

## **Regulatory and technical challenges for the European electricity market**

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## **Abstract**

Two major events lay at the heart of a renewed focus for energy since the turn of the century. First, Europe's increasing dependency on foreign energy sources, stressed by potential tense geopolitical situations, not only made the headlines, but also increased prices of fossil fuels and worries about their long-term availability. Second, the prospect of climate change leads to faster actions than previously anticipated, especially in the transportation and energy sectors. As a matter of fact, consumers are contemplating a major shift from an economy and way of living based on cheap energy to a new paradigm still to be conceived and accepted. Faced with opposing constraints, policymakers have a major challenge to solve: satisfying the short-term expectations of our modern society while preserving the future role of Europe and its citizens.

Electricity will play an increasing role in this challenge because it provides several advantages: it is highly efficient, it can accommodate all energy sources and it contributes to the quality of life. As a large proportion of the Member States' power systems will need to be replaced over the next 10 to 20 years, we have an opportunity to shape Europe's future energy infrastructure to ensure our competitiveness through an efficient pan European market, a sustainable energy environment and the necessary security of supply.

The challenge for transmission system operators should however not be underestimated. The Priority Interconnection Plan published recently by the European Commission identified some €6 billion of new electricity transmission investment by 2013 for projects of European interest alone. This amount is only part of the needs for the European networks as the International Energy Agency projections for transmission network investments in Europe are around \$159 billion between 2005 and 2030<sup>1</sup>.

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<sup>1</sup> International Energy Agency - World Energy Outlook 2006 – New Electricity Generating Capacity and Investments by Region in the Reference Scenario, 2005-2030 – Table 6.1 ; (respectively \$ 1047 billion for generation and \$ 507 billion for distribution networks)

With such a body of evidence, we would expect that the importance of a well developed, well maintained and efficiently operated European transmission network is widely recognised, leading to appropriate European and national legislations and regulations. However, the reality is quite different as the current national policies and regulation are focused on reducing costs, with the political virtue that falling transmission tariffs can be announced regularly to the consumers. It remains to be seen if the renewed political awareness for energy and environment will actually lead to substantial changes as it is hard to see how the future investment challenge contemplated by the International Energy Agency fits into the current regulation regimes of most European countries.

## **1. The internal electricity market: a moving target with many objectives**

During the first few years of market liberalisation, customers in most Member States enjoyed the downward trend of electricity prices resulting from several favourable elements at national level: excess generation capacity, low fossil fuel prices, efficiency gains with (often close to) fully depreciated power plants. In its early years, the opening up of the market provided the potential price reductions contemplated by most governments and industries. Nevertheless, it has not fully delivered on its promises as it is still mostly characterised by national markets with limited cross-border trade, leading to some degree of competition within Member States or neighbouring countries, but not yet at the level of a Pan European market.

This favourable situation changed at the turn of the century for several reasons

- access to abundant (low-priced) fossil fuels became less reliable leading to less stable and mostly rising prices;
- the power stations (and networks) built in the seventies are reaching the end of their life, in some cases accelerated by the internalisation of environmental costs;
- the political choices in favour of one or another sources of energy (e.g. higher penetration for renewables and/or abandoning nuclear energy) distort the optimum generation mix on a given moment from an economic point of view;
- the perceived risk on climate change is slowly but surely modifying the (European) economic order.

What is called a process rather than an event is now on the agenda of the European Commission and all the Member States. Recent major events lie at the heart of this renewed focus.

First, the general public is becoming aware that, as pointed out by the International Energy Agency, “*the energy future we created is unsustainable*”<sup>2</sup>. It is

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<sup>2</sup> International Energy Agency: *World Energy Outlook 2006*, p.3 ; OECD/IEA 2006

now generally recognised that global energy demand will continue to increase for several decades while some hydrocarbon reserves will get closer to their peak production.

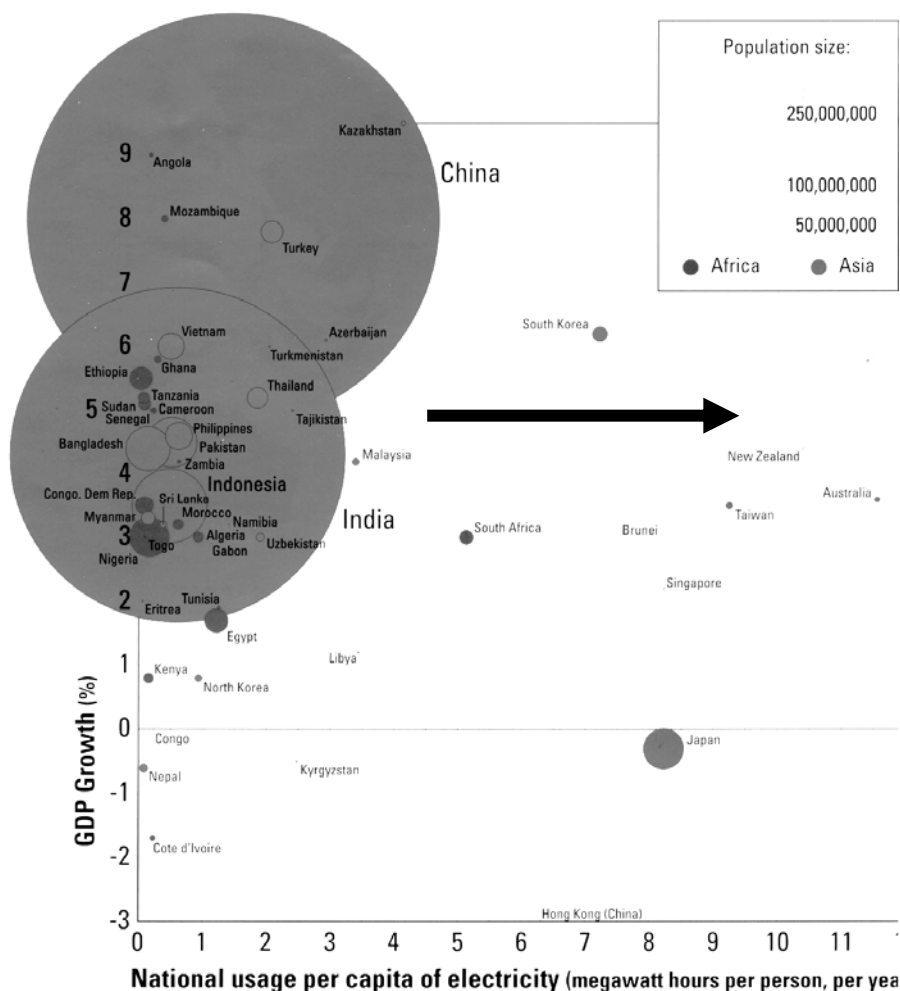
Given the European Union's current dependency on external energy sources for approximately 50% of its needs, and the fact that this figure will probably rise to 70% by 2030, all consumers and industries will inevitably be exposed to increasingly intense competition for foreign energy resources from developing economies. It will also imply a higher sensitivity of our economies and our welfare to future geopolitical uncertainties.

As an example of the challenge ahead for all industrialised countries, the figure 1 below <sup>3</sup> shows the potential increase in national electricity usage (horizontal axis, in megawatt-hours per person, per year) for the population in Asia and Africa when compared, for example, with industrialised countries such as Taiwan, New Zealand and Australia. Taking into account their GDP growth (vertical axis, in %), a rush to secure access to fossil fuels from these countries should not come as a surprise<sup>4</sup>.

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<sup>3</sup> *The World Energy Book*, 2005, p. 29

<sup>4</sup> International Energy Agency - World Energy Outlook 2006 – Page 157 ; “The number of people without electricity stands at around 1.6 billion, equal to over a quarter of the world population. ... Because of continuing population growth, if no new policies are put in place, there will be 1.4 billion people lacking access to electricity in 2030”.



## **2. Transmission networks: blessing or cure?**

### **2.1. Blessing**

During the twentieth century, each country developed its own power system to address its national needs, mostly influenced by the industrial landscape and locally available fossil fuels. The driving force behind moving from regional to national networks was the possibility of reducing spare generation capacity for a given level of security of supply. A national transmission network was also seen as a means to reduce risks and costs through diversification of both primary energy sources and generation technologies. The same reasoning lay at the origin of the interconnection between two or more countries, sometimes also driven by the specificities of national generation plants (such as hydroelectric and nuclear energy being respectively peak and base load generators and thus complementary).

However, the full integration of neighbouring national power systems never happened and was limited, for both commercial and national political reasons, to the bilateral exchange of reserve capacity and limited trade. Increasing the integration of national power systems required a major change!

*The entry into force of Directive 96/92/EC concerning the common rules for the internal market in electricity triggered the start of this process.*

### **2.2. Cure**

With the opening up of the electricity market, interconnections between national transmission networks were given a new objective: to facilitate the wholesale electricity trade so as to promote competition between generators, traders and suppliers, leading to competitive markets and potentially lower electricity prices.

Excess generation capacity was unfortunately not matched in most countries by excess transmission capacity, either at national level or between neighbouring countries. Observed commercial and physical transmission constraints were first believed to be some way found by transmission system operators to protect national generators from competition. As the time needed to build new transmission infrastructure ranges from 5 to 15 years (or more), these bottlenecks would not be removed at short notice.

Allocation mechanisms had to be put in place that would maximise transmission capacity available for international trade while reflecting the price of scarcity through an adequate market-based mechanism. Eight years were needed from the first proposals by ETSO to the publishing of the Regulation<sup>5</sup> imposing the auctioning of cross-border capacity (explicit or implicit with power exchanges, or a combination of both) mostly because of strongly diverging commercial and national interests. Today, most borders satisfy the Regulation requirements.

*However, the Regulation still did not reach its ultimate objective of removing these constraints via new or upgraded infrastructure so as to foster a higher integration of national networks. There are two key reasons for this situation.*

First, the duration for building new (or upgrading existing) transmission infrastructure is prohibitive with respect to the time required to build new generation units<sup>6</sup>. Every day, transmission system operators must face complex administrative procedures that are generally comparable in all Member States (environmental assessments, permit applications at national and local levels, public debates, etc.). The number of entities responsible for issuing permits (ministry, regions, local authorities and other public bodies) and the veto powers of the regions in the context of public hearings increase both the cost and duration of any transmission project.

As a result, very few transmission lines of more than a few kilometres have been built over the last 20 years and most bottlenecks noted in the mid-1990s are still there today. For some market players, lack of unbundling is the main reason for this situation; they argue that it is easy for transmission system operators to blame red tape and long permit procedures. Fortunately, the planning permission issue is now recognised - as it should be - at Commission level and in some Member States, as pointed out recently by Commissioner Piebalgs<sup>7</sup>:

“However, in addition, we have to be aware that it is becoming ever more difficult to gain planning permission to build new overhead power lines, LNG terminals and generating facilities. I should state from the outset that I am not in favour of relaxing environmental and local

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<sup>5</sup> Regulation (EC) No 1228/2003 of the European Parliament and of the Council of 26 June 2003 on conditions for access to the network for cross-border exchanges in electricity

<sup>6</sup> [http://www.etso-net.org/upload/documents/procedures%20400%20kv%20lines5-04-06%20\(2\).pdf](http://www.etso-net.org/upload/documents/procedures%20400%20kv%20lines5-04-06%20(2).pdf)

<sup>7</sup> Andris Piebalgs, Energy Commissioner, The internal energy market must benefit each and every EU citizen, High-Level Workshop on Completion of the Single European Market for Electricity and Gas – striking the balance between competition and energy security, Berlin, 29 March 2007

planning requirements for such projects. I am, however, in favour of ensuring that these procedures run quickly and efficiently and correctly balance the need for environmental protection and security of energy supply<sup>8</sup>.

Second, revenues from capacity auctioning can be freely used by national regulators for three different purposes<sup>9</sup>:

*“Art 6 (6): Any revenues resulting from the allocation of interconnection shall be used for one or more of the following purposes:*

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

Some regulators have chosen the third option (c) because it makes it possible to significantly reduce transmission tariffs at a given moment. For national governments and regulators, it offers a positive message to end consumers within a context of rising commodity prices. However, this approach also leads to a vicious cycle:

- (i) Some national customers, regulators and governments will not be interested in removing bottlenecks too quickly. Investing in interconnections to increase trade between Member States will raise the regulated asset base used to calculate the fair remuneration of the shareholders of transmission system operators and reduce the auction incomes, both leading to an increase in national transmission tariffs.
- (ii) Transmission system operators are faced with a situation where promoting investments increasing transmission capacity may lead to further cuts in their operational expenses at the request of their regulator so as to compensate for the lack of revenues from allocating cross-border capacity (even if, at the end of the day, investments reduce the wholesale price through increased competition).

In other words, when national regulators choose option (c) they indirectly

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<sup>8</sup> Underlined by the author

<sup>9</sup> Regulation (EC) No 1228/2003 of the European Parliament and of the Council of 26 June 2003 on conditions for access to the network for cross-border exchanges in electricity (Text with EEA relevance)

reduce the “national” incentive for cross-border investments. This example confirms - if that were necessary - that despite the fact that the Regulation pursues the objective of greater integration of national markets, it partially fails by overlooking the fact that the “devil may be in the – *national* – details”.

Apart from creating stable investment conditions with the right incentives, a major challenge for the regulatory framework with regard to transmission capacity lies at the operational level. At regulatory fora and hearings, much emphasis has been placed on several issues concerning capacity allocation, of which the three most often cited are:

- ensuring firmness by transmission system operators;
- maximising allocated capacity;
- implementing “flow-based” allocation mechanisms.

Concerning the *firmness and maximisation of allocated capacity*, the issues essentially boil down to the right incentives: if transmission system operators are penalised in cases where firmness would not be ensured while no positive incentives exist for increasing capacity (which essentially is the case today), a conservative capacity assessment will be the logical risk-averse outcome. Recent mechanisms put in place by some national regulators are also transferring all or part of the economic risk of market parties towards the transmission system operator. This approach may be acceptable when the objective is to facilitate new market rules or to attract new parties; providing that such mechanism is not permanent and that the concerned transmission system operator is compensated through the tariffs.

*An incentive scheme that remunerates transmission system operators for increasing capacity could go hand in hand with appropriate compensation for market players in cases where the allocated capacity would have to be curtailed, to the extent that such curtailment would be caused by “capacity overestimation” by the transmission system operator.*

Keeping a balanced risk/reward mechanism, through the thoughtful application of clause a) of the aforementioned Article 6, would be of the essence. Such an incentive scheme should be suspended in cases where capacity would have to be curtailed for reasons beyond the reasonable control of the transmission system operators, in order to avoid “cherry-picking” by market players.

Concerning the third one, *flow-based allocation* is advocated with the aim of

increasing the capacity available to market players. It should be kept in mind that there is a basic trade-off between maximisation of the market liquidity in a given area with a single price and maximisation of the transmission capacity between hubs. Actually, to increase the markets liquidity, market players need the freedom to sink or source their energy within each given price area, which leads to the necessity for the transmission system operator to maintain capacity margins on individual transmission assets. This inherently limits the potential for higher transmission capacities with flow-based methods although it may still yield significant advantages compared with present methods (e.g. improved sharing of capacity between borders, higher stability of the estimated capacity available to the market on a given moment), provided these inherent limitations of the method are understood and accepted.

### **2.3. Cost**

Since liberalisation, the only lever held by governments and regulators on electricity prices remains within the regulated transmission and distribution activities. *As headlines and public opinion have continued to hold governments accountable for the evolution of electricity prices, governments and regulators have been focusing on the short term reduction of network tariffs.*

In the short term, regulators have several tools at their disposal for limiting the tariff impact of transmission investments:

- Depreciation rates might be set at the so-called “technical life duration” of the assets. In the real world, this means that the tariff income from depreciation largely undervalues the economic cost of renewal of the assets and hence, transfers costs to future generations.
- Regulatory schemes may limit earnings to the dividend pay-out ratio necessary to - roughly - maintain shareholder value, without creating additional self-financing capability.
- Additional financing needs may be addressed by ever-increasing long-term debt finance, which is plausible in a period of low interest rates and within a regulated context, to the expense of transferring costs to future generation should interest rates rise again.
- Applying option (c) of Art 6 in such way that any revenues resulting

from the allocation of interconnection capacity reduces the network tariffs instead of financing the investments needed to open the national market.

- Finally, conditions may be set in general, which lead to the deferral of investments.

These methods effective in reducing costs today at the expense of future generations are also enhancing the perception of regulatory risk which could prove to be detrimental when large investment programs will need to be financed.

Another approach to regulation would be to support balanced risk/reward mechanisms for elements such as operational expenses, maximising capacity allocation as mentioned above, procurement of ancillary services or improving the operation of the electricity market. These mechanisms might lead to more sustainable tariff reductions with win/win situations for both operators and network users.

Still more important is the fact that transmission investments often have a direct beneficial effect on the total electricity cost to end users, which largely exceeds the increase in transmission tariffs. By way of example, the figure 3 in section 4 on market coupling illustrates its impact on wholesale prices in the French, Dutch and Belgian area.

However, such measures are more effective in the medium and long run and, consequently, they are seldom applied during periods when primary energy prices are rising.

To summarise, it has become a real challenge for regulators and policymakers to withstand the pressure by lobbying organisations and public opinion in favour of short-term tariff reductions, despite the fact that they would not be financially sustainable in the long run and would lead to cancelling investments with a clearly positive cost/benefit ratio for the market as a whole and/or for other policies (e.g. renewables, rational use of energy).

*Observation of the above features would lead an independent observer to the conclusion that an unsustainable “regulatory bubble” is building up, at the expense of future network users and at the financial risk of the network companies. And yet, it is happening.*

## **2.4. Return to “network” reality**

Keeping the lights on at all times is a highly complex and difficult task that should not be underestimated by policymakers and regulators when writing directives or applying regulations.

For a better understanding, two such critical concepts as “adequacy” and “security” of supply need to be considered separately.

- Adequacy of supply is the ability to meet current and future demand (power and energy) of network users within specified voltage and frequency limits, taking into account planned and unplanned outages of power system components. This concerns the entire value chain of a power system, from gaining access to fossil fuels (at reasonable prices) to investing in due time in (efficient) generation and transmission capacity.
- Security of supply is the ability of a power system to withstand sudden (severe) disturbances such as the loss of one or more components (generation, transmission or distribution), a lightning strike on a line or substation, sudden changes in the output of large wind farms, unforeseen load conditions that do not exceed operating constraints, and other forms of external threats.

### **2.4.1. Adequacy of supply<sup>10</sup>**

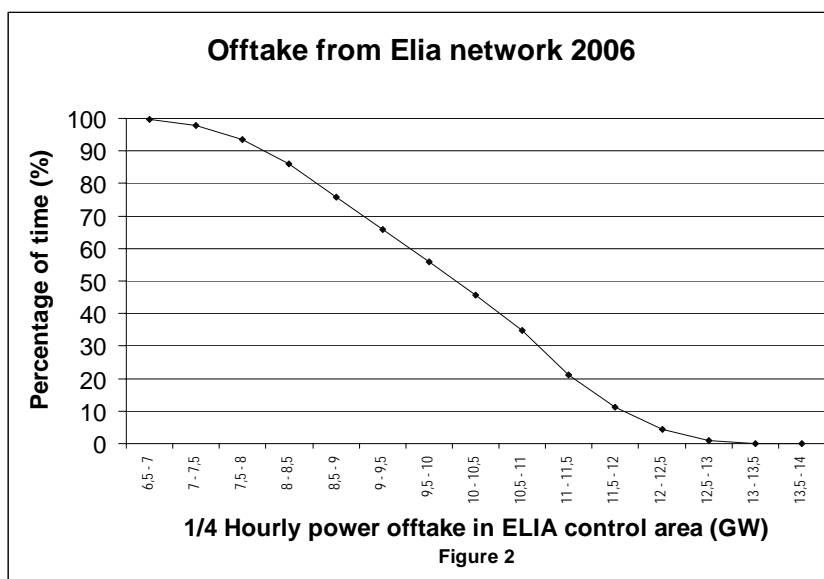
The deregulation process and Europe's dependence on fossil fuel resources located in foreign countries have significantly modified the perception *and* reality of adequacy of supply, though not always in the same way.

A “generation adequate” power system is one with reserve margins that have been optimised in accordance with system characteristics (such as size of the biggest plant, interconnection, hydro availability, wind generation, etc.). The centrally organised “integrated resource planning” in the previous vertically integrated systems aimed to achieve such optimisation based, among other things, on the load duration curve<sup>11</sup> and the costs of the available generation technologies.

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<sup>10</sup> For the purpose of this paper, adequacy of supply will be limited to that part of the value chain dealing with the electricity power system.

<sup>11</sup> representing the volatility of demand over the year



This approach ensured – at least theoretically – that the most economically optimal generation portfolio was built and operated at any given moment: a high capacity factor for units with high fixed and low variable costs (base-load plants); a lower capacity factor for units with low fixed and high variable costs (medium-load to peak-load plants).

Since each generation technology is characterised by an optimal size at a given time era, it also determined the number of power plants of a given technology that should be built so as to fill in the load duration curve. As the cheapest technologies happen to be the most capital intensive, it also led to the concentration of the required financial resources within fewer companies, leading progressively to so-called national champions. The risks could be mostly passed on in the all-in electricity tariffs leading potentially to some excess of capacity but also to major developments in generation technologies as well as a high reliability.

In other words, past national choices regarding a combination of parameters such as market size and generation technologies as well as economic, geographical and geopolitical considerations have resulted in broad diversity in the primary fuel mix and generation technologies, leading to different wholesale prices and market structures across the European Member States.

These structural differences explain most of the transmission constraints observed between Member States since liberalisation started<sup>12</sup>. Unless more transmission capacity is built or major changes modify the generation mix in different Member States (e.g. the internalisation of CO<sub>2</sub> costs or political decisions), these historical choices will continue to determine - for several years to come - electricity flows on the networks (as well as the bottlenecks between areas) and, consequently, the way the liberalised market is working.

Since market liberalisation, the generation side of adequacy is left up to market forces, which implies that the main objective is profitability, or its long-term equivalent shareholder value. Market dynamics have transformed the generation industry into a very cyclical one with boom and bust cycles, due among other things to uncertainty about future policies and regulations, the geopolitical instability for accessing fossil fuels, and the time lag between investment decisions and the commissioning of new plants<sup>13</sup>.

Unless criteria pertaining to security of supply, sustainability and the environment are either internalised by economic incentives, which can be expressed in terms of profitability (e.g. feed-in tariffs, certificates or tradable emission rights) or imposed as constraints (setting the limits within which the market parties can target their profitability objective, e.g. planning permission), there is no certainty that the “market” will deliver the required adequacy of supply.

*For transmission system operators, this situation implies either increasing the level of investments so as to develop a network more resilient for such uncertainties or operating a more stressed network as the technical reserve margins are progressively “consumed”.*

Such a situation has happened in several US states, leading to a lack of transmission capacity, even in the context of regional transmission system operators such as PJM. Moreover, as can be regularly seen during day-to-day operations, the networks have to deal with situations for which they were not initially designed such as large power flows that are induced by generation from large wind farms in northern Europe, or increasing capacity of decentralised generation located in distribution networks.

Thereby, one should not forget that a transmission system operator controls only a part of the electricity value chain.

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<sup>12</sup> with the exception of observed influences on electricity flows due to wind generation in northern Germany or the change in generation mix due to the relative costs of primary fuels and CO<sub>2</sub> costs.

<sup>13</sup> Depending on the technology used, the time lag is between 3 and 10 years.

### **2.4.2. Security of supply**

A failsafe electricity supply is expected by all market players nowadays, regardless of the status of the power system. To this aim, transmission system operators are constantly required to balance multiple constraints:

- maintaining supply and demand balanced in real time across the entire interconnected network;
- taking care of continuously changing flows on their interconnected networks;
- continuously monitoring and adjusting the voltage levels at each node in their network;
- adapting the topology of their network so as to accommodate maintenance or repair works on their assets without endangering the security of supply.

These constraints interact mostly in real-time across the entire interconnected networks. Failure to successfully balance these constraints can cause substantial damage to electricity infrastructure or lead to catastrophic failures and blackouts.

- Large frequency fluctuations can cause severe damage to generating equipment. To avoid such situation, protection systems will disconnect these equipments from the network, potentially worsening the frequency fluctuation and eventually starting a domino effect of disconnections. Load shedding will also automatically or manually be required to avoid system collapse (as observed during the incident of 4 November 2006).
- Sometimes, in just tens of seconds, voltages can locally decline until stable operating situation can no longer be maintained. Conversely, excessively high voltages may exceed the insulation capabilities of transmission components and loads, leading to failures.
- Power flows may lead to the overheating of transmission lines and other equipment depending on ambient temperatures and wind conditions (as well as reactive power). Overheating will cause transmission lines to sag, possibly leading to short circuits resulting from electric arcs or direct

contact with trees or other ground-based objects (as observed during the incident affecting Italy and Switzerland in 2003). Persistent overheating can also cause permanent damage to transmission equipment.

- Operating beyond determined power flows and voltages may induce instability in the entire power system, leading to loss of synchronisation between generators, damaging equipment and, in extreme cases, leading to the breakdown of the interconnected system into separate electrical islands.

Operating a “secure” power system is not as easy as it looks when visiting a dispatching centre, especially when a network is highly interconnected within surrounding networks. There is no broad experience today on the extent to which greater national network integration (with clear advantages in terms of adequacy and broader competition) might positively or negatively impact the security of supply at national level.

### **3. Where do we stand?**

*The day to day operation of the networks shows in fact that Member State electricity networks are increasingly European rather than national. However, their respective legislation (following the “subsidiarity” principle) and their regulation remain mostly national.*

From a transmission system operator perspective, there is no doubt that significant progress has been made in bringing more competition to the electricity market.

- Network access rules for the wholesale market are among the most advanced and market oriented.
- Power exchanges and trading platforms are available in most Member States, offering hedging opportunities as well market splitting or coupling (e.g. Nordpool in Scandinavia, market coupling between France, Belgium and the Netherlands).
- Regional initiatives are taking shape with wholesale prices converging.

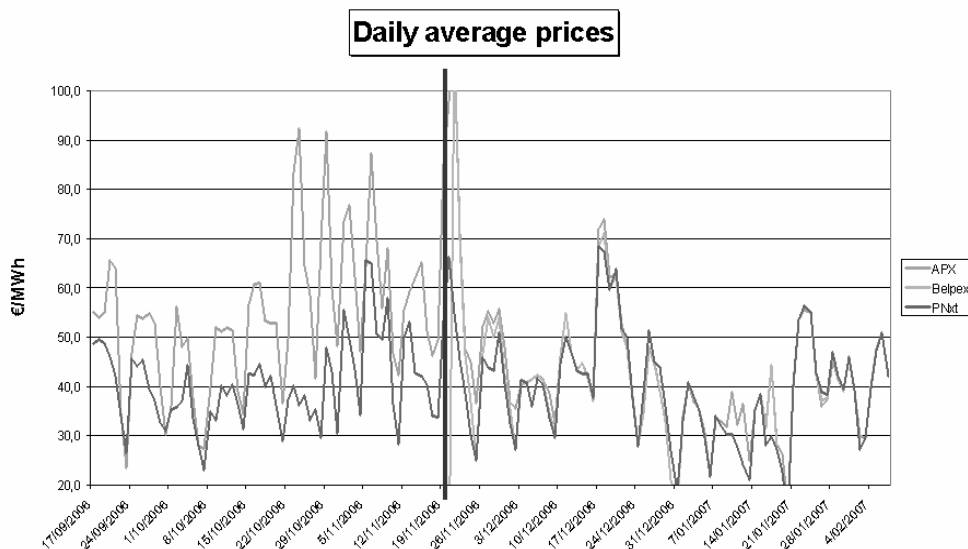


Figure 3

By way of example, the graph on figure 3 shows the price convergence observed soon after the launch of the market coupling between the power exchanges organised by the transmission system operators in France, the Netherlands and Belgium. This market coupling represents a major step forward towards a more integrated market in Continental Europe<sup>14</sup>:

- Instead of two steps (buying first the capacity and then trading via the exchange or otherwise), parties are able to trade in one step in an automatically coupled international market. Market players are not required to buy transport capacity without knowing its underlying market value.
- The market value of the transmission connection is exactly identical to the price difference between the areas. This ensures that congestion income only arises when constraints exist.
- When there are no transmission constraints, the markets converge entirely and the price is identical in the concerned countries.

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<sup>14</sup> Belpex, Successful start of market coupling between APX, Belpex and Powernext , Press release, 21 November 2006

Needless to say, this project required the involvement of many different parties in the three countries: governments, administrations, regulators (electricity and finance), consumer associations, power exchanges and transmission system operators. As different market players were either in favour of or against the price convergence expected from market coupling, several months were needed to obtain a sufficiently large majority in favour of the project since there was no guarantee that it would be beneficial to *all* market parties in *all* three countries *all* the time. The fact that market coupling represented a major step towards a more integrated European market was surely not the deciding factor at Member State level in the whole authorisation process.

This progress towards integrated electricity markets was made without decreasing the security of supply that European customers have been enjoying for so many years despite what was claimed recently by some parties. It is worthwhile to notice that since 2000 all spectacular incidents have been caused by small random events: a communication failure between the Swiss and Italian dispatching centres after a flash-over between a tree and a transmission line in Switzerland, the fitting of a wrong fuse in a London substation, a mistake in tripping a power station in the US and a human error in assessing the load on a 380 kV connection in Germany.

Instead of immediately blaming *all* European transmission system operators *as a group* for insufficient cooperation or failure to comply with grid code rules, policymakers and regulators should have acknowledged the need for faster authorisation procedures allowing transmission investments due to increased European integration and complexity of modern power systems to be built in due time within the countries as well as between them

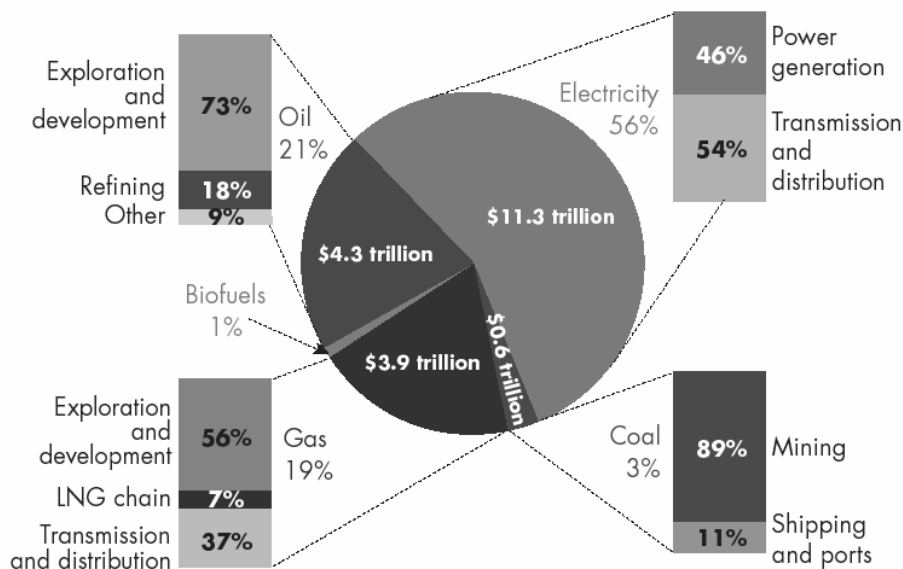
*Drafting more stringent rules enforced by the threat of severe penalties and the promise of permanent supervision by regulators<sup>15</sup> may improve the perception of a more secure European network, but it will be at the expense of an increasingly risk-averse behaviour from transmission system operators.*

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<sup>15</sup> ERGEG; Blackout of 4 November 2006: Final Report Ref. E06-BAG-01-06, 6 February 2007

#### 4. Tomorrow: coping with a massive wave of investments

The IEA assessed that, globally, between 2005 and 2030 there will be a huge need for investment in generation and network infrastructure of around \$11.3 trillion, of which 54% for electricity transmission and distribution networks<sup>16</sup>.



**Total investment = \$20.2 trillion (in year-2005 dollars)**

Figure 4

In section 3 we highlighted the dynamic effects causing boom and bust cycles on the generation side, whose effects may be reinforced by the increasing time lags in transmission investments.

Actually, in the “liberalised market” environment, no experience has yet been acquired for such a huge wave of generation and transmission investments. Recent years have shown a reversal of the time lag needed to build power plants and transmission connections. Since the end of the eighties, building a gas power plant or a wind farm needs some 3 to 4 years while a high voltage line or cable needs from 5 to 15 years. Thereby, many

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<sup>16</sup> International Energy Agency - World Energy Outlook 2006 - Cumulative Investment in Energy Infrastructure in the Reference Scenario by Fuel and Activity, 2005-2030 (in year-2005 dollars) – Figure 2.6

unknowns remain.

- Which technologies will be chosen for electricity generation given the uncertainty about the sourcing of fossil fuel and the CO<sub>2</sub> rules post Kyoto?
- How will the generation mix evolve? What will be the ratio of base and peak load? What will be the ratio of controlled and intermittent generation?
- Where and when will new power plants start operation?
- What level of import/export can be expected?
- What changes in the transmission and distribution infrastructures will be needed to accommodate such generation investments?

These unknowns will also have a major impact on the day-to-day operation of the entire power system. In highly interconnected networks, the real value of a new power plant for secure supply depends on several factors: its technology and related energy source, its geographical location with respect to the surrounding networks (including in neighbouring countries), the characteristics of the other power plants in the power system (primary energy source, base load, peak load, intermittent), the demand profile in the surrounding area and the characteristics of the network (meshing, reserve margin, parallel flows, etc.).

*It is therefore more important than ever to provide a stable legislative and regulatory framework to enable timely decisions on future generation mixes and transmission networks.*

Steps are undertaken at the European level such as the identification of the 314 infrastructure projects ("projects of common interest") whose completion should be facilitated and speeded up<sup>17</sup>. On this list, 42 "Projects of European Interest" have the highest priority. These are cross-border in nature or have significant impact on cross-border trade. The European Commission has also introduced specific rules to ensure an appropriate level of electricity interconnection (and gas supply) between Member States, while facilitating a stable investment climate<sup>18</sup> and concerning measures to

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<sup>17</sup> Guidelines for trans-European energy networks (TEN-E Guidelines)

<sup>18</sup> Directive 2005/89 L33/22 dated 4 February 2006.

safeguard security of supply<sup>19</sup>.

As pointed out in the Priority Interconnection Plan, transmission networks are fundamental for achieving the targeted objectives:

- **Sustainability.** Substantial new energy infrastructure is needed *to integrate "green electricity" into the grid*. It will also improve capacity utilisation and help *to defer inefficient investment in generating capacity*.
- **Competitiveness.** Efficient performance of energy infrastructure is vital for the operation and development of an efficient internal energy market. It underpins the *increase in inter-regional trade*, which leads to *effective competition* and *reduces the scope for market power abuse*.
- **Security of supply.** A well connected energy market further *reduces the risks of shortage of supplies*, thus contributing to increased security of supply and *solidarity amongst Member States*.

The Priority Interconnection Plan and the Energy Review have therefore clearly identified gas and electricity transmission networks as the backbone for any future energy policies in addition to encouraging competition in each Member State.

*Time will tell if this renewed awareness will lead to adequate decisions at Member State level. History seems to show that a change in policy requires costs to become "politically apparent", through price spikes, endangered security of supply, repetitive or major black-outs as it seems to be the case for climate change.*

## 5. European energy policy

An effective policy should have credible, easily understood objectives, which are translated into policy instruments with comprehensive targets that must be reached within a given timeframe, thus making it possible to adjust the corresponding policy instrument should a deviation be detected.

*For the European energy policy, the priority to be given between "Sustainability, Competitiveness and Security of supply" in the case of highly interconnected power systems, such as in Europe, should therefore not be implicit, left only to subsidiarity or taken on a*

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<sup>19</sup> Council Directive 2004/67 L127/92 dated 29 April 2004

*case by case basis.*

Such an energy policy is not easy to design, since the stable environment of the nineties has given way to a future energy landscape that is blurry in terms of global energy dependency, security of supply and greenhouse gas emissions<sup>20,21,22</sup>. With fossil fuel prices and CO<sub>2</sub> emissions still rising, it has become more and more difficult to believe in the prospect of “cheap energy” that is also “sustainable, secure and environmentally friendly”. Moreover, the prospect of meeting Kyoto targets without a major cost to the economy thanks to a higher share of renewables (largely wind), while reducing or abandoning nuclear energy, has lost (some of) its credibility. With the exception of rational use of energy, the new solutions that have been put forward, such as clean coal technology, are still in research and development phase<sup>23</sup>.

*As investments in networks and power stations made in the years ahead will be part of the European power system for the next 50 years, it is critically important to determine – today – the objectives to be met in terms of the three above-mentioned European Commission objectives.*

These conflicting objectives need to be given realistic targets and translated into economic incentives in order to provide the foundation on which investors will base their decisions to finance the investments in generation and network infrastructures foreseen for the next 20 to 30 years. If the perception of the political and regulatory risks remains significant, the cost of capital will rise, leading to more short-term investment decisions that could prove detrimental in the long term.

Generation and network infrastructure are long-lived assets, implying that during their lifetime they propagate the economic conditions, technologies, policies and regulations in place at the time the investment decision was taken. One should not forget that all existing power systems – from power plants to transmission and distribution networks – are still mostly based on the “carbon” economy (excluding hydraulic and nuclear generation). This is of major importance as electricity is a prime energy vector allowing our

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<sup>20</sup> Helm Dieter, Energy policy: politics v economics (supplement), 15/06/2006, New College, Oxford

<sup>21</sup> Chevalier Jean-Marie, Security of energy supply for the European Union, European Review of Energy Markets, Volume 1, Issue 3, 2006

<sup>22</sup> Capros Pantelis, Mantzos Leonidas, Long-term scenarios for strategic energy policy of the European Union, European Review of Energy Markets, Volume 1, Issue 3, 2006

<sup>23</sup> European Technology Platform Smart Grids Vision and Strategy for Europe’s Electricity Networks of the Future; ISBN 92-79-01414-5 © European Communities, 2006

modern societies to get progressively loose of carbon.

***Therefore, policy makers and regulators should take into account that moving towards a low-CO<sub>2</sub> economy requires the re-engineering of a large part of the transmission and distribution networks***, so as to be able:

- to take power up from geographically decentralised generators connected to medium-voltage networks, instead of allowing large-base load power plants deliver their energy from the very high voltage network down to the lower voltage;
- to increasingly operate on a cross-border basis in order to allow large-scale infeed of renewable sources, such as far-offshore wind or photovoltaic power from the Mediterranean, which might be balanced by hydropower from Norway or the Alps; and
- to move the electricity produced by large generation units located close to the coast (e.g. clean coal power plants, large wind farms, nuclear units) and for which the existing transmission network was not designed in the past.

Obviously, this major change will not happen overnight and will require major investments (in assets and human resources). For this to happen, clear and unambiguous objectives need to be set by policymakers ***without delay***.

## **6. The European Commission Strategic Energy Review from ETSO's perspective**

### **ETSO: a proactive association of all transmission system operators**

The association of European Transmission System Operators (ETSO) was created in 1999 at the request of the European Commission to represent all European transmission companies - from Portugal to Romania and from Finland to Cyprus - responsible for ensuring the secure and reliable supply of electricity to more than 500 million citizens.

Transmission system operators play a key role in facilitating market integration within Europe by enabling market facilitation in several ways by:

(i) building new transmission infrastructure to better integrate different national markets; (ii) operating energy flows securely; (iii) organising market-based congestion management methods within and between control areas; (iv) facilitating bilateral as well as exchange-based trade through a trading platform (hub) with adequate balancing arrangements; (v) increasing market transparency; (vi) providing IT tools to facilitate access to the market.

ETSO has paved the way for practical and pragmatic solutions that have found successful implementation at Member State and regional levels. Examples such as pan European inter-transmission system operator compensation for transits of electricity flows (avoiding pancaking of cross-border fees), load flow-based capacity allocation between Member States, the recent coupling of the Belgian, French and Dutch spot markets in cooperation with power exchanges, standards for electronic information exchange in a market environment, and reporting on the adequacy between generation and transmission with respect to future demand are some of the roles played by ETSO with the help of its sister associations (NORDEL, TSOI, UCTE and UKTSOA<sup>24</sup>). ETSO has also taken a leading role in the transparency debate with the launch in November 2006 of ETSOVista, a public transparency platform available via the website. Today ETSOVista contains data on operation and capacity allocation on interconnector infrastructure.

The following paragraphs are excerpted from the ETSO response to the Communications from the Commission to the European Council and the European Parliament on the European Commission's Strategic Energy Review<sup>25</sup>

## **6.1. A Single European Grid**

From a transmission system operator perspective, cooperation has not been discovered by the Directive, as can be witnessed from the development of large synchronous power systems in Europe since the early fifties. Since the entry into force of the first Directive, there have been many examples of fruitful cooperation, be these through the development of interconnections and the joining together of market areas (the Trilateral Coupling of the French, Belgium and Dutch markets, the establishment of Nordel priority

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<sup>24</sup> NORDEL (the Nordic TSOs), TSOI (the association of TSOs in Ireland), UCTE (Union for the Coordination of Transmission of Electricity in the continental countries of Western and Central Europe), and UKTSOA (United Kingdom TSO Association)

<sup>25</sup> <http://www.ets-net.org/upload/documents/ETSO%20Strategic%20Energy%20Review.pdf>

interconnection projects, the development of new interconnections such as several 400 kV lines and DC cables such as Norned, Estlink, and congestion management initiatives such as the Central European Auction Office) or through the creation of the Operational Handbook in the UCTE area.

A European ‘Grid Code’ would clarify what rules need to exist where systems or control areas interconnect. The development of such a code could also be seen as a key future responsibility of ETSO+, as contemplated by the European Commission. For ETSO, this code should focus on functional reliability at borders between control areas, taking into account how these rules interact with the regional grid codes already in place (e.g. in the British Isles, UCTE, Nordel, Baltic States). The details of what happens within control areas should, in accordance with the subsidiarity principle, remain at the regional level while ensuring compatibility with the European ‘Grid Code’.

It is critically important to ensure that the European ‘Grid Code’ as well as the regional and national rules are aligned on opening the access to the networks and that they apply to all network users, including generators, industrial consumers and distribution network operators.

## **6.2. Investment**

ETSO has made clear in its papers on Cross-Border Network Investment<sup>26</sup> that two main issues frustrate increased interconnectivity across the Member States.

- the ever-increasing difficulty in obtaining permits for cross-border infrastructure and infrastructure within Member States;
- the so-called ‘regulatory gap’ as there is currently no requirement for Member State regulators to consider issues outside their own Member State.

Although these points are recognised in the Priority Interconnection Plan and in the Strategic Energy Review, ETSO cannot stress enough the urgent need to adopt, on an EU-wide basis, the permit acceleration proposals. For the last 20 years, the problem is not a lack of willingness to invest, but

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<sup>26</sup> <http://www.ets-net.org/upload/documents/cross-border%20network%20investment%20paper.pdf>

rather gaining siting permits for investments<sup>27</sup>. The regional initiatives may offer potential to bring some of this investment forward and to advance greater cooperation between transmission system operators beyond that which exists today.

### **6.3. Unbundling**

Three options for further unbundling of networks are currently under discussion:

- ownership unbundling (which already exists in several EU and EEA countries);
- an independent system operator (ISO) where ownership can remain with another party but some other aspects of the network function sit with the ISO;
- regional transmission system operators (RTOs) which would be responsible for how the transmission grid is operated in an area covering at least 4 or 5 Member States. The regional system operator would give instructions to national network operators on issues such as dispatching, congestion management, balancing and new investments<sup>28</sup>.

ETSO believes that the perception of independence of a transmission system operator is one key issue that needs to be addressed<sup>29</sup>. Strengthened regulation or control of conduct (e.g. with clear rules to ensure real and full independence of top management) so as to ensure the demonstrable separation of generation and supply from transmission could be a faster and appropriate alternative to other approaches. Both the ISO and RTO models have drawbacks, as can be seen from experiences in other countries, where, in respect of transmission networks, they have not fostered innovation, promoted investment or enhanced efficiency. They also require quite intrusive regulatory oversight for both system operators and asset owners.

*Whatever the outcome in this area, the European Commission should ensure that those*

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<sup>27</sup> <http://www.etsa-net.org/upload/documents/procedures%20400%20kv%20lines.pdf>

<sup>28</sup> Andris Piebalgs, Energy Commissioner, The internal energy market must benefit each and every EU citizen, High-Level Workshop on Completion of the Single European Market for Electricity and Gas – striking the balance between competition and energy security, Berlin, 29 March 2007

<sup>29</sup> ETSO's views relate entirely to electricity transmission as it is necessary to differentiate between electricity and gas transmission and between transmission and distribution in dealing with this question.

*countries in which the independence of the transmission system operator is not a controversial issue (by whatever means this has been achieved) should not have to take a step backwards.*

Resolving issues identified by the Strategic Energy Review also depends on the development of binding regional cooperation agreements among transmission system operators and other entities, such as power exchanges. These binding agreements, which may, for instance, be implemented through regional services (auction offices, market coupling, etc.), should be backed by regulatory regimes to address the ‘regulatory gap’ and by the development of the regulatory governance framework.

*However, one should not underestimate the defence of supposed national interests by a combined action of national regulatory authorities, state agencies and state-owned companies, which may result in market distortion, whatever the perception of the independence of the transmission system operator.*

#### **6.4. The regulatory governance framework**

Starting with the Regulators, ETSO agrees with the European Commission that there is a need for greater consistency among EU regulators in terms of their responsibilities. It is vital that any issues determined at EU level link straight through to the national level such that, among other things, the financial impact on the transmission system operators is recognised in national transmission tariffs.

*ETSO has long argued to be given a formal, institutional role and would favour developing the ETSO+ option alongside ERGEG+.*

ETSO+ contemplates the following areas:

- developing, monitoring and recommending the means to enforce the European ‘Grid Code’;
- regular reporting on generation and transmission adequacy (for example via the reports on a short- and long-term basis already produced by ETSO<sup>30,31</sup>);

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<sup>30</sup> Generation Adequacy Report 2006; <http://www.etso-net.org/upload/documents/adequacy%20report%202006.pdf>

<sup>31</sup> 2006-2007 Winter Outlook Report; [http://www.etso-net.org/upload/documents/WOR\\_2006-07\\_v2.pdf](http://www.etso-net.org/upload/documents/WOR_2006-07_v2.pdf)

- coordinated planning of the pan-European ‘horizontal’ network, as an input to the Priority Interconnection Plan;
- improving real-time system monitoring and coordination of network operation;
- reviewing and developing existing network access conditions;
- facilitating the market in developing consistent/harmonised mechanisms;
- developing a transparency platform for market data via the evolution of ETSOVista;
- reporting on cross border investments.

The governance formulation currently envisaged is one where ETSO+ would develop proposals (taking into account market players' views via consultation) and make recommendations to the European Commission and ERGEG+ such that, were these recommendations adopted, it would be the responsibility of ERGEG+ to ensure these recommendations make their way into national arrangements where the financial consequences of such decisions can be recovered via national transmission tariffs. This process may or may not involve comitology depending upon the nature of the issue and/or whatever legislation emerges from the Strategic Energy Review.

## **6.5. Transparency**

ETSO took a leading role in the transparency debate with the launch in November 2006 of ETSOVista<sup>32</sup>, a public transparency platform available via the ETSO website. Today ETSOVista contains data on operation and capacity allocation on interconnection infrastructure and will be developed further to enhance the quality and value of the data closer to real time. Generators could provide their data via ETSOVista to provide a complete picture for market players in one place. The challenge is now for the generators to agree on what data they are prepared to place in the public domain.

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<sup>32</sup> <http://www.etsovista.org/>

## **7. Conclusions**

Regulatory and technical challenges for the European electricity market are not just about building more interconnections or power plants, but also about the future energy mix for Europe and its dependence on fossil fuels, about setting up an adequate planning permission and regulatory framework for investments in and the operation of complex integrated power systems, about the geographical location of generation sites with respect to demand sites, and about the rational use of energy. For these issues, given the integration of power systems, a European approach linked straight through to the national level would be more efficient as can be witnessed with national policies for a higher penetration of renewable resources - wind energy as well as photovoltaic, tidal, etc. – which appear fragmented and sometimes incompatible.

Although the generation business is not a regulated one, a stable legislative and regulatory framework is essential for setting out a decision-making framework: uncertainties on issues such as planning permission, nuclear phase-out, future emission trading schemes, and so on are still fuelling instability and reinforcing the potential detrimental impact on adequacy of supply caused by investment boom and bust cycles.

Policymakers should also recognise openly that delivering the single electricity market, acting against climate change and promoting renewable energy sources mean higher costs for energy. Building new interconnection lines not driven by demand, enabling the connection of renewable sources, internalising balancing costs for intermittent generators and restarting research and development programmes abandoned since liberalisation are all costs for transmission system operators that will not be offset by higher volumes of electricity delivered to customers. In other words, these policies lead inevitably to higher transmission tariffs on a per energy unit basis.

Also, one cannot simply demand that transmission system operators raise their risk profile by maximising available transmission capacity (e.g. reduce or remove security margins while ensuring firmness of allocated capacity<sup>33</sup>), sharing reserves, merging balancing areas, providing absolute priority for renewable energy, and at the same time advocate to their shareholders that they should be remunerated as a nearly no-risk industrial activity.

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<sup>33</sup> EFET; More transmission capacity for European Cross Border Transmission: Firmness and Maximisation Paper; 20th June 2006

The wave of future investments could be of such a magnitude that it raises major questions about the regulatory regime as a whole. While current regulations (e.g. RPI-x and cost-plus) had the political virtue that falling prices could be announced regularly to the press, it is hard to see how the future investment challenge fits into “short term” regulation regimes<sup>34</sup>.

The greatest contribution to enhancing the efficiency and competitiveness of the European energy market is definitely increasing physical interconnection within and between Member States. Given the need to renew most of existing infrastructure in the next 20 to 30 years, Europe has an enormous opportunity to gain competitive advantage by selecting the most efficient generation-mix, both economically and environmentally, and by completing the physical transmission backbone for the internal energy market.

Transmission system operators are eager to contribute to these major investments, but need some prerequisites to be tackled by policymakers and regulators: obtaining timely planning permission to build and operate new or upgraded transmission infrastructure, providing a favourable climate for private and public investors, ensuring that these companies remain appealing to highly qualified personnel, and, last but not least, ensuring genuine synchronisation between the real situation in the field and ambitious policies decided by EU Member States.

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<sup>34</sup> Helm Dieter, *The Future of Infrastructure Regulation*, Oxera, July 2005, pp. 1-9