges and eventually other wholesale markets, including the intraday and balancing market, as well as ancillary services. Such harmonisation efforts imply a review of network security rules, grid codes, and access and tariff methodologies, such that trade within a region is as easy as trade within a country or TSO control area.

Finally, in this context it is important to review the rules used by TSOs to deal with internal transmission congestion. TSOs should not, in general, be permitted to systematically transform internal constraints into constraints at borders. This is for example done in Nordel, where it is the rule that all internal problems are shifted as much as possible to the borders, after which the market is splitted. Reasonable balance must be drawn between the needs of national network users and those from other Member States. Incentives for doing this be reduced for example where incentives or penalties for dealing with internal constraints are equal to those for dealing with external constraints, bearing in mind the need to create consistent price signals in terms of reference to time and place on either side of the constraint.

To summarize, according to the Commission's Strategy Paper, the following specific objectives should be pursued in the context of cross-border trade:

In the medium term:

- Inter TSO compensation should allow for suitable compensation between Member States for, as a minimum, transit flows and other cross border flows in some cases;
- Transmission charges on generators should be harmonised within a fairly narrow range with, if appropriate, some locational signals introduced at EU level;
- Interconnection capacity should be allocated by non-discriminatory, market based mechanisms consisting of either:
 - within regional markets, a single common co-ordinated market-based mechanism which allows for both "market coupling" encompassing existing day-ahead and possibly intra-day spot markets via the adoption of a common timetable, as well as long term financial hedging;
 - between regional markets, specific market based mechanisms which as far as possible allow for coupling of wholesale markets;
- A high degree of transparency should be provided to network users, including the publication of necessary data relating to transport capabilities of interconnector lines. This is a crucial issue for enabling further third party access and new entry to markets.

In the longer term:

- Both tariffs and inter TSO compensation should be based on a single common model of the European network with, ultimately, zonal based transmission charges at EU level covering, as a minimum, losses and also potentially, fixed investment costs,
- Regional market areas may be served by a single wholesale market (allowing both day ahead and within day nomination) which would contain different price areas in the case of persistent congestion.

In order to improve the shortcomings of the current legislation, ERGEG is currently improving the drafts of Guidelines on both congestion management and transmission tariffication. Therefore, a public consultation on both topics was launched and discussed at the twelfth Florence Forum. The results of these consultations shall be adopted as part of Regulation 1228/2003. All information on ERGEG's public consultations can be found on www.ergeg.org.

Congestion management was also the topic of a separate round of regional Florence mini-fora organised in the end of 2004 and the beginning of 2005. Overall these mini-fora delivered good results even though the target of coordinated day-ahead capacity allocation in the whole EU has not yet been achieved. Resulting from the mini-fora, there are plans now for all interconnectors with non-market based capacity allocation methods to move to market based methods by the beginning of 2006. ERGEG stated in its overall assessment of the mini-fora [8] that a compatible congestion management method for Europe must be able to accommodate both implicit and explicit auctions, with explicit auctioning being the minimum requirement for congested interconnectors in Europe. Implicit auctions target especially the day-ahead and intra-day markets and congested interconnections where price differences change direction. They also have potentially a big positive influence on the liquidity of spot-markets in power exchanges. Finally implicit auctions are expected to enhance the competitive single market because of their efficiency in terms of maximising the use of capacity and mitigating market power. In the regions where implicit auctions are not used yet, the introduction shall be further examined, developed and if applicable, tested in pilot projects. The ETSO/Europex model on Flow Based Market coupling [8] proposes implicit auctions between price areas using European power-exchanges in a decentralised manner. A full implementation of the model requires a high level of coordination and could become feasible only on the mid-, or long-term.

Zonal pricing is also a fundamental choice in the EU electric energy market, with the zones initially corresponding to individual Member States. Considerable improvement of the co-ordination of the congestion management methods is foreseen by the beginning of 2006, notably in Central Eastern, Southern and Western Europe. Finally an introduction of implicit auctions is foreseen between France, Belgium and Netherlands. Between the Nordic countries and Germany a pilot project based on implicit auctions will be launched. The Florence Forum supported an approach whereby the short term focus would be on the follow-up of the first round of mini-fora and the organisation in 2006 of at least one new round of mini-fora, with adequate participation of all market actors, and with an extended mandate.

4.2.4 Reduction of market concentration

Interconnection and new investment is unlikely to significantly erode historically entrenched positions in other than the smallest, most isolated, Member States. It is therefore likely that many Member States will remain subject to significant market concentration for some time. Increasing interconnection could, in any case, in these markets, also be seen as an expensive way of resolving the market dominance issue and, furthermore, there are some cases where, despite a high level of market dominance, infrastructure is already available and not used.

In such cases, therefore complementary measures need to be taken. In particular, Member States should seek to dilute the market power of dominant generating companies and/or to prevent the abuse of dominant positions as follows:

- Investment and capacity release could be used in some cases to reduce the level of concentration, with reciprocal measures between two or more Member States with similar concentration problems;
- Appropriate design of mechanisms to allocate interconnector capacity should mitigate and not add to market power problems within certain Member States and regions;
- Market design should encourage an appropriate mix of both short term trading and longer term bilateral arrangements in order to avoid encouraging collusion;
- The relevant authorities should, on the basis of the necessary information provided by TSOs and power exchanges, monitor the behaviour of market participants closely and should act, using, inter alia, existing competition law and other relevant legislation, to protect consumers from manipulation: ad-hoc intervention in the market should be avoided and this points to the embedment of appropriate market rules designed to prevent undesired manipulations;
- Generators should be required to make transparent, in a consistent manner at European level, their decisions on the availability of generation plant and, where appropriate provide forecasts of availability;
- Demand side participation in wholesale and balancing markets should be encouraged in order to significantly increase the elasticity of demand for electric energy within individual settlement periods and thus reduce the scope for abuse of dominant positions.

Despite the need for some measures to reduce market dominance, it is also important to acknowledge that some of the expected benefits of competition are likely to arise from consolidation to take advantage of the economies of scale and scope that exist in this capital intensive industry. Companies should not, in principle, be prevented from taking such actions to improve their performance provided that customers are protected from monopolistic or oligopolistic practices and that new entrants and smaller companies are not unduly disadvantaged. This comment is also made by Eurelectric, that underlines the fact that big players should not be considered responsible for the fact that their size is already of a European dimension whereas the market dimension is lagging behind. Eurelectric notes that the electric energy sector is a capital intensive industry and that the critical mass therefore is rather large. In their opinion, calling for divestment and related measures merely because of the size of market players would constitute unfair discrimination inconsistent with competition law. There, it is a consistent principle that dominant players in a market do not raise any concern as long as these players do not abuse their dominant position, thus, according to Eurelectric, behaviour and not size should be the criterion.

4.2.5 Security of supply

One of the benefits of market opening is that competitive pressures will prevent overinvestment in reserve generation capacity. However, combined with increasing demand and the retirement of some capacity at the end of its life this means that the balance between supply and demand will be more delicate. According to ETSO's most recent generation adequacy report [37], an erosion of generation adequacy in the European power system will be observed with more areas depending on imports, and fewer able to commit to export capacity. It is apparent that the European power system will be more sensitive to unusual weather situations, mainly in the winter period but possibly at other times of the year as was seen during this summer.

This leads to concerns that, because of the long lead times for investment, wholesale electric energy prices, especially on spot markets, may tend to follow an erratic path. Periods with relatively high prices will be required from time to time to encourage investors into the market and to cover the fixed costs of those already there. However, this volatility may create undesirable conditions for customers if they are not expecting it. Such volatility may also create pressure on governments to intervene in markets at times where prices are high, which will increase regulatory risk and lead to further uncertainty for potential investors, making the problem worse. It is therefore necessary for Member States and Regulators to decide what approach they intend to take to the issue of supply-demand and stick to it. The Commission's Strategy paper stated that ad-hoc intervention in electric energy markets should be avoided. Nordel adds to this that demand response and a market price cleared by market players are the main driving forces for market development. It stresses that any regulatory initiative that affects the price formation in the open electric energy market should be undertaken with the highest possible level of harmonisation.

The Commission's proposed Directive on Infrastructure and Security of Supply therefore requires Member States to publish their approach to these issues. A clearly stated approach is vitally important to obtain a stable "market design" at national level in order to encourage the appropriate investments. The proposal also seeks to clarify the responsibilities, in particular, of transmission system operators in ensuring the ongoing balance between supply and demand in real time.

In general, the market opening process and the introduction of competition implies a presumption in favour of a reliance on market mechanisms and the encouragement of an active demand side. This requires more active participation in the market by customers in terms of making a definite choice about the structure of their supply contract (fixed or variable price, duration etc.). Since customers are not used to thinking in this way about electric energy contracts, an education process may be needed.

The proposed Directive does not, at this stage, explore a more fundamental question about whether the issue of security of supply should be dealt with at national or regional level. From the point of view of economic efficiency it is clearly of benefit if Member States can share reserve capacity since it means a lower level of reserve is needed in each Member State. Thus within regional market areas it may eventually be appropriate for groups of Member States to arrive at a common approach to security of supply for generation. A common approach would remove the risk of distortions of trade between Member States and allow for sharing of reserve capacity. However at the very least, in an integrated market, a strong unilateral approach to security of supply would not be appropriate. This has implications for treatment of interconnection capacity if one country is relying on another to provide reserve capacity. It also means that there needs to be a clear code of conduct on TSOs wishing to take action to restrict cross border flows in emergency situations.

A different issue relating to generation investments are the procedures required in terms of authorisation and planning approval. The process may be unnecessarily heavy in some Member States and be an unnecessary obstacle to investment. A more streamlined and harmonised process would remove such obstacles. It may be that a comparison of the authorisation and planning process between Member States would allow for the spread of a best practice approach.

The proposed Directive in security of supply, for which an agreed text now existed between the Council and Parliament, was discussed at the most recent Florence Forum of September 2005. UCTE presented the progress it had made on the Operational Handbook. A multilateral agreement on phase 1 of the handbook (sections 1 to 3) was signed by the UCTE members on 1 July 2005. The remaining part of the handbook (sections 4-8) should be agreed by the end of 2005. An important part of this section will be the application of the N-1 contingency analysis on a regional basis. An expert team is currently working on this issue. A Compliance Monitoring and Enforcement Programme is also an integral part of the multilateral agreement. A formal procedure to verify compliance will be set up by the end of 2005. The Forum congratulated the work of the UCTE in this area. Participants stressed the need for compatibility between these operational standards and guidelines relating to congestion management as well as compatibility with the regulatory framework. Effective procedures are also required to update the operational rules as markets develop.

4.2.6 Consistent support framework for sustainable energy

One of the prime functions of the 2001 Directive on renewable energy sources (RES) is to deliver the overall Community objective that 22,1% of electric energy will be generated from RES by 2010. This target was reduced to 21% after the accession of the 10 new Member States. Member States have been required to set national targets for the consumption of electric energy produced from RES. Indicative values were set out in the Annex to Directive 2001/77. For the promotion of combined heat and power, the European Commission aims at a target of 18% by 2010, without establishing national targets.

There are three main types of support mechanisms being used in Member States at present. The first type is a fixed feed in tariff whereby all energy from renewable energy sources (RES-E) or from CHP injected into the network is automatically dispatched and receives a guaranteed price, usually much higher than normal market prices. The costs of this obligation are then passed on to customers through transmission or distribution tariffs. Such an approach clearly reduces the overall scope for competition at Community level between generators since it means that a certain proportion of

generation may be outside the market, depending on the exact form of mechanism adopted. On the other hand it gives certainty to investors about the price that will be received and is therefore an effective means of support.

Under the second approach, suppliers or customers are given an obligation to source a certain amount of their energy from RES/CHP. Generators receive a “green certificate” in exchange for a certain amount of RES production which is then sold to suppliers. The latter need certificates to prove they met their obligation. If the required amount is not achieved, then the supplier will be fined according to the deficit between the required and actual amount of green certificates. Similar systems could be established for the support of CHP (“blue” certificates) or energy savings (“white” certificates). In this context, emission allowances are sometimes referred to as “black certificates”. In theory, certificate systems seem more in line with a competitive market. However, because the targets adopted under the Directive are on a national basis, it is often the case that green certificates are only valid for generation produced in the Member State in question. Indeed where such rules have not been adopted, RES energy may be able to achieve a double subsidy from two different Member States by exporting from a country with a feed in tariff regime to another with a certificates type approach.

The final option is a straight subsidy from the government to cover a proportion of either capital or operating costs.

Although this is not a requirement of the Directive, Member States are encouraged to develop schemes to promote RES and CHP which are the least interfering with competition and which are consistent in terms of the basic framework and include mutual recognition of energy generated from RES/CHP. This would have the advantage of establishing competition at two levels; that is, in the generation market for conventional fuels as well as, separately, in the green market and this would be expected to increase the cost effectiveness of support. Existing support schemes should therefore be reviewed with a view to bringing them further in line with market mechanisms. Due attention must be given to avoid disproportionate distortions of the market, in particular through Member States adopting different and potentially incompatible policies.

Besides mechanisms to support RES-E and CHP, other initiatives are being taken to reduce carbon emissions such as the EU Emission Trading Scheme (ETS) that has been in force since January 2005. Emission allowance trading is essentially a reverse version of certificates in that undertakings involved in carbon emitting activity are given a target for the amount of emissions they can release in a time period (overall cap). The operator of an installation is then allocated allowances. If the company intends to emit more than it has been allocated as allowances, it is then possible to purchase additional allowances from those who have been able to exceed their allocation (trade). In this way it is expected that reductions in CO₂ emissions will be made in the most efficient manner. The current ETS applies to large industry and energy activities, including electric energy generation.

The different support schemes for RES, CHP, energy efficiency and the ETS will interact and have an important impact on the functioning of the electric energy market. Because of the different goals these different programmes pursue they might reduce each others efficiency. Reducing the greenhouse gas effect is for example the main goal of the EU ETS. Stimulating RES is a rather low-efficient way to reach this objective since not all RES contribute to CO₂ emission reductions to the same extent and although increasing the use of RES will decrease the use of conventional sources, this will not necessarily concern the most polluting fuels. Therefore, interactions between these different programmes should be carefully monitored to guarantee that one programme's targets do not counteract another.

In a recent report published by the European Commissions DG for Environment [40], the interactions between the EU ETS and certificate systems are discussed. This report illustrates that the presence of these different programmes on one hand influence key variables of the electric energy market such as the wholesale and retail electric energy price, the demand for electric energy and so on. On the other hand, it is shown that one programme might affect the goals of the others and that these programmes interact in complicated ways, with interactions transmitted through wholesale and retail electric energy markets, through markets for the various commodities created by the programmes (i.e., CO₂ allowances, green certificates, and white certificates), and through other markets (e.g., fuel, labour).

The most important interactions that are demonstrated in this study to exist between the different programmes are the following [40]:

- The presence of certificate programmes generally would not affect EU-wide CO₂ emissions from sources covered by the EU ETS although other facets of the EU ETS would be affected:
 - The CO₂ allowance price would be reduced.
 - The overall cost of meeting the CO₂ cap would be increased (but this comparison does not take into account the non- CO₂ benefits of these certificate programmes).
 - Changes in the location of CO₂ allowance purchases/sales due to these certificate programmes could affect national CO₂ emissions.
 - The burden of EU ETS costs and electric energy price impacts on different producers and consumers could be affected by the presence of a certificate programme. The effects on a particular group depend upon the many specifics of the programmes, especially on whether the certificate programme is large enough to affect the price of CO₂ allowances, and also on the electric energy and certificate market conditions.
- Providing CO₂ credits for green or white certificates would not be desirable, primarily because it would represent double counting and thus undermine the EU ETS CO₂ cap.
- There are some circumstances in which a certificate programme could yield additional EU-wide CO₂ reductions.
 - In theory, the certificate programmes could be so stringent as to reduce CO₂ emissions below the cap, although this is highly unlikely to occur in practice.
 - The presence of the certificate programmes could lead governments to reduce allowances to participating facilities and thus create a lower cap that reflects the impact of these programmes when establishing the total amount of allowances of the Member State's National Allocation Plan. In this case, the country also would ensure that the expected CO₂ emission reductions count towards its Kyoto commitment.
 - The white certificate programme might reduce emissions from facilities not covered by the EU ETS (e.g., energy efficiency measures that reduce household/commercial fuel use).
- There are some circumstances in which a certificate programme might lower the cost of meeting the EU ETS CO₂ cap.
 - If retail electric energy prices did not fully reflect CO₂ costs, the retail price effects of green or white certificate programmes could compensate for the inadequate price signal.
- Conclusions regarding the effects of the EU ETS on green certificate programmes are generally similar to the effects in the other direction.
 - The EU ETS generally would not affect the amount of green generation but would decrease the price of green certificates, change the location of green generation, and alter the distributional effects of achieving a green generation target.
 - If the green target was relative (i.e., green generation as a percentage of total generation), reductions in overall electric energy demand due to price effects of the EU ETS could decrease somewhat the quantity of green generation.
 - In contrast, if the green certificate programme included a price ceiling, the EU ETS could increase somewhat the quantity of green generation.
- Conclusions regarding the effects of the EU ETS on white certificate programmes are somewhat different both because of the white certificate programme coverage (beyond sources covered by the EU ETS) and its nature as a credit-based (rather than a cap and trade) programme.
 - Electric energy price effects of the EU ETS could lead to energy savings that were in addition to savings due to the white certificate programme.
 - Like the green certificate programme, however, the presence of the EU ETS would alter the distributional effects of a white certificate programme.

Besides the different goals and interactions of the different support schemes, another issue to consider is a possible European harmonization of support schemes for RES and CHP. The 2001 Directive underlined that it would be "too early to decide on a Community-wide framework regarding support schemes, in view of the limited experience with national schemes and the current relatively low share of price supported electric energy produced from RES in the Community." According to

Article 4 of the Directive, the European Commission “shall, not later than 27 October 2005, present a well-documented report on experience gained with the application and coexistence of the different mechanisms. The report shall assess the success, including cost-effectiveness, of the support systems in promoting the consumption of electric energy produced from RES in conformity with the national indicative targets. This report shall, if necessary, be accompanied by a proposal for a Community framework with regard to support schemes for electric energy produced from RES.” Any proposal for a framework should, according to Article 4 of the Directive 2001/77/EC:

- Contribute to the achievement of the national indicative targets;
- Be compatible with the principles of the internal electric energy market;
- Take into account the characteristics of different RES, together with the different technologies, and geographical differences;
- Promote the use of RES in an effective way, and be simple and, at the same time, as efficient as possible, particularly in terms of cost;
- Include sufficient transitional periods for national support systems of at least seven years and maintain investor confidence.

In anticipation of this report, a lot of studies and industry position papers have been published, evaluating the different support systems and commenting on a possible harmonisation, such as [41], [42], [43], [44], [45] and [46]. On 7 December 2005, the Commission published this long-anticipated report on RES [47]. The currently implemented support schemes were assessed based on their level, effectiveness and investor's profit per technology. As expected, the Commission did not regard it as appropriate to present at this stage a harmonized European support scheme. Instead, it calls for a coordinated approach based on two pillars: cooperation between countries and optimization of the impact of national schemes. Regarding cooperation, the Commission mentions the emerging cooperation between the feed-in tariff systems in Germany, Spain and France, or on the Iberian market and the new planned common Swedish-Norwegian green certificate system as examples. Member States with systems with a sufficient degree of similarity could then later be sub-harmonised, which is in accordance with the strategy of increasing the importance of regional markets.

Optimising national systems concerns economic mechanisms and cost-effectiveness but also calls for the removal of administrative and grid barriers. Member States should optimise and fine tune their support schemes by among other things

- Increasing legislative stability and reducing investment risk. One of the main concerns with national support schemes is any stop-and-go nature of a system. Any instability in the system creates high investment risks. Thus, the system needs to be regarded as stable and reliable by the market participants in the long run in order to reduce the perceived risks.
- Reducing administrative barriers, including the streamlining of administrative procedures. Clear guidelines, one-stop authorisation agencies, the establishment of pre-planning mechanisms and lighter procedures are concrete proposals to Member States in addition to the full implementation of the RES-E Directive.
- Addressing grid issues and the transparency of connection conditions. The Commission recommends, firstly, that the principles of cost bearing and sharing should be fully transparent and non-discriminatory. Secondly, the necessary grid infrastructure development should be undertaken to accommodate the further development of sustainable electric energy generation. Thirdly, the costs associated with grid infrastructure development should normally be covered by grid operators. Fourthly, the pricing for electric energy throughout the electric energy network should be fair and transparent, taking into account the benefits of embedded generation.
- Encouraging technology diversity. Some support schemes tend to support only the strongest of the renewable technologies in terms of cost competitiveness. Such schemes could therefore be complemented with other support instruments, in order to diversify the technological development. A good overall support policy for renewable electric energy should preferably cover different renewable technologies.
- Ensuring compatibility with the internal electric energy market. EU Member States are in the process of liberalising their power markets. This criterion assesses the ease with which a support scheme can be integrated into a liberalised power market, and its effectiveness in functioning together with existing and new policy instruments.

As a next step, the Commission will further analyse the options for and impacts of increased optimisation, coordination and possible harmonisation, conditions in terms of progress in liberalisation and transmission capacity, and learn from the further experience gained with various support schemes in the Member States. The Commission will closely monitor the state of play in EU RES policy and, not later than December 2007, make a report of the level of Member States systems for promoting RES-E in the context of the on-going assessment related to 2020 targets and a policy framework for renewable energy beyond 2010. Based on the results of this evaluation, the Commission may propose a different approach and framework for schemes to support electric energy produced from RES in the European Union, taking into account the need for adequate transitional time and provisions. In particular, the advantages and disadvantages of further harmonisation will be analysed.

The European Parliament has recently adopted a Resolution on Renewable Energies clarifying the criteria for a possible future harmonised European incentive system [48]. In this Resolution, the Parliament pleaded for a 30% target for 2020, accompanied with mandatory national 2020 targets to give a clear signal to market actors as well as to national policy makers. According to the Parliament, in order to have the necessary signals for the highly differentiated energy markets like electric energy, transport fuels and the heating and cooling sector the EU target must to be broken down to both sector and national targets.

4.2.7 Consistent regulation

Interactions between Directives and Regulations do not only occur in the field of sustainable energy. Eurelectric showed in [47] that in the energy field, a number of Directives reinforce and support each other, but that there is also evidence of conflicting effects among a number of Directives. Such inconsistencies have the potential to create confusion and uncertainty and, in the case of the electric energy industry, tend to increase the industry's risks and costs. They could in some cases even undermine the ability of the industry to deliver efficiently on energy policy goals.

In the EU regulatory and law-making process the single energy market, security of supply and environmental sustainability are on a separate agenda. This could result in failures instead of synergies [35]. For instance, renewable energy policies often raise new obstacles to competition on wholesale markets and to availability of interconnections. The regulatory framework in the energy field, as in all other areas, should be coherent and consistent with the general framework of a single European market. Policy makers should try to find a balance between the three main pillars of the EU's energy policy – economic competitiveness, security of supply and environmental/social cohesion. It is of crucial importance for policy makers to be aware of the impacts that different EU Directives have on the three pillars of energy policy and to understand the danger that conflicting messages may jeopardise investments and thus also undermine security of supply. It is essential to undertake a transparent and thorough impact assessment for any proposed EU Directive or Regulation, in order to carefully evaluate all mutual cross effects between proposed and existing legislation. Being aware of the positive and negative interactions is an indispensable requirement for a successful energy policy.

4.2.8 Technical consequences and implications of regulatory decisions

The interconnected high voltage grid of Europe, being UCTE, Nordel, UKTSOA and ESBNG, are the backbone of the European Internal Electricity Market (IEM). The IEM is not only governed by legislation, but also by the laws of physics. Therefore, the legislative and regulatory framework has to comply with the technical boundary conditions. This involves providing feedback between these two totally different fields throughout the process of developing an adequate legislation. This is vitally important when considering the representation of the electricity grid, where a choice has to be made between simplicity and correctness, the connection of RES to the transmission grid and the future development of the grid. In this section, the importance of the link between the politics and engineering is discussed.

Technical aspects of the grid modelling

The European electricity grid is quite well interconnected. Especially in the UCTE area, power flows in virtually any region influence the remainder of the synchronous area. However, the general grid management philosophy applied in Europe is that the internal networks of each country are strong enough to accommodate any possible internal load and generation dispatch: the control zones are considered to be copper plates. The main constraints are assumed to be located on the international interconnections. This makes Europe a zonal market, with the control areas (generally countries) treated as copper-plates connected with thin threads representing the constraints on cross-border flows (Figure 5).

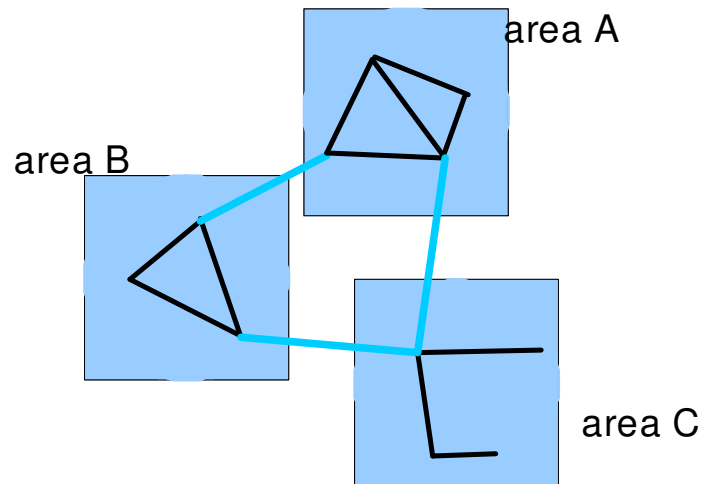


Figure 5. Copper plates connected by thin threads: zonal grid representation

The consequence of this zonal approach to grid management in Europe is the treatment of cross-border capacity. As in a zonal model each country is represented by its equivalent node, it is impossible to capture the influence of the internal dispatch on individual cross-border lines. On the contrary, this influence is assumed to be identical, as is the case of two nodes connected by two identical parallel lines. Moreover, due to the highly meshed nature of the European grid, even in the presence of balanced control areas (no imports/exports) there are significant power flows on the cross-border lines (Figure 6).

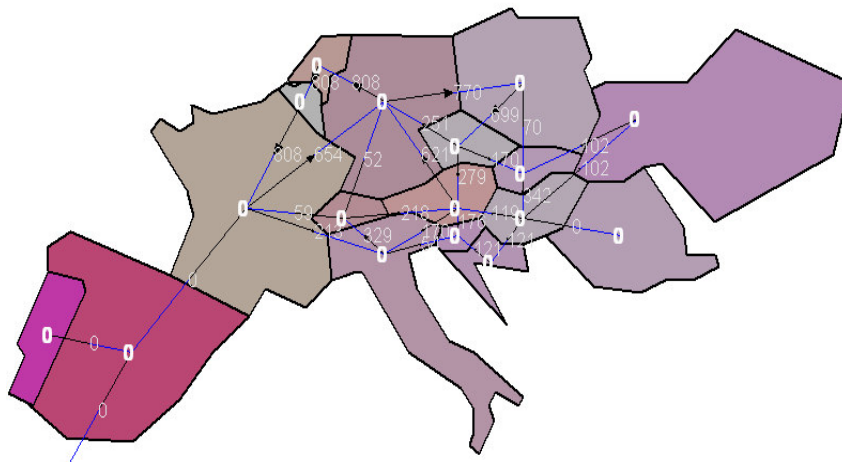


Figure 6. Aggregated cross-border flows in UCTE network with balanced control areas.

Both factors have a significant influence on the way the technical interactions in the European grid are modelled. Basically, there are three possibilities [61].

- Full nodal model with high level of detail covering at least the high voltage grid. This representation would lead to the highest accuracy, however, this model also requires a tremendous amount of data and computing power. Using a full nodal model, the influence of different grid investments and electric power generation schemes can be studied. Also the correct assessment of stochastic behavior of power flows can be made.
- Intermediate model with a limited level of detail, modelling each cross-border line individually and consisting of several key internal nodes and lines. This representation reduces the need for individual data, but a good trade-off between simplicity and correctness is difficult to obtain. International trade can be represented quite accurately using such a reduced model as well as a sufficient assessment of congestion.
- Zonal model, highly simplified with the only one node per country and one border link per electrical border. This model is the easiest to implement and is most common in market models, where in each country there is one price, and where a market between neighbouring countries can exist. This model however disregards the difference between transmission capacity and transfer capacity, introducing difficulties.

Transmission capacity vs. transfer capacity

Physically, the electrical grid consists of nodes (busses or busbars) connected by lines and/or transformers. However, in a zonal model clusters of nodes (typically belonging to the same control area or a country) are aggregated into zones. Such zones are considered as copper-plates, i.e; internal transmission constraints are ignored. In a zonal network representation, zones are connected to other areas by means of virtual links, which in some way aggregate the transmission capacity of individual, physical lines linking nodes belonging to both zones. The capacity of these virtual links is designated as transfer capacity.

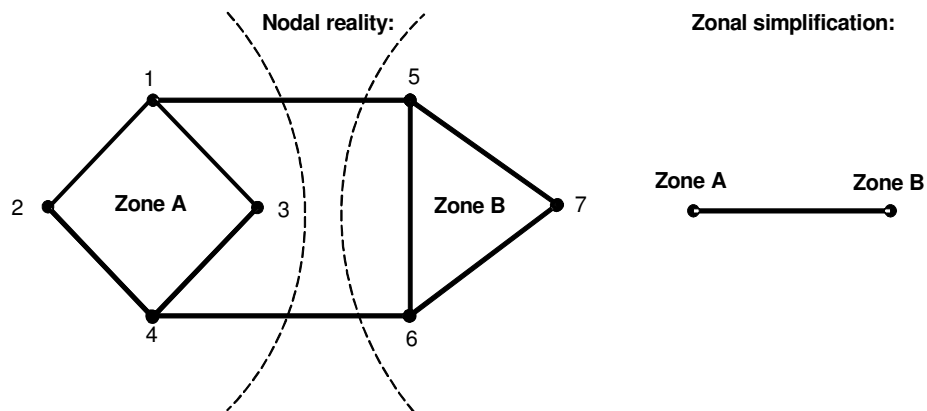


Figure 7. From a nodal physical reality to a market oriented network representation

The difference between nodal and zonal network representations is illustrated in Figure 7, where the 7-node system is replaced by its 2-zone equivalent. The physical capacity of the lines interconnecting zones A and B, being 1-5 and 4-6, is replaced by an aggregated commercial capacity A-B. Since the TSO's must ensure that the power flows always comply with security limits, some restrictions might be put on the cross-border flows. These limits are expressed in terms of cross-border transfer capacities, giving the maximum power exchange between the zones concerned. However, the latter is not equal to the sum of the physical capacities, but is a result of existing or forecasted network conditions, strongly depending on nodal power injections and power flow patterns. It serves as an index, helping market players to estimate trade possibilities. The guidelines for estimating transfer capacities are given by ETSO and UCTE [50]-[54].

New grid investments and changing load and generation patterns

Aggregated transfer capacities in a zonal network model can also be affected by the shifts of generation within a control zone, as they influence the power flows on the interconnections. Depending on network topology and predictability of the internal dispatch pattern, variations of nodal power injections can have a significant influence on the variation of cross-border flows. Therefore, these capacities are very sensitive not only to the investments (reinforcement of cross-border interconnection, new transmission lines, FACTS and other flow control devices), but also to the changing load and generation pattern. However, both investment decisions and changing power flow patterns are difficult to forecast. Additionally, increased penetration of unpredictable wind energy systems leads to less predictability of the load generation dispatch, negatively influencing the accuracy of the zonal network representation.

Distributions of power flows

Distribution of power flows in the grid can be simulated using either full AC power flow or a simplified DC approximation. The DC method introduces a number of simplifications in the way the grid is studied (i.e. neglects line resistances and reactive power management), but, provided certain criteria are met, it proves to be sufficient to model active power flows [55]-[59]. Thanks to its robustness and simplicity the method is very often employed for techno-economic studies [60].

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