Bruges
European Economic
Research Papers

BEER n° 18 (2010)

Interconnector Investment for a Well-functioning Internal Market

What EU regime of regulatory incentives?

Lionel Kapff
Jacques Pelkmans

College of Europe
Collège d'Europe

Brugge

Natolin

DEPARTMENT OF
EUROPEAN ECONOMIC STUDIES

Interconnector Investment for a Well-functioning Internal Market

What EU regime of regulatory incentives?

Lionel Kapff[*] and Jacques Pelkmans[**]

Abstract

Sufficient cross-border electricity transmission infrastructure is a pre-requisite for a functioning European internal market for electricity. Also, the achievement of the EU's energy policy objectives – sustainability, competitiveness and security of supply – critically depends on adequate investment in physical interconnections between the member states. Mainly focusing on the "regulatory path", this paper assesses different ways to achieve a sufficient level of interconnector investment.

In a first step, economic analysis identifies numerous impediments to interconnector investment adding up to an "***interconnector investment failure***".

Reflecting on the ***proper regulatory design*** of an EU framework able to overcome the interconnector investment failure, a number of recommendations are put forward:

- All congestion rents should be channeled into interconnector building. Unused rents should be transferred to a European interconnector fund supervised by an EU agency.
- Even though inherently sub-optimal, merchant transmission investment can be used as a means to put pressure on regulated transmission system operators (TSO) that do not deliver. An EU agency should have exclusive competence on merchant interconnector exemptions.
- A European TSO organization should be entrusted with supra-national network planning, supervised by an EU agency.
- The agency should decide on investment cost reallocation for interconnector projects that yield strong externalities. Payments could be settled via a European interconnector fund.
- In case of non-compliance with the supra-national network plan, the EU agency should have the right to organize a tender – financed by the European interconnector fund – in order to get the "missing link" built.

Assessing the ***existing EU regulatory framework***, the efforts of the 2009 "third energy package" to fill the "regulatory gap" with new EU bodies – ACER and ENTSO-E – are acknowledged.

[*] Alumnus of the College of Europe, Bruges, e-mail: lionel.kapff@coleurope.eu; Business Analyst, Deloitte Consulting, Diegem, e-mail: lkapff@deloitte.com

[**] Jan Tinbergen Chair and Director, Economics Department, College of Europe, Bruges, jacques.pelkmans@coleurope.eu; Senior Fellow, CEPS, Brussels, jacques.pelkmans@ceps.eu

However, striking holes in regulatory framework are spotted, notably with regard to the use of congestion rents, interconnector cost allocation, and the distribution of decision making powers on new infrastructure exemptions

A discussion of the TEN-E interconnector funding scheme shows that massive funding can be an *interim* solution to the problem of insufficient interconnection capacities while overcoming the political deadlock on sensible regulatory topics such as interconnector cost allocation. The paper ends with policy recommendations.

Key words: cross-border electricity transmission infrastructure, interconnection, internal electricity market, investment incentives, third energy package

JEL codes: L 51, L94, F 15

1. Introduction

Sufficient cross-border electricity transmission infrastructure is a pre-requisite for a functioning EU internal market for electricity. Without adequate physical interconnection[1], the idea of creating a single market "simply cannot work" (Bjørnebye 2006:333).

Market integration has been the aim of EU policy ever since the first electricity directive[2] of 1996 having triggered or enhanced a liberalization process all over Europe. One and a half decade later, the goal of a competitive internal electricity market (IEM) has still not been achieved: European markets and networks are fragmented, congestion occurs frequently at many borders within the EU and most of these national markets are dominated by powerful incumbents.

An interconnected electricity grid is of fundamental importance to achieve the core aims of the EU energy policy: "sustainability, competitiveness, and security of supply" (European Commission (EC) 2008a:4). Indeed, the integration of renewable energy sources into the European grid necessitates a far-reaching reorganization and interconnection of electricity networks to allow flows from optimal generation sites in the north (wind) and south (solar) to major load centers. Better interconnected electricity networks also support greater competition and trade between the Member States (MS) leading to price convergence and competitive electricity prices. Finally, interconnectors improve the security of supply by allowing for solidarity between the MS in case of energy supply disruptions.

Yet, the "current state of the EU's energy infrastructure [does] not allow for sustainability, competitiveness and security of supply" (EC 2008a:5). Ageing installations, insufficient investment in infrastructure, a lack of transmission capacities and the existence of "energy islands"[3] call for immediate and vigorous action (EC 2008a:5, Monti 2010:47ff).

While the need for substantial investment in more interconnection capacity is widely recognized, the ways and means to promote such investments are more controversial. This paper attempts to design an EU regulatory framework for sufficient interconnector investment to make the EU internal electricity market function properly. Stated another way: What is the proper regulatory framework for the EU to overcome the present interconnector investment failure?

To answer this question, the paper is organized as follows: Section 2 sets out the problem, i.e. the ***interconnector investment (market and regulatory) failure***. After a brief presentation of the interconnection status quo in the EU, an economic analysis of cross-border transmission capacity is provided, highlighting welfare effects, investment incentives and barriers to sufficient investment. Moreover, we discuss whether and to what extent efficient congestion management can remedy or overcome the problem of underinvestment in interconnectors.

Section 3 develops an EU regulatory framework to overcome the interconnector investment failure, based on economic analysis. For this purpose we discuss the proper use of congestion rents, the potential role of merchant transmission investment – as opposed to regulated transmission investment – and, based on the functional subsidiarity test, the optimal allocation (to the EU or Member States' level) of regulatory powers for network planning and interconnector cost allocation. Based on the results of this analysis a proper EU framework is proposed. Finally, different incentive models to promote interconnector investment are juxtaposed with their strengths and weaknesses.

[1] Art. 2 (13) Directive 2009/72/EC defines interconnectors as "equipment used to link electricity systems". Turvey (2006:1457) provides another useful definition: "An interconnector, in the case of electricity, is a cable or overhead line connecting two separate market or pricing areas."
[2] Directive 96/92/EC.
[3] "Energy islands" are countries or regions largely cut off from the rest of the internal market, such as the Baltic States, Italy or the Iberian Peninsula.

Section 4 recalls the existing EU regulatory framework for interconnector investment and assesses potential shortcomings. Thus, the new EU institutions of the 2009 "third energy package" – ACER and ENTSO-E – as well as the regime for new infrastructure exemptions are discussed with a view of their effectiveness in solving the interconnector investment failure. Also, the Trans-European Energy Networks (TEN-E) are considered, in particular the scope of EU interconnector funding. This leads us to present a series of policy recommendations for a "fourth energy package".

Section 5 concludes.

2. Investment in cross-border electricity transmission infrastructure

2.1. The role of interconnectors for the completion of the internal electricity market

Besides the fundamental properties of any (sectoral) internal market such as free movement, removal of exclusive rights (hence, the right of establishment, too), proper regulation to pre-empt market failures (e.g. consumer protection, natural monopoly, etc.) and the appropriate combination of (EU) regulation and competition policy to ensure effective competition, network markets like electricity will require a far more sector-specific and tailored regime for the EU internal market to work properly. Following Vandenborre (2008), one can specify six sector-specific requirements: (i) market-based congestion management; (ii) organized wholesale markets; (iii) low market concentration; (iv) a conducive investment climate; (v) technical and economic integration of transmission infrastructure; (vi) sufficient capacity of interconnectors. Although we address item (v), and (v) as a corollary, all 6 items hang together in complicated ways. Arriving at an effective EU regime for interconnector investment is therefore an indispensable but not sufficient condition for obtaining a properly functioning EU internal electricity market. Historically, European transmission systems have been constructed to ensure sufficient electricity supply to national end users. Cross-border interconnectors were set up in order to allow for mutual assistance in case of technical disruptions, and not to promote inter-state trade in electricity as such (Bjørnebye 2006:335, Nies 2010:64, Talus & Wälde 2006:358f).

In contrast, the single market for electricity across the EU crucially depends upon – among other things– the provision and availability of sufficient cross-border transmission capacity (ERGEG 2007:4). As pointed out above, a physically interconnected Europe-wide electricity grid is a *conditio sine qua non* for a genuine IEM.

In general, increased interconnection is considered to be beneficial for the following reasons[4]:

- Positive social welfare effects of market integration and price convergence[5]
- Improved level of competition / mitigation of market power[6]
  - (Threat of) low-cost imports put pressure on incumbents to reduce their prices.
  - Market integration erodes high market shares of incumbents in the MS.
- Improved security of supply
  - Interconnection allows for solidarity between MS in case of disruption.[7]
- Integration of renewables in the network / achievement of environmental targets

[4] See inter alia Bolkart 2005:5, Nies 2010:15f, Turvey 2006:1458, Valeri 2009:4679ff.

[5] See section 2.2.

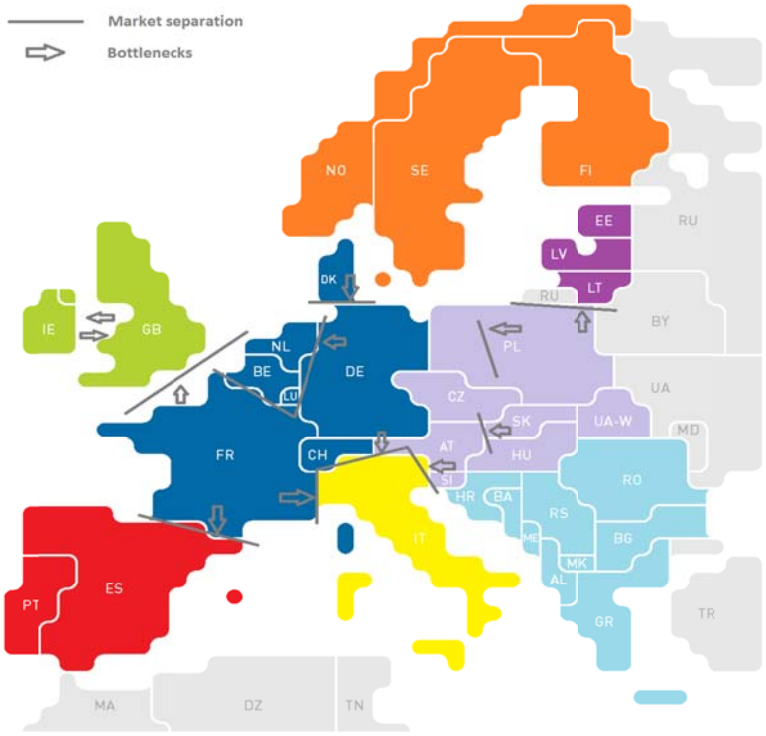
[6] See Borenstein et al. (2000) and Léautier (2001) for an analytical treatment of this point as well as Küpper et al. (2009) for some practical evidence from the Belgian electricity market.

[7] Yet, interconnection can also produce new types of "transnational infrastructure vulnerability". The "European black-out" of 04/11/2006 has shown the possibility of a "cascading failure": An incident on a line in North-Western Germany affected over 20 countries; electricity supply was selectively cut to some 15 million households from Denmark to Morocco (Van der Vleuten & Lagendijk 2010).

  - o Optimal generation sites for renewable energy need to be linked to major load centers. Interconnection also allows exploiting the complementarities of wind (peak by night and in winter) and solar power (peak by day and in summer).
- More efficient system operation and dispatch
  - o Reduction of unserved energy
  - o Reduction of reserve needs via pooling
  - o Reduction of X-inefficiencies and managerial slack due to competitive pressure

Still, interconnection levels in Europe are low (EC 2008a:5). As shown in figure 1, Europe is currently divided in eight sub-markets which are insufficiently interconnected to fully exploit existing price differentials by arbitrage.

Figure 1: Electricity sub-markets in Europe



Source: Illustration by Kapff/Pelkmans based on EC 2007:16ff; EC 2008a:6ff; Haas et al. 2008:30ff; UCTE 2008:49

Most notable is the "insulation" of the Baltic States, the Iberian Peninsula and Italy. But even inside sub-markets bottlenecks impede cross-border electricity flows and price convergence. Further electricity market "integration is hampered by insufficient interconnector capacity and a lack of adequate incentives to invest in additional capacity to eliminate long-established bottlenecks." An inefficient use of existing capacities often aggravates the problem (EC 2007a:8).

The need for action has been acknowledged by the heads of EU governments at the 2002 Barcelona Council. A target level of electricity interconnections equivalent to at least 10% of installed production capacity was set for all MS (European Council 2002:15).

2.2. The economics of electricity interconnectors

To understand why liberalized markets do not deliver sufficient cross-border transmission infrastructure even though arbitrage opportunities exist, it is useful to have a closer look at the economics of electricity interconnectors. In a first step, welfare effects of interconnection are analyzed using a simple two-country model. A case study of the Franco-German interconnection (in Box 1) is added as a practical example, illustrating this economic analysis. In a second step, the incentives for (merchant) transmission investment are contrasted with the major barriers to investment.

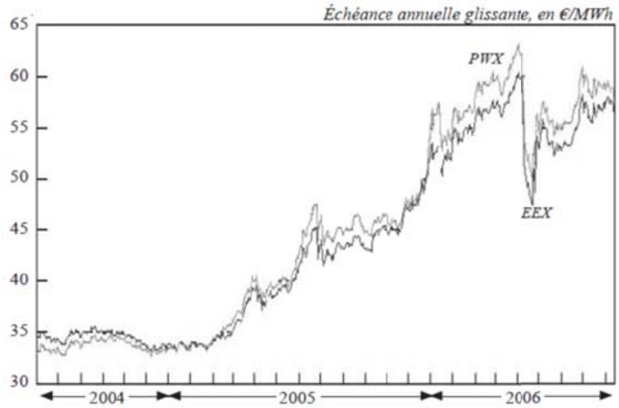
Box 1: The Franco-German market integration: Welfare effects of a good interconnection

The French and German electricity markets are characterized by very different patterns:

- France's energy mix is heavily focused on nuclear (77.2%) and hydro (11.2%), whereas Germany mainly relies on coal (48.7%), nuclear (22.1%) and gas (11.4%) for electricity production.[8]
- The French market is dominated by the state-owned incumbent EDF (85.2% of market share[9]), whereas the German market is divided into a three-tier structure led by four large utilities (EnBW, E.ON, RWE, Vattenfall) with regional market power.[10] In 2000, EDF took control of EnBW which operates the Franco-German interconnectors together with RWE and RTE.
- The single French Transmission System Operator RTE is owned by EDF, but legally unbundled according to the minimum provisions of Directive 2003/54/EC. Germany has four legally unbundled TSOs controlled by the top-tier utilities. In 2010, E.ON sold its transmission network to the Dutch TSO TenneT.

Both countries benefit from a relatively high interconnection capacity: 3,050 MW from Germany to France and 2,800 MW in the other direction.[11] Capacities are allocated via explicit auctioning [12] since 2005. The congestion revenues (EUR 160.8 million in 2008) are equally shared between both countries (Bundesnetzagentur 2007:6, 2009:28). As depicted in figure 4, the high level of interconnection has led to a strong convergence of electricity spot prices.

Figure 2: Electricity spot prices in France (PWX) and Germany (EEX)



Source: Chevalier & Percebois 2008:28

Interestingly, this price convergence has caused discontent in French politics. In fact, since the French power exchange Powernext has been created in 2001, French prices closely follow the substantially higher German ones. From a French point of view, France can thus no longer take advantage of its "highly competitive electricity production capacities […] based on cost-effective standardized environmental-friendly nuclear power plants" (Champsaur 2009:5f) and "has to pay for the sub-optimal German energy mix" (Chevalier et al. 2008:136). Because of the strong interconnection of France and Germany, the price formation works like on a

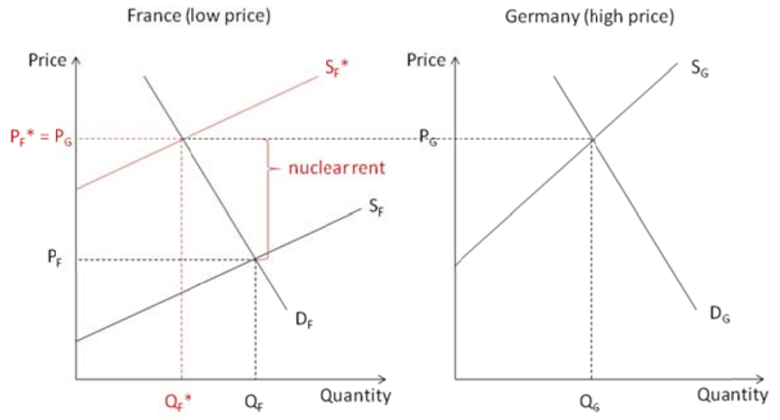
[8] 2007 data from the International Energy Agency (IEA), see [http://www.iea.org].
[9] 2009 data from EDF, see "Management Report 2010" on [http://www.edf.com].
[10] For a detailed description cf. Von Danwitz (2006:426ff) and Schulze (2006:190ff).
[11] Net transfer capacity data (Winter 2009/2010) from ENTSO-E, see [http://www.entsoe.eu].
[12] Readers not familiar with implicit and explicit auctioning in electricity congestion management for interconnectors see EC 2007a:180 and Zachmann 2008:1667f.

single market: The variable costs of the marginal power plant that is needed to satisfy the common electricity demand determines the market price.

In peak load times (⅔ of the time in this case) this marginal power plant is a rather expensive German gas-fired power station. Only in base load times (⅓ of the time) French nuclear power plants determine the common market price. Yet, even in base load times more expensive German coal-fired plants might be price setters. Thus, most of the time French consumers now have to pay substantially higher prices (P_F*=P_G in figure 5) than prior to market liberalization and open cross-border trade, when regulated tariffs at the cost level of nuclear power plants were applied (P_F). French consumers would in fact benefit from less interconnection because in isolation the French prices would reflect local production costs. Besides, this situation enables the French utility EDF to earn a substantial "nuclear rent" selling its low-cost energy at high market prices.

In sum, market liberalization and the use of interconnectors for electricity trade has messed up France's national energy strategy. The large-scale nuclear program initiated in the 1970s was tailored for national needs and aimed at low electricity prices and independence from volatile fossil fuel markets.

Figure 3: Impact of an interconnection (without congestion): Case of France-Germany



Source: Adapted from Chevalier & Percebois 2008:90

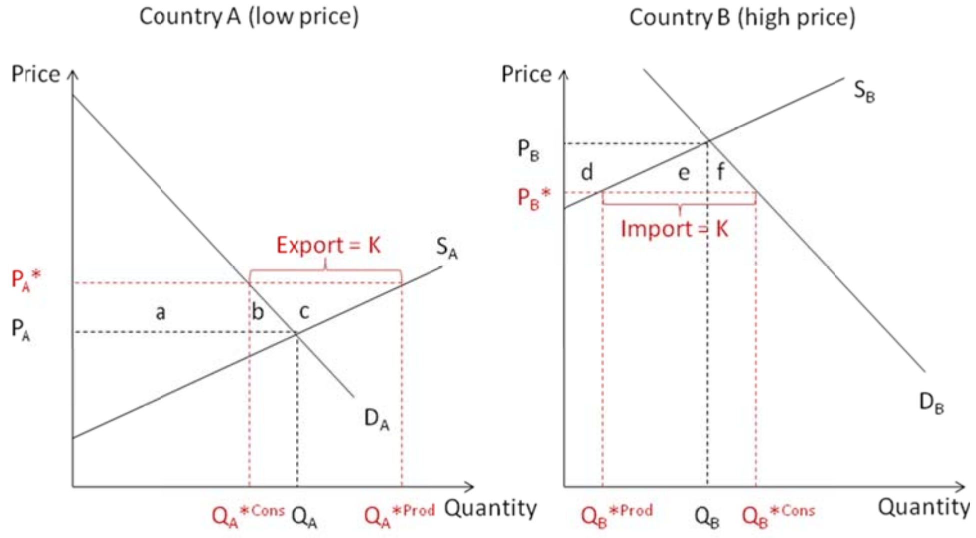
Yet, cross-border trade has created a new dependence on gas prices even though local production hardly relies on this energy source. Moreover, if EDF's "nuclear rents" persist, public support of nuclear energy might fade away (Champsaur 2009:5).

This case study suggests that the effects of interconnection in liberalized markets are highly complex. There are winners (German consumers in base load times, EDF) and losers (French consumers, German producers in base load times) causing some (political) opposition to further interconnection and liberalization. In this case, ownership structures add further complexity: EDF controls the (legally unbundled) TSOs on both sides of the border (RTE, EnBW Transportnetze) and *de facto* decides whether the interconnectors are upgraded to solve the "problem" of rising congestion. Still, the French State controlling 84.5% of EDF's capital is certainly not deprived of some discretionary power on the issue.

2.2.1. *Welfare effects of cross-border transmission capacity*

To illustrate welfare effects of interconnection, we use the simple long-run static one-period theoretical model represented in figure 2 assuming fully competitive behavior. In this two-node world, countries A and B are self-sufficient at P_AQ_A and P_BQ_B respectively. Country A's energy supply is more efficient than country B's, thus $P_A < P_B$.

Figure 4: Welfare effects of interconnection



Source: Adapted from Turvey 2006:1459

Now the two countries are interconnected with a transmission line of capacity K. The amount K of electricity is exported from low-price country A to high-price country B. This arbitrage leads to some price convergence: The price in A increases to P_A*, the price in B decreases to P_B*. At these new price levels, A consumes Q_A*^{Cons} and produces Q_A*^{Prod}, whereas B consumes Q_B*^{Cons} and produces Q_B*^{Prod}. In this example, the amount of electricity traded is limited by the capacity of the interconnector. If there were no capacity constraint, trade would continue up to the point of perfect price convergence where no arbitrage opportunity exists.

Electricity trade via the interconnector has an impact on welfare in both countries: In low-price country A, the price increase leads to a loss of consumer surplus of a+b. The producer surplus rises by a+b+c, where a+b is redistributed from consumers and c is a net welfare gain for country A due to electricity exports. In high-price country B, the price reduction increases consumer surplus by d+e+f and reduces producer surplus by d. This results in a net welfare gain of e+f for country B. The analysis shows that in social welfare terms interconnection is very beneficial even if a capacity constraint does not allow for full price convergence. However, there is some redistribution from consumers to producers and vice versa. As will be discussed below, this is one of the reasons why further interconnection might be opposed.

In addition to the welfare gains, the owners of the rights to use the interconnector earn a congestion revenue of $(P_B* - P_A*)*K$.[13] Note that this static analysis does not take into account further net benefits once the interconnection would reduce market power of generators in importing country B. Additional benefits might also be expected from greater security of supply and more efficient system operation.

The analysis can be expanded to a three-country model where electricity flows from low-price country A to high-price country B via a medium-price transit country X. This electricity flow will only be possible in case of transmission infrastructure investment in country X.

[13] This point will be further developed in subsection 2.2.2.

Figure 5: Stylized example of interconnector flows in a three-country model

Source: Adapted from Frontier Economics & Consentec 2008:14

The price and welfare effects of interconnection in countries A and B remain the same as in the two-country model. In transit country X, prices do not change when assuming that net inflows from country A are offset by equivalent net outflows to country B. The cost of the transmission investment in X will – in case of a regulated investment[14] – most likely to be borne by the grid users in X. Thus, country X will incur the additional costs of the infrastructure in its transmission charges, even though it does not benefit from the investment. On the other hand, countries A and B reap the benefits of the new infrastructure, but incur no additional costs.

If the "investment is beneficial from an overall perspective, [i.e.] the generation costs of meeting demand in [all] three countries are reduced by a greater amount than the costs of the new transmission infrastructure (over its lifetime)", it should be realized. Yet, "from the perspective of [country X] alone this investment is welfare reducing" (Frontier Economics et al. 2008:15).

Note that inter Transmission System Operator (TSO) compensation mechanisms and congestion rents are ignored in this model. Frontier Economics et al. (2008:14ff) show that TSO and congestion rents are in most cases insufficient to solve the investment incentive issue in Figure 3.

This stylized "example demonstrates that the incentives of individual [Member States] might not be aligned with overall welfare improvement when considered from a wider regional [or EU] perspective." Frequently, the misalignment of costs and benefits distorts the incentives for welfare increasing interconnector investment (Frontier Economics et al. 2008:15f).

2.2.2. Investment incentives

Why should economic agents decide to invest in cross-border transmission capacity? The following economic analysis will highlight merchant (i.e. private) investment incentives concerning interconnectors and identify a market failure that requires regulatory intervention.

A merchant investor might decide to invest in an interconnector if the project yields a positive net present value. The appropriate discount rate will depend on the weighted average cost of capital (WACC) of the investor, possibly adjusted for the project-specific level of risk.[15] To determine the cash-flows, the (estimated) costs of building and operating the interconnector are compared to the (estimated) *private* benefits, i.e. either the difference between prices at either end of the interconnector multiplied by the flow (congestion rent) or a regulated usage tariff multiplied by the flow. The following analysis will concentrate on non-regulated revenues.

Figure 6 shows the private and social benefits of an interconnection between low-price country A and high-price country B assuming perfect competition in generation and supply. Based on the aggregated supply and demand curves the import and export price dependency curves (PDC) – also known as excess curves – for both countries can be constructed. Because import for country A corresponds to export for country B the curves can be plotted in one figure.

If there were no transmission capacity constraint, the amount K_2 would be imported leading to perfect price convergence to P_2 in both countries. If the available transmission capacity is K_1, the

[14] The transmission sector is a regulated activity in the EU. Investment costs are recovered from revenues of regulated transmission tariffs. Merchant investments are possible, but rare (Knops et al. 2007:293).

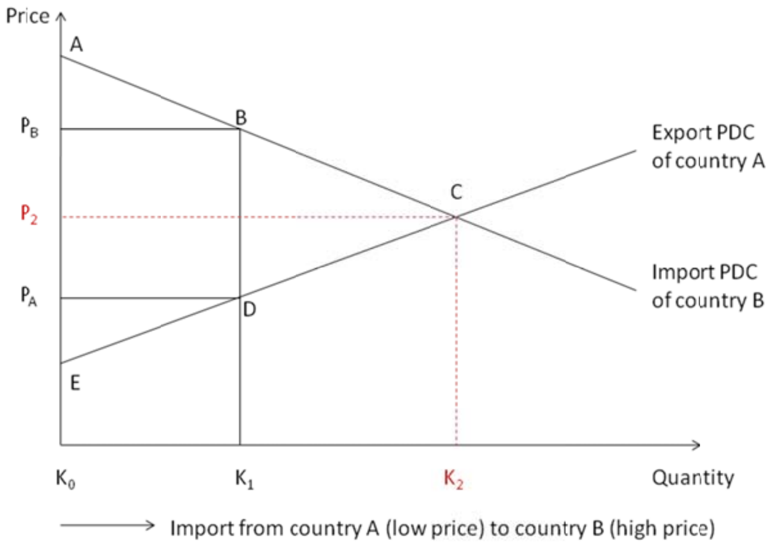
[15] See Knops & De Jong (2007:307ff) for a discussion of risk-adapted WACCs for interconnector projects.

price is P_A in country A and P_B in country B. In that situation, the triangle BCD represents the congestion cost, i.e. the deadweight loss caused by insufficient transmission capacity. The square P_BBP_AD corresponds to the congestion rent, i.e. the marginal price of congestion ($P_B - P_A$) multiplied by the available interconnection capacity K_1.

In the situation where no transmission capacity is available, the societal loss due to the missing link corresponds to the triangle ACE. A merchant investor considering the construction of an interconnector with the capacity K_1 would compare the costs of the project to the *private* benefits, i.e. the congestion rent P_BBP_AD. However, from a *social* perspective the value of the new interconnector consists of the reduction of the congestion costs ABDE. In addition, other elements discussed above such as security of supply or dilution of market power may contribute to the social value of the new interconnector. As a result, the interconnector investment leads to a positive externality. The merchant investor cannot reap the full benefits of his investment decision. Typically, positive externalities lead to underinvestment as compared to the socially optimal level.

Indeed, the socially optimal transmission capacity is K_2 where no congestion costs occur.[16] However, in that situation private benefits – corresponding to the congestion rent – would also be zero, i.e. the merchant investor would have no revenues. The privately optimal transmission capacity – which is necessarily smaller than the socially optimal one – corresponds to the point where the marginal costs of the project equal the marginal price of congestion. As a merchant investor must recoup its costs from exploitation of the trade potential across the interconnector, he has a considerable interest to keep markets at both sides "disintegrated", in order to maintain an exploitable price differential (Knops et al. 2007:307).

Figure 6: Private and social revenues of interconnection capacities



Source: Adapted from Joskow & Tirole 2005:240; Knops & De Jong 2007:306

In sum, "the market" will not deliver sufficient interconnector investment because of positive externalities – a problem that might be solved by appropriate regulation. The proper regulatory approach to merchant transmission investment will be discussed in section 3.2, the EU regulatory regime in section 4.1.3.

16 K_2 is the socially optimal transmission capacity when ignoring the costs of the interconnector. Otherwise, it corresponds to the crossing point of the marginal (social) cost curve and the curve of the marginal social value of congestion, i.e. the curve representing the marginal value of a reduction of congestion costs by one additional unit of interconnection capacity.

2.2.3. Barriers to investment

Some barriers to sufficient interconnector investment have already been mentioned:

- New interconnection capacity – even though socially beneficial – creates winners and losers. If losers are not compensated, they will oppose the investment.
- The "incentives of individual countries might not be aligned with overall welfare improvement when considered from a wider regional [or EU] perspective" (Frontier Economics et al. 2008:15). As the analysis based on Figure 3 suggests, infrastructure investment may be necessary in a Member State that would not benefit from the new interconnector.
- Merchant transmission investment leads to positive externalities and therefore to underinvestment as compared to the social optimum.

Yet, a substantial number of additional barriers impede interconnector investment:

- Investment incentives within an integrated [that is, not unbundled] vertical electricity company are likely to be distorted. A vertically integrated company has "no incentive to develop the network in the overall interest of the market with the consequence of facilitating new entry at generation or supply levels (EC 2007c:32)." This is particularly true for interconnection capacity facilitating more competition in the incumbent's home market. "Instead, the investment decisions of vertically integrated utilities tend to be biased to the needs of their supply affiliates" (EC 2007c:32; see also Léautier 2001:47).
    - This incentive issue can be addressed by sufficiently strong unbundling of transmission operations from the rest of the value chain. [17]
- As has been adumbrated in the case study of the Franco-German interconnection, a vertically integrated company that controls TSOs on both sides of the border has some discretionary power on the degree of market integration and can decide from a strategic *company* perspective whether to invest in interconnection or not.
- On the other hand, also non-affiliated TSOs "have often tended to behave more as competitors than as partners with mutual interests" (EC 2008a:10).
- Planning and authorization procedures for new interconnectors are complicated, time-consuming and costly. When two or more Member States are concerned by a project, lack of harmonized procedures often lead to excessive delays. But delays can also be caused by local opposition often based on the rejection of the environmental, health or visual impact of the project (EC 2007a:179, EC 2007b:7ff). Building a new interconnection may in some cases take more than a decade, whereas it takes two or three years to construct a wind farm or a combined-cycle gas turbine (EC 2008a:23). In view of these problems, generation investment – at least in traditional technologies – might appear as an attractive substitute to interconnector investment.
- Interconnector investments are highly risky and complex ventures:
    - In successfully liberalized markets, grid and generation investments are decoupled due to unbundling. Grid investments thus face uncertain generation decisions (Meeus et al. 2006:591f), i.e. an uncertainty on the actual use of the infrastructure. In the worst case, an interconnector can become a stranded asset.
    - Cross-border projects are subject to high regulatory uncertainty over time. Changing regulatory frameworks, the introduction of new congestion management mechanisms or the review of regulated tariffs might significantly alter the return on investment.
    - Investors also face uncertainty concerning possibly changing market architectures and energy mixes of the interconnected markets as well as volatile

[17] Legal unbundling has proven to be insufficient to address this issue (EC 2007a). The EC and ERGEG advocate for ownership unbundling as the most efficient form of separation (EC 2007c, ERGEG 2007). A detailed assessment of the unbundling issue goes beyond the scope of this paper. See e.g. Pollitt (2008) as well as EC (2007c) for a detailed discussion.

fuel and carbon prices – all influencing the price differential, i.e. the source of revenue.
    - The possibility of a later parallel [regulated] interconnector is an additional risk for a merchant interconnector (Knops et al. 2007:301).[18]
- Finally, potential interconnector investors are further discouraged by the existence of a "regulatory gap", due to the fact that each regulator only has authority within its national market (ERGEG 2007:15) and no authority decides on cross-border and regional issues.
    - There is no supra-national authority responsible for the cost allocation of cross-border projects, for example deciding on a compensation for transit country X investing in transmission infrastructure solely beneficial for countries A and B.
    - Investors face an important risk of project failure when the concerned national regulatory authorities (NRAs) are unable to agree on key regulatory provisions for a cross-border project and no supra-national authority settles the conflict.
    - Moreover, the European dimension of investment projects is often neglected by the investing parties as well as the concerned NRAs. A lack of supra-national network planning may impede the identification and priority of the most beneficial interconnector investments.

2.3. Congestion management: A solution?

Some authors – pointing at the inefficient use of existing interconnection capacities – argue that efforts should be concentrated on the optimization of congestion management mechanisms rather than on building new interconnectors (Nies 2010:11). Indeed, the EC energy sector inquiry shows that non-market-based allocation methods as well as explicit auctions do not lead to an optimal use of scarce interconnector capacity (EC 2007a:180ff). Empirical research further suggests that explicit auctions are significant barriers to efficient cross-border trade (Zachmann 2008:1667) allowing for anti-competitive behavior such as capacity withholding or inefficient arbitrage by dominant generators, i.e. trading from a high to a low price area to sustain market power (Bunn et al. 2010:243ff). Most authors therefore advocate implicit auctioning mechanisms facilitating an optimal use of existing capacities and a high degree of market integration.[19]

Nevertheless, implicit auctioning is not a panacea for all the shortcomings of interconnectors. Even though it helps to make optimal use of existent facilities, it does not solve the root problem of interconnector underinvestment and mismatched investment incentives (Frontier Economics et al. 2008:2). Moreover, congestion management is of no use when urgently needed infrastructure simply does not exist. A genuine EU internal market for electricity requires both: efficient congestion management *and* sufficient interconnector investment.

2.4. Conclusion: The interconnector investment failure

"One of the reasons that a single 'internal' EU market for electricity has not been accomplished yet, is that many interconnectors are chronically congested or that they simply do not exist" (Knops et al. 2007:317). The economic analysis above has identified numerous barriers to sufficient interconnector investment in the EU. These will be referred to as "interconnector investment failure" hereafter.[20]

When addressing this interconnector investment failure with a view to create a properly functioning internal electricity market, a well-designed incentive-compatible regulatory framework is urgently needed. The following section will attempt to derive such a framework.

[18] Littlechild (2004) discusses the example of the two parallel interconnectors Murraylink (merchant) and SNI (regulated) in Australia.
[19] For an empirical study of successful market coupling with implicit auctioning, see Küpper et al. (2009) for the trilateral market coupling of France, Belgium and the Netherlands.
[20] Some issues at stake are clearly a "regulatory failure" rather than a "market failure", hence, our term "interconnector investment failure".

3. An EU regulatory framework for a properly working internal market

This section reflects on the appropriate design of an EU regulatory framework able to overcome the interconnector investment failure. We shall first discuss the use of congestion rents and regulatory issues of merchant and regulated transmission investment.

Subsequently, the optimal allocation of regulatory powers (between the EU and national levels) for network planning and interconnector cost allocation is derived from a functional subsidiarity test. Finally, different incentive models for regulated TSOs are compared.

As pointed out above, sufficiently strong unbundling of transmission operations from the rest of the value chain – preferably ownership unbundling – is crucial to avoid distorted (investment) incentives. As noted before, a detailed assessment of this issue goes beyond the scope of this paper.

3.1. Use of congestion rents

As seen in section 2.2.2, congestion rents constitute the sole source of income for unregulated merchant transmission investors. However, most interconnectors in Europe are regulated operations.

In case of a regulated interconnector, the investors recover their costs via revenues from usage fees determined by the NRAs. Thus, the investors' income does not depend on the amount of congestion that occurs, but only on the flows going through the interconnector. However, when congestion occurs and market-based allocation mechanisms are used, a congestion charge is paid by the market parties. This congestion rent – collected by the regulated transmission investors – does not constitute a source of extra profit. In fact, the congestion rents have to be put into a separate fund and used for one or more of the purposes defined by art. 6 Regulation 1228/2003[21]: (1) guaranteeing the actual availability of the allocated capacity; (2) network investments maintaining or increasing interconnection capacities; and/or (3) 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.

In 2007, ETSO-members reported congestion rents totaling to € 1.7 billion (EC 2009a:3).[22] As depicted in table 1, only 16.2% of these rents were used to upgrade interconnection capacities (option 2). Most TSOs, particularly those owned by vertically integrated utilities (EC 2007c:34), decided to redistribute the lion's share of the collected rents in form of reduced network usage charges (option 3).

Table 1: Use of congestion rents on interconnections by ETSO-members in 2007

	Use of congestion rents		
Total congestion rents on interconnections	*Option 1:* Guaranteeing the actual availability of the allocated capacity	*Option 2:* Interconnector investment	*Option 3:* Tariff reduction
€ 1,668.5 M	€ 11.0 M	€ 270.6 M	€ 1,386.9 M
100.0%	0.7%	16.2%	83.1%

Source: Calculations by the Kapff/Pelkmans based on data from EC DG Energy [http://ec.europa.eu/energy/gas_electricity/]

[21] The provisions of Regulation 714/2009 entering into force on 03/03/2011 are discussed in section 4.1.1.
[22] Detailed data for each interconnection and TSO as well as on the use of the congestion rents is available on the EC DG Energy website [http://ec.europa.eu/energy/gas_electricity/].

In the short-run, redistribution is beneficial for market parties because it reduces their congestion costs by P_BBP_AD (in figure 6 assuming an interconnector capacity of K_1). Yet, the social welfare effect of this solution is nil; the societal loss due to congestion is still BCD. The only way to increase the social welfare is to invest in interconnector capacity.

Pushing the capacity limit to the right reduces – in the long-run, once the new capacity has become operational – the deadweight loss BCD. However, there is a theoretical point of optimal congestion, where the cost of remedying (i.e. the cost of investment) exactly offsets the benefit (i.e. the reduced social cost of congestion). Interconnector investment beyond this point destroys social welfare.

Leaving the options on the use of congestion rents open is causing underinvestment (Meeus et al. 2005a:31f). Existence of congestion and congestion rents is a clear signal that the market requires increased interconnection capacity (ERGEG 2007:26). Nonetheless, most TSOs do not respond to this market request. One reason is that insufficiently unbundled TSOs prefer redistributing congestion rents rather than investing in infrastructure that would penalize their generation and supply affiliates with increased import competition. Another reason might be that NRAs favour immediate results – reduced network usage tariffs – over (uncertain) long-run welfare gains and therefore do not sufficiently insist on interconnector investment.

To overcome this unsatisfactory situation, one could imagine the following solution: TSOs would be obliged to channel congestion rents into interconnector investment. In other words, option 3 of Table 1 would be abandoned. To avoid overinvestment beyond the point of optimal congestion, a cost-benefit-analysis would be applied by the NRAs concerned. In case the relevant NRAs disagree on the outcome of this analysis, a supra-national European agency would take the final decision. If TSOs do not come up with appropriate projects within a reasonable time period, the congestion rents would be transferred to a European fund. All European TSOs would have the right to apply for these funds to finance interconnector projects. The European agency would then choose the eligible projects based upon transparent criteria favouring projects of "European interest". For reasons of equity and political acceptance, TSOs having substantially contributed to the fund over years and which do come up with an adequate project would be favoured over non-contributing TSOs.

3.2. Merchant vs. regulated transmission investment

Due to its natural monopoly characteristics, the transmission sector is a regulated activity in the EU: most transmission investments, including interconnectors, are recovered from revenues of regulated transmission tariffs. Nonetheless, the EU also provides a special legal regime for merchant interconnector investments allowing for exemptions from regulated third party access (rTPA), regulated tariffs and the provisions on the use of congestion rents.[23] To date, three interconnectors have received exemptions: the BritNed interconnector between the Netherlands and Britain, Estlink between Finland and Estonia, and the East-West interconnector between Ireland and Britain (EC 2009a:5).

A debate lingers among economists about whether merchant transmission investment – obviously leading to suboptimal results[24] – is an acceptable response to the insufficient level of interconnector investment. The backdrop of this debate about second-best options is that the alternative – regulated interconnector investment – has so far failed to deliver satisfactory results. This prompts us to pose the following four questions:

(a) How can TSOs be incentivized to provide sufficient regulated interconnector investment?

[23] See art. 7 Regulation 1228/2003. The new provisions of art. 17 Regulation 714/2009 entering into force on 03/03/2011 are discussed in detail in section 4.1.3.
[24] See section 2.2.2.

Directive 2003/54/EC obliges TSOs to invest to ensure the long-term ability of the system to meet reasonable transmission demands.[25] Congestion on interconnectors is a clear market signal indicating unsatisfied transmission demand. In the regulatory regime, a TSO considering an (interconnector) investment would be required to apply for regulatory approval with regard to its investment plan in order to include this investment in the costs upon which the regulated tariff is based (Knops et al. 2007:295). The investment costs would then be recovered from the revenues of the adjusted regulatory tariff.

However, the mere obligation to invest – which is by the way difficult to put in practice, particularly for cross-border investments – does not provide any incentive for TSOs to adequately invest, notably if they are insufficiently unbundled. Therefore, NRAs have to provide tariff incentives and appropriate economic signals to encourage such investments (EC 2009b:4). NRAs are free to decide on the design of their incentive schemes. The most common mechanisms will be presented in section 3.4.

(b) Should one allow for merchant transmission investment?

Merchant transmission investment is of course nothing else than the working of market forces convinced of sufficient return on investment. Therefore, if such market players can help improve the interconnectivity of electricity markets, it should be considered subject to a societal cost/benefit analysis. We provide five specific arguments in favour and four against.

First, insufficiently unbundled TSOs have little incentive to invest in interconnectors, harming their generation and supply affiliates. Merchant investment could fill this gap. Second, "regulatory uncertainty impedes investment by regulated private [TSOs]." In fact, "a regulator cannot credibly commit to 'allow high profits' if ex-post the state of the world turns out to be good, but will happily allow the company to suffer any losses. Hence, given uncertainty, the ex-ante expected rate of return will be lowered, depressing investment." A solution might be to allow for "regulatory holidays" for a pre-determined number of years "opening the option of merchant investment" (Brunekreeft et al. 2005:86). Third, "owners of the existing transmission networks may be unenterprising and fail to seize productive opportunities" (Turvey 2006:1459) – a situation that can be solved by allowing profit-seeking merchant investors to respond to market signals. Fourth, in a situation where a new interconnector would connect a high-price and a low-price country, the authorities of the low-price market might be reluctant to agree (even if the overall welfare effect is positive) since the market price in their country would increase. Merchant investment, if approved by a supra-national entity, would overcome this regulatory failure.[26] Finally, there may be insufficient political support to raise regulated tariffs to finance an interconnector project and a merchant initiative may yet result in transmission capacity expansion (Knops et al. 2007:296f).

Nonetheless, merchant transmission investment is far from being a panacea due to a number of inherent inefficiencies. First, as discussed in section 2.2.2, the profit-maximizing interconnection capacity is smaller than the social optimum.

Positive externalities will necessarily lead to investment in sub-optimal capacities. Second, once the merchant interconnector has been built, it might be used in a strategic profit-maximizing way rather than at its maximum capacity. If the interconnector has, at a certain moment of time, "sufficient capacity to reduce the price [differential] to zero, its owners would not gain from using it in this way. Instead, ignoring [transmission] losses, they would equate marginal cost at the injection terminal with marginal revenue at the delivery terminal" to maximize their profits (Turvey 2006:1459). Third, a central concern about merchant transmission investment is that in a

[25] See art. 9 Directive 2003/54/EC and art. 12 Directive 2009/72/EC.

[26] It is assumed that the investment has an overall welfare increasing effect. This could, of course, be assessed by the supra-national entity.

European market configuration that is still evolving, it may lock-in the current situation[27] making future regulatory intervention difficult (Brunekreeft et al. 2005:87). Knops et al. (2007:317) also underline that merchant investors "have a considerable interest [in keeping] the markets [on] both sides of the interconnector [separated]" to maximize their revenues. Thus, a "merchant interconnector could […] have the character of a Trojan horse, yielding more interconnection capacity in the [short-run], but proving an obstacle to real market integration in the long-run." Finally, one can imagine a generation company investing in an interconnector as a market barrier. Constructed up to the point of no-entry (Knops et al. 2007:313), the new merchant interconnector would make any parallel interconnector economically unviable and thereby protect the incumbent's generation markets from massive import competition.

In sum, merchant investment yields some interesting opportunities to compensate the weaknesses of regulated investment. However, regulatory intervention to limit its inherent inefficiencies is needed. Pure merchant investment is unlikely to deliver satisfactory results.

(c) How should merchant investments be regulated to deliver the best possible results?

In the current exemption regime based upon art. 7 Regulation 1228/2003, only NRAs can grant full or partial exemptions for merchant interconnectors on a case-by-case basis. If more than one Member State is involved, which is generally the case for interconnectors, NRAs are obliged to cooperate. Moreover, the exemption decision must be notified to the European Commission which may request amendments or withdrawal. It has already been adumbrated that this framework might lead to sub-optimal results. Indeed, the vague formulations of Regulation 1228/2003 and the absence of legally binding Commission guidelines[28] allow for a high degree of discretion by the NRAs. A NRA unwilling to accept higher consumer prices (in case of a low-price country) or stronger import competition (in case of capture by generation companies) is able to block an overall welfare increasing merchant investment. Even the Commission's veto power does not help in such a case. It would therefore make sense to transfer the decisional power on merchant interconnector exemptions to an independent supra-national entity. This entity would ensure that decisions are taken on "European social welfare" grounds and that exemptions are evenly implemented all over Europe, i.e. it would guarantee a level-playing-field.[29]

Another critical regulatory problem is that a merchant investor is unable to extract all the welfare gains accruing from a new interconnector (positive externality) and therefore invests in a socially sub-optimal capacity.

A possible way to mitigate this effect is to organize a tender for the highest capacity. However, in practice it will be difficult to attract a sufficient number of bidders to realize an efficient auction (Knops et al. 2007:313). A formal capacity check by regulatory authorities, as implemented in Australia, has also proven to be deficient (Brunekreeft 2005:177f). An alternative is to negotiate the amount of capacity with the merchant investor. The relevant authorities could consider passing on a certain part of the additional positive welfare effects (inter alia the triangles ABP_B and P_ADE in figure 6) to the merchant investor (Knops et al. 2007:307) in case he agrees on building a larger capacity.

Concerning the use of merchant interconnectors, EU law does not allow for exemptions from use-it-or-lose-it and must-offer provisions[30] and thereby mitigates anti-competitive capacity withholding strategies. It is also important to note that the grant of an exemption under art. 7

[27] Notably, decentralized power exchanges and the postage stamp pricing system might evolve over time. System changes would require stranded-cost bail-outs by the governments (Brunekreeft 2005:179).
[28] The EC has published a "Commission staff working document" on the application of art. 7 Regulation 1228/2003 (EC 2009b) which is not legally binding for NRAs. For a discussion of the legal value of such "soft law" see Petit et al. (2009:196ff).
[29] For a further discussion of the EU exemption regime see section 4.1.3.
[30] See art. 6 (3) and (4) Regulation 1228/2003 as well as art. 16 (3) and (4) Regulation 714/2009.

Regulation 1228/2003 does not rule out the possibility of intervention by the competition authorities in case of an abuse of the dominant position (natural monopoly).

(d) Can merchant and regulated (double track) transmission investment help to overcome the interconnector investment failure?

"It is unlikely that policymakers will be able to rely primarily on a merchant model to govern transmission investment" (Joskow et al. 2005:262). On the other hand, the regulated regime has so far failed to solve the interconnector investment failure. Among other things, insufficient unbundling and inadequate incentive schemes cause TSOs to refrain from investing in cross-border capacities. The real choice therefore frequently lies "between a merchant interconnector of smaller capacity than would ideally be desirable and having no interconnector at all" (Turvey 2006:1459; see also Brunekreeft 2005:178). Allowing for merchant investments enables NRAs to put some pressure on regulated TSOs to deliver. If this does not help, merchant transmission investment is a way to get the most needed infrastructure built in a timely manner (as this maximizes the present value for the investor).

To sum up, it makes sense to rely on both regulated and merchant transmission investment. However, due to its inherent sub-optimality, merchant investment should be considered as a last resort for the realization of projects that would otherwise not be delivered.

Finally, one should underline that – for technical reasons – the merchant model will most likely only be used where the access to infrastructure can be well controlled and managed, i.e. where loop-flows only provide minor disturbances. This is typically the case for (sub-sea) HVDC interconnectors (ERGEG 2007:24), whereas synchronized HVAC interconnectors lack these characteristics.[31]

Box 2: The NorNed cable: An interconnector success story

The NorNed cable linking the Netherlands and Norway with a capacity of 700 MW is operational since May 2008. With a length of 580 km it is the longest sub-sea HVDC cable on earth. NorNed is a cooperation of the Dutch TSO TenneT and its Norwegian homologue Statnett.

Beyond security of supply considerations, the rationale of NorNed lays in the astonishing complementarities of Dutch and Norwegian electricity markets. Whereas Norway's energy mix is dominated by hydro (98.2%), the Netherlands rely mainly on gas (57.2%) and coal (27.6%) for electricity production.[32] Hydro-power systems are flexible, i.e. production can inexpensively be adapted to changing demand. On the other hand, thermal systems provide stable base load energy, whilst adjustments are relatively expensive. The demand in both countries has also opposite characteristics: it is relatively stable in Norway and volatile in the Netherlands (Hammer 2007:286f, Statnett et al. 2008:7). The link between both countries allows Norway to export its cheaper hydro-power during peak hours to the Netherlands. During the night, Dutch thermal energy is sold to Norway where it is used to reduce local production and to pump water back into storage lakes. The Dutch thermal power plants can thereby constantly be operated at optimal capacity. Norway on its part benefits from highly profitable electricity trade.[33]

The NorNed project started as a merchant initiative in 1994 when Statkraft, a Norwegian group of producers, and NEA, a Dutch group of producers, signed an agreement for exclusive trade on the planned interconnector. With the rTPA provisions of the second energy package of 2003, the companies' agreement could no longer be maintained and the deal was terminated. Yet, Statnett

[31] High-voltage direct current (HVDC) lines allow for the controlled transport of bulk power from point-to-point over long distances with relatively low losses. The advantage of high-voltage alternating current (HVAC) lines is their ability to self-adjust in case of (minor) disturbances. Yet, a control of the electricity flows is not possible and the losses on long distances are relatively high. See e.g. Nies (2010:24ff) for a further comparison of both systems.

[32] 2007 data from the IEA, see [http://www.iea.org].

[33] Note that a similar pattern exists between Switzerland (hydro-power and pump-storage facilities) and France (nuclear base load energy).

and TenneT reinitiated the project and adapted it to the new legislation. End of 2004, the Dutch and Norwegian authorities gave the green light for the regulated interconnector investment which is now subject to the general rTPA rules (Knops et al. 2007:301f, Hammer 2007:286ff). Initially, the cable was planned with a capacity of 600 MW, but the socio-economic cost-benefit-analysis by the Dutch regulator DTe predicted a negative net present value at this capacity. It was therefore augmented to 700 MW (Van der Lippe et al. 2007:270ff).
The project costs of EUR 600 million were equally shared between both TSOs. For financing, the Dutch side relied on a EUR 140 million loan from the European Investment Bank (EIB) (TenneT 2007) and congestion revenues (option 2 of art. 6 Regulation 1228/2003) released by DTe (Meeus et al. 2005:6). Moreover, as “project of common interest” NorNed obtained a TEN-E funding of EUR 3 million.[34] The interconnector’s capacity is currently allocated by explicit day-ahead auctions. The gate-closure times of the relevant power exchanges will be harmonized in order to implement a market coupling scheme in the near future (Statnett et al. 2008:8ff). Regulated usage fees and congestion rents yielded a revenue of EUR 70 million in the first four months of operation (TenneT 2008). These high revenues are certainly encouraging for the investors, but also point to a socially sub-optimal capacity.

The case of NorNed (see Box 2) shows that a project which is highly beneficial for both parties is relatively easy to implement. Yet, this is not the case for all projects. Therefore, the issue of supranational interconnector cost allocation will be discussed in the next section.

3.3. Supra-national network planning and interconnector cost allocation

A key question of electricity market liberalization concerns the degree of centralization that is needed to achieve a properly functioning internal market. The current approach – mainly relying on NRAs and very few centralized decisional powers at EU-level[35] – has so far failed to deliver market integration. Indeed, national ministries, competition authorities and regulatory agencies frequently act without taking into account the common European interest. Notably, some Member States grant their “national champions” disproportionate advantages in the name of security of supply objectives (EC 2007c:15). Besides, a “regulatory gap” hampers interconnector investment and further market integration. Actually, NRAs have competences within their countries, but cross-border issues cooperation among them is mostly inefficient (EC 2010b:2).

This section reflects on two regulatory issues having a cross-border and European dimension: network planning and interconnector cost allocation. Network planning by TSOs is often exclusively based on national needs and takes into account – at best – the impact on direct neighbours. This neglect of the European dimension has led up to a situation where congestion on interconnectors hampers cross-border trade and market integration (ERGEG 2009:8). As to cost allocation, the problem has already been sketched in section 2.2.1: there is no (supra-national) entity deciding on a compensation for transit country X investing in transmission infrastructure solely beneficial for countries A and B. Yet, “as long as the cross-border compensation [issue] remains unsettled, it will be difficult to justify interconnector investments, as these become sunk and less relevant to bargaining over the determination of [compensation] payments once made” (Brunekreeft et al. 2005:82).

Both network planning and interconnector cost allocation suffer from an inefficient allocation of regulatory powers. In the EU, regulatory powers should ideally be assigned according to the principle of subsidiarity in areas with concurrent competences between the EU and Member States' levels (art. 5 TFEU). The subsidiarity principle is based on close alignment of policies and

[34] See EC DG Energy website [http://ec.europa.eu/energy/gas_electricity/] for more information. The TEN-E framework will be discussed in section 4.2.
[35] Under the “second energy package”, the EC has for example a veto-right on new infrastructure exemptions and can influence the European electricity market design via competition policy. If a MS does not comply with EU legislation, the EC can open an infringement procedure and refer the MS to the ECJ.

powers with the preference of voters and therefore tends to lead to decentralisation. However, this close alignment may be overridden by compelling considerations of scale (decentralisation may cause policies to be too costly) and/or cross-border externalities (higher degrees of centralisation can internalize) but this has to be carefully verified in a functional subsidiarity test[36]. To determine the optimal level of (de)centralization for network planning and interconnector cost allocation in the EU internal market, the analysis in Box 3 builds on the subsidiarity test proposed by Pelkmans (2006a:36ff, 2006b:57ff). The approach chosen is a functional one putting forward an idealized regulatory framework as a yardstick against which policy should be measured. In short, the test goes through five steps. First, given the TEU treaty, subsidiarity only applies to shared powers and these has to be verified in art. 3 – 6, TFEU. Second, based on the economics underlying art. 5, sub 3 TEU (subsidiarity), a 'need to act in common' has to be established based on economies of scale and/or cross-border intra-EU externalities. Third, **the query whether or not this 'need' can be credibly and durably met by means of inter Member** States' cooperation (that is, without further centralisation) has to be addressed. Fourth, if this is not the case, regulatory powers ought to be assigned to the EU level and, fifth, the costs of this centralisation have to be minimized by a sophisticated application of the principle of proportionality.

Box 3: Functional subsidiarity test for network planning and interconnector cost allocation

Step 1: com-petence?	Shared competence between the EU and the Member States applies to the area of energy according to art. 4 TFEU. *Conclusion:* There are shared competences; the subsidiarity test can be applied.
Step 2: "Need to act in common"?	Negative cross-border externalities: Network "planning is presently made primarily from national perspectives despite the fact that investments in one country often have significant implications for the neighbouring countries" (Moselle 2008:12). In such a situation, interconnectors are built – if any – at sub-optimal locations that maximize national, but not overall European welfare. Countries might use interconnectors as a substitute for generation capacity and thereby shift the burden of generation investment to their neighbors. Insufficient coordination of network planning might lead to situations where congestion is "pushed to the borders" and "exported" to neighbouring countries. Positive cross-border externalities: Many welfare increasing interconnector investments do not take place because (1) their need is not clearly identified due to a lack of coordinated planning and because (2) investing countries are often unable to reap all the benefits of their investment due to inefficient cost allocation mechanisms. Economies of scale: Common network planning might yield some (limited) scale economies. An extreme version of positive externalities is found in public goods. Pan-European security of electricity supply can be seen as an "impure" public good that is not sufficiently provided in absence of common (or centralized) action.[37] *Conclusion:* The presence of strong externalities justifies a "need to act in common".

[36] See Sun & Pelkmans, 1995 ; Pelkmans, 2005 and Pelkmans, 2006b for the development and application of the functional subsidiarity test to several EU policy domains.

[37] See Lieb-Dóczy et al. (2003) for a discussion of the public good characteristics of security of electricity supply.

Step 3: credible co-operation feasible?	Several initiatives of common action – sometimes pushed by the European Commission – have evolved: the European energy regulators' clubs CEER and ERGEG, numerous TSO cooperations such as ETSO, UCTE or Nordel as well as the Electricity Regulatory Forum (Florence Forum) for all electricity stakeholders. These initiatives were able to achieve important – yet slow – progress in (regional) market integration agreeing on issues like market coupling, synchronization or ITC schemes[38]. Yet, precisely with respect to common network planning and interconnector cost allocation, they have failed to deliver – with the notable exception of Nordel. Clearly, where massive expenditures for infrastructure building are at stake, a credible cooperation of Member States, NRAs and TSOs appears not to be feasible. In absence of a supra-national authority, any party would (be tempted to) terminate the cooperation when it sees itself obliged to invest in infrastructure primarily yielding benefits for others or to disburse high compensation payments for other investing parties. The credibility of common action is further challenged by the minimal possibilities to impose collective sanctions in these consensus-based initiatives. *Conclusion:* Common action via inter-Member States cooperation has proven to be insufficient.
Step 4: EU-level?	In view of the results of steps 1 to 3, regulatory powers on network planning and interconnector cost allocation should be assigned to EU-level. Indeed, as Sun & Pelkmans (1995) put it, in the logic of subsidiarity far-reaching liberalization and market integration in network industries require some degree of centralization beyond inter-member States' cooperation.
Step 5: Proporti onality	Any measure at EU-level must be proportional to the desired outcome (art. 5, sub 4 TEU). Where possible, regulatory powers (e.g. for implementation, monitoring, enforcement) should be assigned to the Member State level.

Based on the insight that network planning and interconnector cost allocation require some degree of centralization, one can envisage – while respecting the principle of proportionality – the following regulatory framework (depicted in figure 7)[39]:

A European TSO organization with mandatory membership for all EU TSOs would undertake supra-national network planning based upon national network plans and demand/supply forecasts provided by TSOs and NRAs as well as a public consultation procedure. It would assume a pan-European view towards network planning and identify the most important (interconnector) investment requirements. The organization's major outputs would be a Europe-wide network development plan and cost-benefit-analyses of all recommended bottleneck investments. To avoid negotiation deadlocks, decision-making inside the European TSO organization would follow the principle of qualified majority voting (QMV). It is important to note that, as a rule, supra-national planning would be a complement to, and not a substitute for, individual TSO network planning.

The European network development plan proposal would be reviewed by an independent EU regulatory agency. To fulfill this task, the agency would build on information from the NRAs and

[38] Note that the current ITC scheme (legal basis: art. 3 Regulation 1228/2003 and art. 13 Regulation 714/2009) provides compensation for physical cross-border electricity flows on *existing* infrastructure, but *de facto* does not include any compensation for investment in *new* infrastructure (ERGEG 2007:18f, Meeus et al. 2006:598).

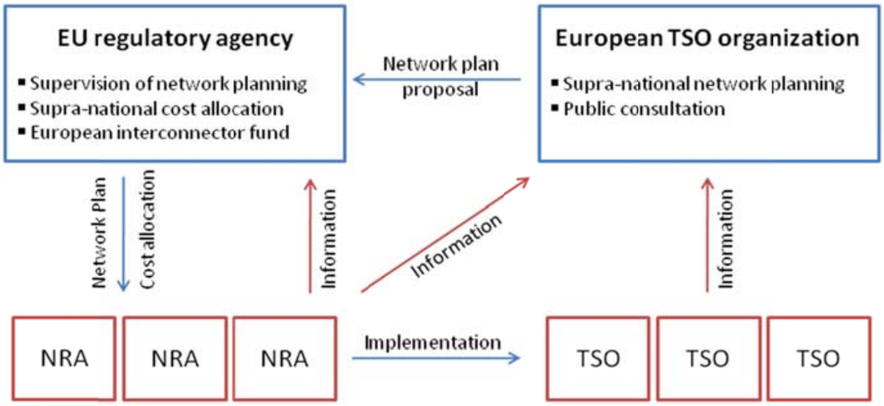
[39] See Frontier Economics et al. (2008:27ff) for a similar proposal.

where necessary on its own public consultations. In addition, it would dispose of far-reaching investigation powers and sufficient technical staff. The agency's primary role would be regulatory rather than technical: it would decide on the priority of projects and when and whether they are implemented. Where the cost-benefit-analysis shows that an interconnector investment would create net losers but would be overall welfare increasing, the agency would decide on an inter-Member States' cost allocation based upon transparent guidelines.

The compensation payments would be settled via a European interconnector fund with Member States' and TSO contributions decided by the agency. This fund could also encompass unused congestion rents and TEN-E funds for electricity interconnectors. Further, the agency would have the right to use parts of the fund to incentivize TSOs to deliver priority projects more rapidly.

In general, NRAs would be in charge of implementing the amended European network development plan and transferring the compensation payments. The whole process would be monitored by the agency. Where TSOs and NRAs would fail to deliver a decided priority project, the agency would have the right to organize a tender open to all interested parties, including merchant investors, and financed by the European interconnector fund.

Figure 7: Framework for supra-national network planning and interconnector cost allocation



Source: Illustration by Kapff/Pelkmans

3.4. Incentivizing regulated TSOs

NRAs have to ensure that TSOs are granted appropriate tariff incentives to foster market integration and security of supply (art. 6 Directive 2005/89/EC, art. 36 (8) Directive 2009/72/EC), i.e. inter alia to invest in sufficient interconnection capacity. In principle, NRAs are free to decide on the design of their incentive schemes. The aim of this section is to present the strengths and weaknesses of the most common incentive mechanisms.

Some authors argue that "a purely national approach to the design of [TSO] incentives risks creating a patchwork of different national schemes with cross-border differences that could create barriers to [market] integration" (Moselle 2008:16). On the other hand, one might argue that NRAs should implement incentive schemes tailored to local specificities and should have the right to innovate. The latter would suggest allowing for diversity through experimentation in the form of beneficial regulatory competition. Best practice might then be promoted in a non-binding way by a European agency. Such experimentation can be favoured because no "perfect solution" to the incentive issue exists; rather the different schemes should be considered in the context of each specific case. In general, regulatory uncertainty or volatility – e.g. due to frequently hanging incentive schemes or "regulatory opportunism"[40] – has adverse effects on long-run investments

[40] In the infrastructure investment context, "regulatory opportunism" refers to a typical "hold-up problem" of specific assets: Once the infrastructure has been built, the regulator might renegotiate or simply breach

(EC 2007b:7, Égert 2009:8). Avoiding this is precisely one important argument for establishing independent regulatory bodies that – contrary to governments subject to elections and lobby pressures – are able to make credible commitments (Stiglitz 1998:8ff).

3.4.1. Market-based incentives

Market-based incentive schemes exploit the "merchant investment incentives" discussed in section 2.2.2. Indeed, regulated TSOs might be granted the right to keep – in addition to the regulated usage fees – a certain portion of the congestion rents a new interconnector generates. This encourages TSOs to invest where heavy congestion occurs and the market demands more interconnection capacity. NRAs might decide to limit this scheme to investments above a certain baseline, i.e. to exclude investments that would take place anyway, e.g. for security reasons. The scheme might also be limited in time.

The major drawback of this scheme is that TSOs – just like merchant investors – have an incentive to underinvest (as compared to the social optimum) in order to maximize their revenues. Moreover, TSOs would have the adverse incentive to minimize the baseline applicable to this scheme (Frontier Economics et al. 2008:41ff).

3.4.2. Rate of return regulation

NRAs might decide to award TSOs a higher than normal regulated rate of return on the capital employed for interconnector investments. If this additional return is only granted when commissioning the new interconnectors, TSOs can be encouraged to deliver in a timely manner. Such a rate of return uplift is justified if the timely delivery of the interconnector generates more benefits than the additional costs of the uplift (Frontier Economics et al. 2008:40f).

The major weakness of this scheme is that it might lead to overinvestment and inefficiencies (Égert 2009:5, Cambini et al. 2010:3). However, NRAs can mitigate the overinvestment effect by selecting the projects eligible to the scheme. Also, the additional return might be linked to some measure of utilization so as to avoid the construction of unneeded infrastructure. Another drawback of this rate of return scheme is that TSOs might get a premium payment for investments they would have undertaken anyway (Frontier Economics et al. 2008:41).

3.4.3. Performance-based incentives

Performance-based incentive schemes are based on the idea that TSOs *can* be entrepreneurial so that it would be better to reduce regulatory intrusion to the minimum. Regulatory "objectives are defined in the most general way leaving all internal decisions, optimization potentials and trade-offs to the TSOs." Ideally, TSOs would be benchmarked against indicators that "cover completely the relevant TSO tasks, use parameters that are quantifiable and available, and rely only on exogenously verifiable parameters that cannot be arbitrarily altered by the TSOs" (Frontier Economics et al. 2008:44). Suitable performance indicators include available interconnection capacity, cross-border flows, reduction of congestion, timely delivery of new infrastructure, and some security of supply measures (Frontier Economics et al. 2008:44f, Knops 2009:107, Van der Lippe et al. 2007:278).

The weakness of this scheme is that, while avoiding regulatory intrusion, it requires intrusive regulatory oversight. Also, care is needed to ensure that targets are not too easy to achieve and that specific targets do not distort TSO behaviour. In the end, the success of this scheme depends on the appropriateness of the chosen indicators and regulatory targets.

---

the "regulatory contract". Such a behavior might yield positive social welfare effects in the short-run, but depresses investment in the long-run. For a detailed discussion of the issue see Lyon et al. (2005).

3.4.4. Investment funding

Interconnector investment incentives provided by Member States can also take the form of direct state subsidies or indirectly e. g. low-interest or interest-free loans, state guarantees, etc. Such selective aid measures granted by Member States will in most cases fulfill the conditions of art. 107 (1) TFEU and qualify as (prohibited) state aid. Aid for "important projects of common European interest" is however compatible with the internal market in accordance with art. 107 (3) littera (b) TFEU. An interconnector project necessary at European level should meet this condition (Bjørnebye 2006:342).[41]

However, it is improbable that Member States will rely on such costly schemes because interconnector investment typically generates positive cross-border externalities – the Member State providing investment funds is generally unable to reap all the benefits the new interconnector creates. Due to this market failure, investment funding is better dealt with at EU-level.[42]

3.5. Conclusion: the regulatory framework for a properly working internal market

The recommendations for a proper regulatory framework designed to overcome the interconnector investment failure can now be enumerated:

- All congestion rents should be channeled into interconnector building. A European fund for unused congestion rents should be established and supervised by a European agency.
- Merchant transmission investment should be encouraged where regulated TSOs fail to deliver sufficient interconnection capacity. A European agency should be responsible for granting all exemptions to merchant investors. Regulation is needed to limit the adverse effects given merchant investment's inherent sub-optimality.
- Supra-national network planning should be undertaken by a European TSO organization taking a pan-European view and deciding by QMV. The European network development plan proposal should be reviewed by an independent EU regulatory agency. The agency ought to decide on the prioritization and implementation of interconnector investment projects. If overall welfare increasing projects yield net losers, the agency should determine a cost reallocation to be implemented via a European interconnector fund. NRAs should be entrusted with the enforcement of the final European network development plan. In case of non-compliance, the agency should have the right to organize a tender in order to build the "missing links".
- The choice of appropriate incentive schemes for regulated TSOs should be left to NRAs. In so doing, local specificities can be accounted for and regulatory competition as well as innovation may generate better results. Which incentive scheme is most suitable will depend on the specificities of each specific case.
- Independence of NRAs should be guaranteed in order to minimize regulatory uncertainty (e.g. due to frequently changing incentive schemes or "regulatory opportunism") for interconnector investors.

4. The EU regulatory framework

The three regulatory stumbling blocks to an interconnected internal electricity market have been identified: improper use of congestion rents, a "regulatory gap" on cross-border issues, and insufficient unbundling. Prompted by the 2005/2006 energy sector inquiry results and grave security of supply concerns, the EU has accelerated the pace of regulatory reform. Notably, the

[41] Alternatively, Member States may choose to escape the assessment of the 'common European' interest of the interconnector investment by structuring state financing in accordance with the *Altmark* criteria (ECJ case C-280/00). See Bjørnebye (2006:343ff) for a detailed discussion.

[42] See section 4.2 for an assessment of TEN-E, the EU interconnector funding framework.

2009 “third energy package” establishing the Agency for the Cooperation of Energy Regulators (ACER) and codifying various provisions favouring interconnector investment are aimed at fostering greater market integration. Interconnectors have also found their way into the Treaty: Art. 194 TFEU stipulates that the “Union policy on energy shall aim […] to […] promote the interconnection of energy networks.”

This section will assess how and how effectively the *existing* EU regulatory framework, i.e. the “third energy package”, addresses the interconnector investment failure. We shall focus on the new institutional framework and the exemption regime for new infrastructure as well as identify shortcomings, followed by policy recommendations. The Trans-European Energy Networks (TEN-E) – the EU’s interconnector funding scheme so far – will be discussed too.

4.1. The “third energy package”: completing the EU internal market for electricity?

4.1.1. Value-added of the “third energy package”

As compared to its predecessor the “third energy package” introduces a number of improvements designed to tackle the interconnector investment failure:

- A new unbundling regime establishes ownership unbundling – the most efficient solution – as a standard. Nevertheless, vertically integrated utilities are free to implement two alternative solutions that are suspected to yield sub-optimal results (EC 2007c, Pollitt 2008).[43]
- A new institutional framework with an EU regulatory agency – ACER – and a pan-European TSO organization – ENTSO-E – aims at filling the “regulatory gap” on cross-border issues.[44]
- The independence of NRAs has been strengthened by detailed provisions on their status, powers and duties (arts. 35-40 Directive 2009/72/EC). Further, NRAs are now obliged to cooperate with the Agency and amongst each other.
- Some limited progress has been achieved on the use of congestion rents (art. 16 (6) Regulation 714/2009). The redistribution of these rents via reduced network usage charges (option 3) has been declassed to a stopgap solution for the case that TSOs fail to spend them on guaranteeing the actual availability of the allocated capacity (option 1) or network investments (option 2). Also, NRAs may set a cap to the socially sub-optimal option 3. Whether these provisions will alter the actual practice of TSOs and NRAs is an open question.

The “third energy package” is certainly a step in the right direction. Still, many provisions are disappointing because they are insufficient to effectively tackle the interconnector investment failure. Even though the “second energy package” has still not been fully implemented by all Member States[45], a serious reflection about a “fourth energy package” is unavoidable. If the EU wants to achieve a properly functioning internal electricity market (an undisputable instrumental goal in the treaty serving the higher EU aims in art. 3, TEU; see also art. 26, TFEU) with competitive electricity prices, a high degree of security of supply and a strong reliance on renewable energy sources, it has no choice but to push ahead regulatory reform enabling urgently needed interconnector investment. Based on the insights of this section’s analysis, policy recommendations will be formulated in subsection 4.3.

4.1.2. ACER and ENTSO-E: Filling the “regulatory gap”?

The “third energy package” gives birth to two EU bodies – ACER and ENTSO-E – in order to fill the perceived “regulatory gap” on cross-border issues.

[43] See EC (2010a) for a detailed description of the new unbundling regime.
[44] See section 4.1.2 for a discussion.
[45] In June 2009, the EC initiated infringement procedures against 25 Member States for violation of the 2003 “second energy package” legislation on electricity (EC 25/06/2009, EC 2010b:2ff).

ENTSO-E, a coordination network for all European TSOs, was established late 2008 and is fully operational since July 2009 (Staschus 2009:31). The "third energy package" mandates ENTSO-E to elaborate harmonized network operation rules, a non-binding pan-European ten-year network development plan (TYNDP), and generation adequacy outlooks.[46] The organization's statutes have not been published yet, but must be submitted to the European Commission for approval before March 2011. As emphasized before, the establishment of some kind of QMV procedure will be of paramount importance in order to allow cross-border planning to be independent of national interests.

Regulation 713/2009 establishes ACER as an EU "regulatory" agency with legal personality. It will become operational early 2011. Beyond its general advisory role, the agency's major tasks include the provision of a cooperative framework for NRAs, the regulatory oversight of ENTSO-E, notably concerning the TYNDP, and some minor individual exemption-decisions on cross-border issues[47]. The very limited regulatory powers of ACER are attributable to the Meroni doctrine (ECJ case 9/56). According to this case law, EU agencies cannot be delegated (independent) tasks the Member States have delegated to the EU level or tasks that would involve non-trivial discretionary power (Swanson 2009:41ff, Westerhof 2009:26).[48] From a constitutional perspective, this would undermine the careful institutional balance at EU level. The Commission traditionally holds that the doctrine clearly prevents the EU from having an independent EU energy regulator with binding decisional powers as sketched in section 3. Only a Treaty amendment could alter this situation (EC 2007c:49). In recent years European lawyers have become increasingly critical of the Commission's rigid and doctrinal position. This is partly due to a lingering suspicion that the legal doctrine is (mis)used to maintain or protect the Commission's powerful position with respect to network industries in the single market.[49] In part, it is due to the generalisations made from a curious case in 1956 (under the ECSC) referring to a body under private law (see e.g. Dutheil de la Rochere 2009). Other considerations can be found as well (see e.g. Lavrijsen & Hancher 2008, Chiti 2010, Griller & Orator 2010). We think that this debate is only beginning and there is every reason to incorporate functional economic arguments critical to the proper functioning of the internal market, the hard core of European integration and its treaties. However, even if the Meroni doctrine would be made more flexible, a proposal for a more independent EU agency would still have to pass Council (where Member States might well fail to agree) and the European Parliament (which has shown a critical attitude in the case of a – weak – EU body for e-communications but not for ACER).

Regarding network planning and interconnector cost allocation, the major achievement of the "third energy package" is to introduce a joint EU (though hardly supranational) dimension. However, some severe omissions will prevent the framework from delivering satisfying results in a timely manner.

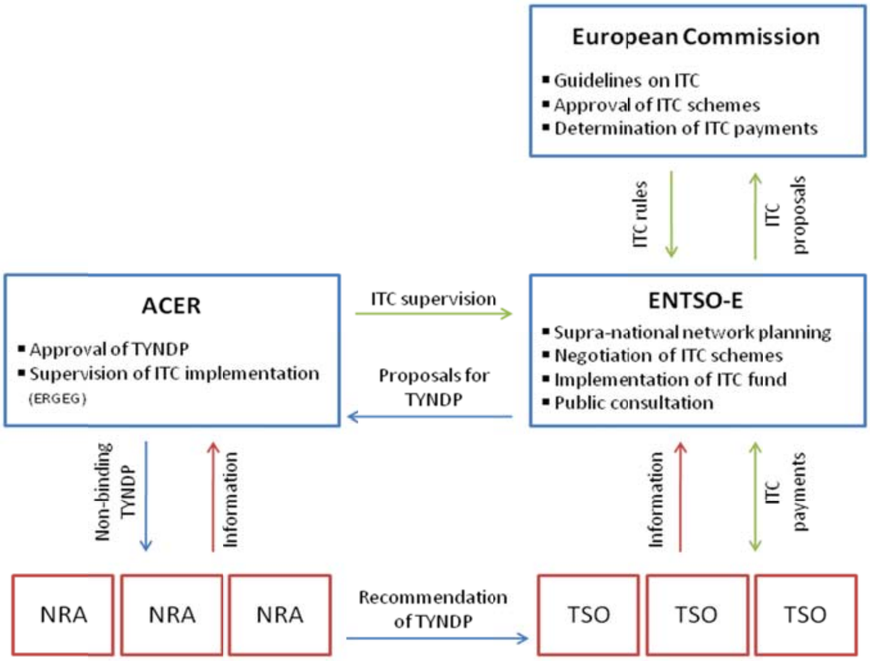
In the new EU framework (see figure 8), ENTSO-E will publish biennially a pan-European TYNDP proposal. This proposal will build on national and regional network development plans, extensive public consultations and negotiations between the TSOs. Taking a broader European view, it shall identify investment gaps, notably with respect to interconnection capacities. ACER will be in charge of monitoring ENTSO-E's network planning procedure and provide an opinion on the TYNDP. The agency will particularly verify whether ENTSO-E's bottom-up approach has not led to a mere compilation of national plans and whether European top-down policy goals such as the TEN-E axes or the 20/20/20 environmental targets have been sufficiently integrated. After the final approval of the TYNDP, NRAs and ACER will review national plans to assess their consistency with the pan-European one. It is important to underline that the TYNDP has *no* binding power

[46] Legal basis: arts. 4-12 Regulation 714/2009.
[47] See section 4.1.3.
[48] Still, Gottschal (2009:58f) claims that ACER is incompatible with the Meroni doctrine and thereby creating a severe imbalance of powers.
[49] See e.g. Geradin (2006) who maintains that the doctrine can be explained "as much" by political as by legal reasoning.

and that the issues of investment financing and cost-sharing lay outside of its scope (ERGEG 2009:11).

The new EU framework does not solve the interconnector cost allocation issue. Neither ACER nor ENTSO-E has any (binding) decisional power on the allocation of investment costs in case of interconnector investment generating strong externalities.[50] Yet, based on art. 13 Regulation 714/2009[51], the Commission might introduce an ITC mechanism that inter alia takes into account the costs of "investment in new infrastructure". After years of fruitless bargaining of TSOs and NRAs, the Commission decided to draw up – based upon extensive consultations – binding guidelines for an EU ITC scheme (O'Briain 2009:3f). In the current Commission Regulation draft (EC 2009c), ENTSO-E is mandated to implement a central ITC fund and to settle the TSO payments under the supervision of ACER. Ranges of ITC charges per MWh of physical net flow have been fixed by the EC in the draft Regulation. Still, the Commission proposal that will probably be implemented in the autumn of 2010 does not contain any reference to the costs of *new* infrastructure – it only provides a fixed-rate compensation for flows on *existing* infrastructure. The proposed mechanism might remove some distortions of investment incentives (EC 2008b), but is insufficient to overcome the interconnector investment failure as it does not provide sufficient incentives to invest in interconnectors in the presence of strong externalities.

Figure 8: Network planning and interconnector cost allocation in the "third energy package"



Source: Illustration by Kapff/Pelkmans based on EC 2009c; O'Briain 2009; Regulations 713/2009 and 714/2009

An expansion of the proposed ITC mechanism including a specific scheme taking explicitly into account the externalities of investment in *new* interconnectors could be a solution. However, the competences on such a new-interconnector-ITC-scheme would have to be shifted either to the Commission or to ACER. Indeed, ENTSO-E as a TSO organization would find it difficult to decide on heavy compensation payments between its members. TSOs would be unable to find an

[50] Interestingly, this "hot topic" was intensively discussed up to the negotiations on the "third energy package", but has disappeared from the scene ever since.
[51] Note that art. 3 Regulation 1228/2003 already included the same provisions.

agreement on such a regulatory task. They would probably even "collude" to jointly block all investments in order to avoid undesired ITC payments.

All in all, the "third energy package" architecture does not solve the interconnector investment failure. The non-binding TYNDP might trigger some additional interconnector investment in case it identifies new bottlenecks where the investors are able to reap the lion's share of the investments' benefits. However, in case of severe externalities, no investment will take place since TSOs cannot be forced to invest and no satisfactory cost allocation mechanism exists.

4.1.3. New infrastructure exemptions

As mentioned in section 3.2, the EU disposes of a special legal regime for merchant interconnector investments. Under art. 17 Regulation 714/2009 "new […] interconnectors may, upon request, be [partially] exempted, for a limited period of time[52], from the provisions" on rTPA, regulated tariffs, unbundling and the use of congestion rents. As a rule, investments have to fulfill the following conditions in order to be granted an exemption:

(1) "The investment must enhance competition in electricity supply."
(2) "The level of risk attached to the investment [must be] such that the investment would not take place unless an exemption is granted."
(3) The investor must be at least legally unbundled from the TSOs to whose networks the interconnector is linked.
(4) The interconnector must be economically self-sufficient. Cross-subsidization based upon revenues from regulated network usage fees is prohibited.
(5) "The exemption must not be to the detriment of competition or the effective functioning of the internal market, or the efficient functioning of the regulated systems to which the interconnector is linked."

These conditions adequately represent the regulatory choice to only allow for merchant transmission investment if regulated TSOs fail to deliver. The "strict necessity test" ensures that the scope of exemptions does not go beyond what is necessary to realize the investment (Bjørnebye 2006:350) and thereby tries to minimize the adverse effects of merchant transmission investment's inherent sub-optimality.

The decision on exemptions is taken on a case-by-case basis by the concerned NRAs. These may decide – upon joint request or in case of incapability to reach an agreement within six months – to refer the decision to ACER. Besides, the Commission holds a veto-right on all exemptions and may issue guidelines on the implementation of the exemption regime.[53]

The weakness of the EU exemption regime for merchant interconnectors lays in the distribution of decisional powers. For instance, some Member States may be excessively generous when granting exemptions (EC 2007c:57). This would not only endanger the level playing field between TSOs, but also impede further market integration by allowing for excessively sub-optimal merchant interconnectors. In addition, the choice to limit ACER's role to a "decision-maker of last resort"[54] results in two other undesirable effects. First, NRAs have the possibility to jointly veto

[52] Note that this time constraint was introduced by the "third energy package". Exemptions granted under Regulation 1228/2003 are untouched by the new provisions (recital 23 Regulation 714/2009); any other decision would have amounted to "regulatory opportunism" depressing future investment.

[53] To date, the EC has only published a non-binding "Commission staff working document" on the application of art. 7 Regulation 1228/2003 (EC 2009b).

[54] This choice corresponds to the common Council position in the "third energy package" negotiations, but goes against the proposals of the EC and the European Parliament who advocated for an exclusive agency competence (EC 2007c:50, Swanson 2009:44).

an overall welfare increasing merchant interconnector.[55] This might be the case if the NRA in the low-price market does not want the domestic electricity prices to increase and the NRA in the high-price market is captured by the generation industry. Second, ACER is prevented from using merchant investment as a means to put pressure on NRAs and TSOs that fail to deliver. To overcome these problems, ACER should have exclusive competence on exemptions for new merchant interconnectors.

4.2. Trans-European Energy Networks (TEN-E)

Besides its regulatory powers, the Commission has an additional tool at its disposal to support interconnector investment: the Trans-European Energy Networks (TEN-E)[56]. The TEN-E framework includes some degree of supra-national network planning, a funding scheme and coordination support for key interconnector projects.

The network planning component of TEN-E consists in identifying – mainly based upon congestion studies (Meeus et al. 2006:593)[57] – bottlenecks hampering European electricity market integration and the connection of renewable energy sources. The TEN-E guidelines (Decision 1364/2006/EC) distinguish two types of bottlenecks: "projects of European interest" (31 electricity projects) and "projects of common interest" (164 electricity projects).

With a TEN-E budget line of about € 20 million a year, the EU helps to fund new gas and electricity interconnectors, with priority given to "projects of European interest" (EC 2008a:25). Generally, the TEN-E financing – mainly used to support feasibility studies – "has a relatively minor effect on the overall budget of [an interconnector] project, but it can act as an important stimulator at an early and risky stage" (Meeus et al. 2006:597). In addition, the "TEN-E label" gives access to new financing opportunities, particularly to EIB loans, European Investment Fund loan guarantees, and potentially to additional support from the Structural and Cohesion Funds. Finally, in the framework of the 2009/2010 "European Energy Programme for Recovery" (EEPR), twelve electricity interconnector projects were granted € 910 million corresponding to co-financing parts of up to 50% (EC 04/03/2010).

Under the TEN-E guidelines, the Commission may also appoint European coordinators for key interconnector projects that face substantial delays. These coordinators shall promote the European dimension of the project, offer strategic support and provide practical advice. This includes tackling obstacles to project development, bringing parties together, defining appropriate implementation strategies as well as securing top-level political attention in the Member States concerned (EC 2008a:16). Furthermore, in negotiations with the Member States, the Commission tries to streamline national authorization procedures for "projects of European interest" with the aim of limiting the administrative burden to a maximum time span of five years (EC 2007b:13).

From a functional subsidiarity perspective, interconnector investment funding is better dealt with at EU-level due to strong positive cross-border externalities and a lack of credibility of financing commitments by Member States acting commonly (see Box 3). Yet, the TEN-E approach with its very limited budget also lacks credibility – it does not have the means to realize the projects it has identified being of "European interest". This raises the question whether the EU should possess a large TEN-E fund – financed by direct Member States contributions or indirectly via the general EU budget – to support interconnector investment in the Union. For instance, Helm (2007:440ff) strongly advocates a *European* interconnector investment program with centralized

[55] Yet, the possibility of a single NRA vetoing an (overall welfare increasing) merchant interconnector as provided by Regulation 1228/2003 does not exist anymore.

[56] Legal basis: arts. 170-172 TFEU. Note that the Commission currently works on a TEN-E successor, the so-called "Energy Security and Infrastructure Instrument". See EC DG Energy website [http://ec.europa.eu/energy/gas_electricity/].

[57] Yet, frequently political interference ensures that no MS "goes away empty-handed".

planning and financing components in order to meet security of supply as well as climate change challenges. Other authors criticize such ideas as a “rejection of the market-based philosophy […] returning to central planning” (Bower 2003:1). In this context, the TEN-E guidelines underline that, “as a rule, the construction […] of energy infrastructure should be subject to market principles” and that EU funding “should therefore remain highly exceptional […] and duly justified” (recital 4 Decision 1364/2006/EC). Indeed, the rationale of TEN-E is to support interconnector building where “the market” fails to deliver crucially needed infrastructure.

With a TEN-E fund of sufficient size, the EU could rapidly break the most severe bottlenecks. Such investment funding could thus counterbalance the sub-optimality of the current regulatory framework. One might also argue that interconnector funding would yield higher social welfare returns than, for example, most EU agricultural funding schemes. Notably, competitive electricity prices, security of supply and a healthy environment (via the network integration of renewables) benefit *all* European citizens whereas agricultural funding favours a small minority. In the end, the scope and size of TEN-E funding boils down to a political choice of priorities. A steady and substantial increase of the TEN-E funds is foreseeable due to the increased prominence of environmental targets and security of supply considerations. Also, the political deadlock on interconnector cost allocation schemes encourages politicians to look for alternative solutions to the “regulatory path”. Yet, a large-scale *European* investment program seems to be a suggestion far removed from today’s political reality.

Box 4: Connecting the Iberian “electricity island”

Electricity flows from France to Spain are presently limited to 1,300 MW and to 500 MW in the other direction.[58] The insufficient interconnection capacity of the continuously congested lines causes the isolation of the Iberian “electricity island”. An additional high voltage interconnection was declared “project of European interest” in 1994, but its accomplishment has been stagnating ever since (Nies 2010:97). An additional interconnection would allow for the integration of the Iberian Peninsula in the internal electricity market, for a higher security of supply, for more competition in Spain’s oligopolistic electricity market and for the connection of Spain’s large renewable energy generation capacities (wind/solar) to major European load centers.

In a 2002 merger case, EDF and its transmission affiliate RTE undertook to increase the interconnection capacity between both countries by at least 2,700 MW upgrading existing lines and building two additional ones (case COMP/M.2684 – EnBW/EDP/Cajastur/Hidrocantabrico, Talus et al. 2006:362). Yet, insufficient coordination of the concerned parties on both sides of the border, strong opposition by the local population and environmentalists, lengthy authorization procedures as well as the technical difficulty of crossing the Pyrenees caused substantial delays in the implementation of the new interconnection (EC 2007b:9).

In autumn 2007, the former European Commissioner Mario Monti was nominated European Coordinator for the Franco-Spanish interconnection. Based on the work of an Italian consultancy and intense consultations, he proposed solutions taking into consideration European, but also local and environmental interests (Monti 2008). In 2008, the French and Spanish heads of state agreed to relaunch the project on the basis of Monti’s proposals (RF et al. 2008a, 2008b). The solution is to bury the 60 km international section underground and to operate it with HVDC. Where possible, the line will follow existing infrastructure (railways, roads) already crossing the Pyrenees (EC 2008a:17). Late 2008, the concerned TSOs RTE and REE founded a 50/50-joint-venture to manage the project. The construction works are expected to begin early 2011 with the aim of putting the regulated line into operation by no later than 2014 (EurActiv 10/03/2010).[59]

The total costs of the project are estimated at € 500-750 million, whereas an HVAC overland line would have required only € 90 million (Nies 2010:98). In the framework of the EEPR, the

[58] Net transfer capacity data (Winter 2009/2010) from ENTSO-E, see [http://www.entsoe.eu].
[59] See [http://www.liaison-france-espagne.org/] for detailed information on the project.

project was granted TEN-E funds of € 225 million (EC 04/03/2010). Further, it will be eligible to low-interest EIB loans.
This case shows that the Commission can play an important role mediating between the different stakeholders of an interconnector project boosting its implementation. Also, substantial EU funding helps to overcome political deadlocks.

4.3. Conclusion: towards a properly functioning EU internal market for electricity

This section's analysis of the *existing* EU regulatory framework and the TEN-E interconnector funding scheme has shown that there is still quite some progress to be made in order to achieve a well-functioning EU internal market for electricity. The following policy recommendations can be drawn:

- The unbundling regime of the "fourth energy package" should abandon the ITO option and further disincentivize the second-best ISO solution.[60]
- Congestion rents should be exclusively used to guarantee the availability of allocated capacities and for interconnector investment. Unused congestion rents should be transferred to a European interconnector fund managed by ACER.
- The ENTSO-E statutes should establish QMV decision-making processes. This would allow cross-border planning to be independent from national interests and avoid deadlocks.
- Supra-national network planning should have some binding power, yet not on specific interconnectors as this would be too intrusive. Instead, one could imagine setting binding target capacities for particularly congested borders, but leaving the way to achieve these targets to the concerned TSOs (Knops 2009:107).
- The interconnector cost allocation issue should be tackled with a European interconnector fund, possibly building on an augmented ITC mechanism. Regulatory decisions on payments from and to the fund should be taken by ACER or the Commission.
- ACER should obtain exclusive competence on new infrastructure exemptions. The agency should also have the right to use merchant investment as a means to put pressure on regulated TSOs that do not deliver crucially needed interconnectors. As a last resort, the agency should have the right to organize a tender for a "missing link" – financed by the EU interconnector fund.
- Depending on political priorities, the EU might choose to increase TEN-E interconnector funding in order to achieve market integration, security of supply and environmental goals in a timely manner. This choice would very probably yield higher social welfare returns than other EU funding schemes, notably in agriculture. Nonetheless, it should be clear that funding can only be an *interim* solution while overcoming the political deadlock on the regulatory question of interconnector cost allocation.
- Finally, more coordination and consistency at EU-level is needed. Regulatory efforts, supra-national network planning, TEN-E funding, EIB loans, merchant interconnector exemptions, programs for economic recovery, Structural and Cohesion Funds as well as environmental and EU2020 targets – to name only the most important EU factors that influence interconnector investment – would yield better results if their coordination and consistency would be improved.

[60] Directive 2009/72/EC of the "third energy package" introduces a new unbundling regime with three different models: (1) the *ownership unbundling* model, where the TSO owns and operates the transmission assets and is fully (ownership) unbundled from the rest of the system; (2) the *independent system operator (ISO)* model, where system operation and system ownership are separated. The ISO – in which vertically integrated utilities can have no stake – manages, but does not own, the transmission assets. The integrated company can maintain its ownership in the transmission assets; and (3) the *independent transmission operator (ITO)* model, where the TSO is strictly legally and functionally separated from the rest of the system. Still, the TSO is owned by the vertically integrated utility.
The ISO and the ITO models appear to be insufficient to overcome the distorted (investment) incentives of electricity utilities. See e.g. EC 2010a:4ff and Pollitt 2008:704ff for a detailed assessment.

5. Conclusion

This paper has explored different ways – mainly focusing on the "regulatory path" – to achieve sufficient interconnector investment for a well-functioning EU internal market for electricity.

The problem at stake – i.e. the ***interconnector investment failure*** – has been introduced in section 2. First, the paramount importance of interconnectors for the achievement of the EU's energy policy goals – sustainability, competitiveness and security of supply – has been sketched. The economic analysis of interconnector investment has identified numerous impediments to a sufficient level of investment. These include positive externalities, redistributive welfare effects and distorted incentives of vertically integrated utilities, but also lengthy authorization procedures, high levels of risk and cross-border coordination problems. On top of it, a "regulatory gap" on cross-border issues paralyses the expansion of interconnection capacities in the EU. The sum of all these investment barriers has been designated as "interconnector investment failure".

Section 3 has reflected on the ***proper regulatory design*** of an EU framework able to overcome the interconnector investment failure. Based on the shortcomings of the "second energy package", it has put forward a number of recommendations:

- All congestion rents should be channeled into interconnector building. Unused rents should be transferred to a European interconnector fund supervised by an EU agency.
- Even though inherently sub-optimal, merchant transmission investment can be used as a means to put pressure on regulated TSOs that do not deliver. An EU agency should have exclusive competence on merchant interconnector exemptions.
- A European TSO organization should be entrusted with supra-national network planning, yet supervised by an EU agency.
- The agency should decide on investment cost reallocation for interconnector projects that yield strong externalities. Payments could be settled via a European interconnector fund.
- In case of non-compliance with the supra-national network plan, the EU agency should have the right to organize a tender – financed by the European interconnector fund – in order to get the "missing link" built.
- The choice of incentive schemes for regulated TSOs should be left to NRAs in order to stimulate regulatory competition and innovation (experiments) as well as appropriate responses to local specificities.

Finally, section 4 has assessed the ***existing EU regulatory framework*** for interconnector investment. The provisions of the "third energy package" are a step in the right direction, particularly as to the efforts to fill the "regulatory gap" with two new supra-national bodies – ACER and ENTSO-E. However, the "third energy package" is clearly insufficient to effectively tackle the interconnector investment failure. Striking holes in regulatory framework have been identified, notably with regard to the use of congestion rents, interconnector cost allocation, and the distribution of decisional powers on new infrastructure exemptions. Appropriate policy recommendations have been proposed. Finally, an assessment of the TEN-E interconnector funding scheme has shown that massive funding can be – if politically desired – an *interim* solution to the problem of insufficient interconnection capacities while overcoming the political deadlock on sensible topics such as interconnector cost allocation.

Nevertheless, there is no way around substantial regulatory reform. If the EU wants to reap the considerable economic benefits of a properly functioning internal market for electricity , not to speak of the suitability to combine it with measures fighting climate change, whilst bolstering security of energy supply, it will have to adopt the essentials of the "fourth energy package" proposed above!

References

Bauby, P. & Varone, F. (2007): “Europeanization of the French electricity policy: four paradoxes”, *Journal of European Public Policy*, Vol. 14 Issue 7, pp. 1048-1060.

Bjørnebye, H. (2006): “Interconnecting the internal electricity market: a goal without a plan?”, *Competition and Regulation in Network Industries*, Vol. 1 Issue 3, pp. 333-354.

Bolkart, A. (2005): “*Investment in European electricity transmission networks: How can we get it just right? Economically appropriate ways of incorporating transmission network investment in the regulatory framework of competitive EU electricity markets*”, Bruges, 52 pp.

Borenstein, S. & Bushnell, J. & Stoft, S. (2002): “The competitive effects of transmission capacity in a deregulated electricity industry”, *RAND Journal of Economics*, Vol. 31 Issue 2, pp. 294-325.

Bower, J. (2003): “Should the EU be investing in cross-border electricity transmission capacity?”, *Research Symposium European Electricity Markets*, The Hague, September 2003, 4 pp.

Brunekreeft, G. (2005): “Regulatory issues in merchant transmission investment”, *Utilities Policy*, Vol. 13 Issue 2, pp. 175-186.

Brunekreeft, G. & Neuhoff, K. & Newbery, D. (2005): “Electricity transmission: An overview of the current debate”, *Utilities Policy*, Vol. 13 Issue 2, pp. 73-93.

Bundesnetzagentur (2009): “*Monitoringbericht 2009*”, Bonn, 299 pp.

Bundesnetzagentur (2007): “Report on the use of the French-German interconnection in 2006”, Bonn, 20 pp.

Bunn, D. & Zachmann, G. (2010): “Inefficient arbitrage in inter-regional electricity transmission”, *Journal of Regulatory Economics*, Vol. 37 Issue 3, pp. 243-265.

Cambini, C. & Rondi, L. (2010): “Incentive regulation and investment: evidence from European energy utilities”, *Journal of Regulatory Economics*, Vol. 38 Issue 1, pp. 1-26.

Champsaur, P. (2009): “*Rapport de la commission sur l’organisation du marché de l’électricité*”, Paris, 35 pp.

Chevalier, J.-M. & Percebois, J. (2008): “*Gaz et électricité : un défi pour l’Europe et pour la France*”, Rapport Conseil d’Analyse Économique (CAE), n° 74, Paris, 152 pp.

Chiti, E. (2009): “An important part of the EU’s institutional machinery: Features, problems and perspectives of European agencies”, *Common Market Law Review*, Vol. 46 Issue 5, pp. 1395-1442.

Consentec & Frontier Economics (2004): “*Analysis of Cross-Border Congestion Management Methods for the EU Internal Electricity Market*”, study commissioned by EC (DG Transport and Energy), Aachen, 138 pp.

Dutheil de la Rochère, J. (2009): “EU regulatory agencies: What future do they have?”, in: Bulterman, M. & Hancher, L. & McDonnell, A. & Sevenster, H. (eds.): “*Views of European law from the mountain: Liber Amicorum Piet Jan Slot*”, New York, pp. 355-366.

Égert, B. (2009): “Infrastructure investment in network industries: The role of incentive regulation and regulatory independence”, *CESifo Working Paper*, n° 2642, 22 pp.

ERGEG (2007): “*Cross Border Framework for Electricity Transmission Network Infrastructure – An ERGEG Conclusions Paper*”, Brussels, 30 pp.

ERGEG (2009): “*Draft advice on the Community-wide ten-year Electricity Network Development Plan*”, Brussels, 32 pp.

ERGEG & CEER (2009): “*Implementing the 3rd Package: The next steps*”, Brussels, 27 pp.

European Commission, DG Competition (2007a): “*Energy sector inquiry*”, Brussels, 363 pp.

European Commission (2007b): “*Priority Interconnection Plan*”, Brussels, 21 pp.

European Commission, DG Energy and Transport (2007c): "*Impact assessment accompanying the legislative package on the internal market for electricity and gas*", Brussels, 106 pp.

European Commission, DG Energy and Transport (2008a): "*Interconnecting Europe: new perspectives for trans-European energy networks*", Luxembourg, 31 pp.

European Commission, DG Energy and Transport (2008b): "*Impact Assessment of the Inter Transmission System Operator Compensation Mechanism and Harmonisation of Transmission Tariffs for Electricity*", Brussels, 54 pp.

European Commission (2009a): "*Report on progress in creating the internal gas and electricity market*", Brussels, 60 pp.

European Commission (2009b): "*Commission staff working document on Article 22 of Directive 2003/55/EC concerning common rules for the internal market in natural gas and Article 7 of Regulation (EC) No 1228/2003 on conditions for access to the network for cross-border exchanges in electricity*", Brussels, 19 pp.

European Commission, DG Energy (2009c): "*Draft Commission Regulation laying down guidelines establishing a mechanism for the compensation of transmission system operators for the costs of hosting cross border flows of electricity and a common regulatory approach to transmission charging*", Brussels, 9 pp.

European Commission (2010a): "*Interpretative note on Directive 2009/72/EC concerning common rules for the internal market in electricity and Directive 2009/73/EC concerning common rules for the internal market in natural gas: The unbundling regime*", Brussels, 29 pp.

European Commission (2010b): "*Report on progress in creating the internal gas and electricity market*", Brussels, 56 pp.

European Commission (2010c): "*Commission decision establishing the 2010 annual work programme for grants in the field of trans-European networks (TEN) – area of energy infrastructures (TEN-E)*", Brussels, 8 pp.

European Council (2002): "*Presidency Conclusions – Barcelona European Council 15 and 16 March 2002*", Brussels, 73 pp.

Finon, D. (2003): "Introducing competition in the French electricity supply industry: erosion of the public hierarchy by the European institutional integration", in: Glachant, J.-M. & Finon, D. (eds.): "*Competition in European electricity markets: a cross-country comparison*", Cheltenham, pp. 257-284.

Frontier Economics & Consentec (2008): "*Improving incentives for investment in electricity transmission infrastructure*", report prepared for EC (DG Energy and Transport), London, 66 pp.

Genoud, C. and Varone, F. (2002): "Does Privatisation Matter? Liberalisation and regulation: The case of European electricity", *Public Management Review*, Vol. 4 Issue 2, pp. 231-256.

Geradin, D. (2006): "*Twenty years of liberalisation of network industries in the EU: Where do we go now?*", inaugural lecture, Tilburg University, 31 pp.

Gottschal, E. (2009): "The role of an energy agency in regulating an internal energy market", in: Roggenkamp, M. & Hammer, U. (eds.): "*European Energy Law Report VI*", Antwerp, pp. 51-59.

Green, R. (2006): "Electricity liberalisation in Europe – how competitive will it be?", *Energy Policy*, Vol. 34 Issue 16, pp. 2532-2541.

Griller, S. & Orator, A. (2010): "Everything under control? The 'way forward' for European agencies in the footsteps of the Meroni doctrine", *European Law Review*, Vol. 35 Issue 1, pp. 3-35.

Haas, R. & Auer, H. & Faber, Th. & Wagner, E. (2008): "The relevance of cross-border transmission capacities for competition in the continental European electricity market", *International Journal of Global Energy Issues*, Vol. 29 Issue 1/2, pp. 28-54.

Hammer, U. (2007): "Interconnectors and market coupling – illustrated by Norned", in: Roggenkamp, M. & Hammer, U. (eds.): "*European Energy Law Report IV*", Antwerp, pp. 281-292.

Helm, D. (2007): "European energy policy: Securing supplies and meeting the challenge of climate change", in: Helm, D. (ed.): "*The new energy paradigm*", Oxford, pp. 440-451.

Jamasb, T. and Pollitt, M. (2005): "Electricity Market Reform in the European Union: Review of Progress toward Liberalisation & Integration", *Energy Journal*, European Electricity Liberalisation Special Issue, pp. 11-41.

Jamasb, T. & Pollitt, M. (2006): "Electricity market liberalisation and integration in the EU", *CESifo DICE Report*, 2/2006, pp. 16-23.

Joskow, P. (2005): "Incentive regulation in theory and practice: electricity distribution and transmission networks", *AEI-Brookings Joint Center for Regulatory Studies*, Working paper 05-18, 77 pp.

Joskow, P. & Tirole, J. (2005): "Merchant transmission investment", *Journal of Industrial Economics*, Vol. 53 Issue 2, pp. 233-264.

Knops, H. & De Jong, H. (2007): "Regulated vs. merchant transmission investment", in: Roggenkamp, M. & Hammer, U. (eds.): "*European Energy Law Report IV*", Antwerp, pp. 293-319.

Knops, H. (2009): "How adequate is the European legal regime for investments in electricity networks?", in: Roggenkamp, M. & Hammer, U. (eds.): "*European Energy Law Report VI*", Antwerp, pp. 91-113.

Küpper, G. & Delarue, E. & Delvaux, B. & Meeus, L. & Bekaert, D. & Willems, B. & Proost, S. & D'haeseleer, W. & Deketelaere, K. & Belmans, R. (2009): "Does More International Transmission Capacity Increase Competition in the Belgian Electricity Market?", *Electricity Journal*, Vol. 22 Issue 1, pp. 21-36.

Lavrijsen, S. & Hancher, L. (2008): "Networks on track: from European regulatory networks to European regulatory network agencies", *Legal Issues of Economic Integration*, Vol. 34 Issue 1, pp. 23-55.

Léautier, Th.-O. (2001): "Transmission Constraints and imperfect markets for power", *Journal of Regulatory Economics*, Vol. 19 Issue 1, pp. 27-54.

Léautier, Th.-O. & Thelen, V. (2009): "Optimal expansion of the power transmission grid: Why not?", *Journal of Regulatory Economics*, Vol. 36 Issue 2, pp. 127-153.

Lieb-Dóczy, E. & Börner, A.-R. & MacKerron, G. (2003): "Who Secures the Security of Supply? European Perspectives on Security, Competition, and Liability", *Electricity Journal*, Vol. 16 Issue 10, pp. 10-19.

Littlechild, S. (2004): "Regulated and Merchant Interconnectors in Australia: SNI and Murraylink Revisited", *Cambridge Working Papers in Economics*, CWPE 0410, 52 pp.

Lyon, Th. & Mayo, J. (2005): "Regulatory Opportunism and Investment Behavior: Evidence from the U.S. Electric Utility Industry", *RAND Journal of Economics*, Vol. 36 Issue 3, pp. 628-644.

Meeus, L. & Purchala, K. & Belmans, R. (2005a): "Development of the internal electricity market in Europe", *Electricity Journal*, Vol. 18 Issue 6, pp. 25-35.

Meeus, L. & Purchala, K. & Belmans, R. (2005b): "Market opening: The Norned submarine HVDC cable", *Proceedings of Power-Gen Europe 2005*, Milan, 20 pp.

Meeus, L. & Purchala, K. & Van Hertem, D. & Belmans, R. (2006): "Regulated cross-border transmission investment in Europe", *European Transactions on Electrical Power*, Vol. 16 Issue 6, pp. 591-601.

Monti, M. (2008): "*Projet d'intérêt européen EL3: Interconnexion électrique France-Espagne*", Brussels, 26 pp.

Monti, M. (2010): "*A new strategy for the single market at the service of Europe's economy and society*", Report to the President of the European Commission, Brussels, 107 pp.

Moselle, B. (2008): "Reforming TSOs: Using the 'Third Package' legislation to promote efficiency and accelerate regional integration in EU wholesale power markets", *Electricity Journal*, Vol. 21 Issue 8, pp. 9-17.

Newbery, D. (2002): "European Deregulation: Problems of liberalizing the electricity industry", *European Economic Review*, Vol. 46 Issue 4/5, pp. 919-927.

Nies, S. (2010): "At the speed of light? Electricity interconnections for Europe", *Études ifri "Gouvernance européenne et géopolitique de l'énergie"*, n° 8, 168 pp.

O'Briain, T. (2009): "Inter TSO compensation and transmission tariff harmonization: Commission proposal for binding guidelines", *17th meeting of the European Electricity Regulatory Forum*, Rome, 16 pp.

Pelkmans, J. (2006a): “*European Integration – Methods and Economic Analysis*”, 3rd edition, Harlow, 480 pp.

Pelkmans, J. (2006b): “Testing for subsidiarity”, in: Bruha, Th. & Nowak, C. (eds.): “*Die Europäische Union: Innere Verfasstheit und globale Handlungsfähigkeit*“, Baden-Baden, pp. 57-88.

Percebois, J. (2008): “Electricity liberalization in the European Union: Balancing benefits and risks”, *Energy Journal*, Vol. 29 Issue 1, pp. 1-19.

Petit, N. & Rato, M. (2009): “From Hard to Soft Enforcement of EC Competition Law – A Bestiary of ‘Sunshine’ Enforcement Instruments”, in: Gheur, Ch. & Petit, N. (eds.): *“Alternative Enforcement Techniques in EC Competition Law: Settlements, commitments and other novel instruments”*, Brussels, pp. 183-220.

Pollitt, M. (2008): “The arguments for and against ownership unbundling of energy transmission networks”, *Energy Policy*, Vol. 36 Issue 2, pp. 704-713.

Pollitt, M. (2009): “Electricity Liberalisation in the European Union: A Progress Report“, *Cambridge Working Paper in Economics*, n° 953, 27 pp.

République française (RF) & Reino de España (2008a): “*Accord de coopération sur l’interconnexion électrique entre le gouvernement de la République française et le gouvernement du Royaume d’Espagne*”, Zaragoza, 3 pp.

République française (RF) & Reino de España (2008b): “*Déclaration conjointe sur les interconnexions électriques et gazières entre la France et l’Espagne*”, Zaragoza, 2 pp.

Schulze, A. (2006): “*Liberalisierung von Netzindustrien – Eine ökonomische Analyse am Beispiel der Eisenbahn, der Telekommunikation und der leitungsgebundenen Energieversorgung*“, Potsdam, 252 pp.

Schuman, D. & Widmaier, U. (2003): “Political strategies of large companies and their significance for the implementation of the European single electricity market: The examples of France and Germany”, *Journal of Public Affairs*, Vol. 3 Issue 3, pp. 260-272.

Sioshansi, F. (2006): “Electricity market reform: What has the experience taught us thus far?”, *Utilities Policy*, Vol. 14 Issue 2, pp. 63-75.

Slotboom, M. (2008): “Antitrust rules and the energy sector inquiry”, in: Roggenkamp, M. & Hammer, U. (eds.): “*European Energy Law Report V*”, Antwerp, pp. 3-21.

Staschus, K. (2009): “ Systèmes sans frontières”, *Modern Power Systems*, November 2009, pp. 31-32.

Statnett & TenneT (2008): “*NorNed: Europe’s link for the future*”, Oslo, Arnhem, 12 pp.

Stiglitz, J. (1998): “Distinguished Lecture on Economics in Government: The Private Uses of Public Interests: Incentives and Institutions*”, Journal of Economic Perspectives*, Vol. 12 Issue 2, pp. 3-22.

Sun, J.-M. & Pelkmans, J. (1995): “Why Liberalisation needs Centralisation: Subsidiarity and EU telecoms”, *World Economy*, Vol. 18 Issue 5, pp. 635-664.

Swanson, C.-A. (2009): “The Agency for the Cooperation of Energy Regulators – a regulatory perspective”, in: Roggenkamp, M. & Hammer, U. (eds.): “*European Energy Law Report VI*”, Antwerp, pp. 37-50.

Talus, K. & Wälde, Th. (2006): “Electricity interconnectors: a serious challenge for EC competition law”, *Competition and Regulation in Network Industries*, Vol. 1 Issue 3, pp. 355-390.

Thatcher, M. (2007): “Regulatory agencies, the state and markets: a Franco-British comparison”, *Journal of European Public Policy*, Vol. 14 Issue 7, pp. 1028–1047.

Turvey, R. (2006): “Interconnector economics”, *Energy Policy*, Vol. 34 Issue 13, pp. 1457-1472.

UCTE (2008): “*Annual Report 2008*”, Brussels, 55 pp.

Valeri, L. (2009): “Welfare and competition effects of electricity interconnection between Ireland and Great Britain”, *Energy Policy*, Vol. 37 Issue 11, pp. 4679–4688.

Vandenborre, C. (2008): “Regional integration of energy markets: conceptual and practical considerations”, in: Roggenkamp, M. & Hammer, U. (eds.): “*European Energy Law Report V*”, Antwerp, pp. 63-71.

Van der Lippe, C. & Meijer, P. (2007): “A regulator’s view on the Norned cable – a missing link?”, in: Roggenkamp, M. & Hammer, U. (eds.): “*European Energy Law Report IV*”, Antwerp, pp. 267-280.

Van der Vleuten, E. & Lagendijk, V. (2010): „Interpreting transnational infrastructure vulnerability: European blackout and the historical dynamics of transnational electricity governance”, *Energy Policy*, Vol. 38 Issue 4, pp. 2053-2062.

Von Danwitz, T. (2006): “Regulation and liberalization of the European electricity market – a German view”, *Energy Law Journal*, Vol. 27 Issue 2, pp. 423-450.

Westerhof, J. (2009): “The third energy market package”, in: Roggenkamp, M. & Hammer, U. (eds.): “*European Energy Law Report VI*”, Antwerp, pp. 19-35.

Zachmann, G. (2008): “Electricity wholesale market prices in Europe: Convergence?”, *Energy Economics*, Vol. 30 Issue 4, pp. 1659-1671.

Legal documents

Consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union, *Official Journal of the European Union*, Vol. 55 C 115, May 9th 2008, pp. 1-388.

Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC, *Official Journal of the European Union*, Vol. 46 L 176, July 15th 2003, pp. 37-55.

Decision No 1364/2006/EC of the European Parliament and of the Council of 6 September 2006 laying down guidelines for trans-European energy networks and repealing Decision 96/391/EC and Decision No 1229/2003/EC, *Official Journal of the European Union*, Vol. 49 L 262, September 22nd 2006, pp. 1-23.

Directive 2005/89/EC of the European Parliament and of the Council of 18 January 2006 concerning measures to safeguard security of electricity supply and infrastructure investment, *Official Journal of the European Union*, Vol. 49 L 33, February 4th 2006, pp. 22-27.

Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC, *Official Journal of the European Union*, Vol. 52 L 211, August 14th 2009, pp. 55-93.

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, *Official Journal of the European Union*, Vol. 46 L 176, July 15th 2003, pp. 1-10.

Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators, *Official Journal of the European Union*, Vol. 52 L 211, August 14th 2009, pp. 1-14.

Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003, *Official Journal of the European Union*, Vol. 52 L 211, August 14th 2009, pp. 15-35.

Newspaper articles and press releases

European Commission (25/06/2009): “*Commission acts to ensure effective and competitive energy market across Europe*”, IP/09/1035, Brussels, 2 pp.

European Commission (04/03/2010): “*Economic Recovery: Second batch of 4-billion-euro package goes to 43 pipeline and electricity projects*”, IP/10/231, Brussels, 7 pp.

EurActiv (23/02/2009): “*ERGEG: EU regulation at a turning point*”, Brussels, 5 pp.

EurActiv (10/03/2010): “*L’agenda de la ligne électrique France-Espagne se précise*”, Paris, 2 pp.

TenneT (22/11/2007): “*The European Investment Bank finances NorNed*”, Arnhem, 1 p.

TenneT (11/09/2008): “*Longest subsea high-voltage cable in the world opened*”, Arnhem, 2 pp.

List of 'Bruges European Economic Research Papers' (BEER)

BEER paper n° 18 (October 2010)
Interconnector Investment for a Well-functioning Internal Market. What EU regime of regulatory incentives?, by Lionel Kapff and Jacques Pelkmans

BEER paper n° 17 (July 2010)
Product Market Reform in EU Countries - Are the methodology and evidence sufficiently robust?, by Jacques Pelkmans

BEER paper n° 16 (March 2010)
The Determinants of Investment in Information and Communication Technologies by Paolo Guerrieri, Matteo Luciani and Valentina Meliciani

BEER paper n° 15 (December 2009)
Informational Barriers to Energy Efficiency – Theory and European Policies by Lars-Morten Andersen and Raimund Bleischwitz

BEER paper n° 14 (December 2008)
EU Policies and Cluster Development of Hydrogen Communities by Raimund Bleischwitz, Nikolas Bader, Anne Nygaard Madsen and Per Dannemand Andersen

BEER paper n° 13 (April 2008)
Economic Approaches of the Internal Market, by Jacques Pelkmans.

BEER paper n° 12 (March 2008)
Cartels: the Probability of Getting Caught in the European Union, by Emmanuel Combe, Constance Monnier and Renaud Legal.

BEER paper n° 11 (June 2007)
Regional Business Cycle Synchronization in Europe?, by Lourdes Acedo Montoya and Jakob de Haan.

BEER paper n° 10 (March 2007)
Family Types and the Persistence of Regional Disparities in Europe, by Gilles Duranton, Andrés Rodríguez-Pose and Richard Sandall.

BEER paper n° 9 (February 2007)
Analysing the Contribution of Business Services to European Economic Growth, by Henk Kox and Luis Rubalcaba.

BEER paper n° 8 (November 2006)
The Determinants of Country Risk in Eastern European Countries. Evidence from Sovereign Bond Spreads, by Kiril Strahilov.

BEER paper n° 7 (November 2006)
Regional business cycles and the emergence of sheltered economies in the southern periphery of Europe by Andrés Rodríguez-Pose and Ugo Fratesi.

BEER paper n° 6 (November 2006)
The 2005 Reform of the Stability and Growth Pact: Too Little, Too Late?, by Fiorella Kostoris Padoa Schioppa.

BEER paper n° 5 (October 2006)
R&D, Spillovers, Innovation Systems and the Genesis of Regional Growth in Europe, by Andrés Rodríguez-Pose and Riccardo Crescenzi.

BEER paper n° 4 (July 2006)
Mixed Public-Private Enterprises in Europe: Economic Theory and an Empirical Analysis of Italian Water Utilities, by Alessandro Marra.

BEER paper n° 3 (November 2005)
Regional Wage And Employment Responses To Market Potential In The EU, by Keith Head & Thierry Mayer.

BEER paper n° 2 (May 2005)
Technology diffusion, services and endogenous growth in Europe. Is the Lisbon Strategy still alive?, by Paolo Guerrieri , Bernardo Maggi , Valentina Meliciani & Pier Carlo Padoan.

BEER paper n° 1 (November 2004)
Education, Migration, And Job Satisfaction: The Regional Returns Of Human Capital In The EU, by Andrés Rodríguez-Pose & Montserrat Vilalta-Bufí.

List of 'Bruges European Economic Policy briefings' (BEEP)

BEEP briefing n° 19 (September 2008)
The Policy Framework for the Promotion of Hydrogen and Fuel Cells in Europe, A Critical Assessment, by Raimund Bleischwitz and Nikolas Bader

BEEP briefing n° 18 (September 2007)
How Social is European Integration?, by Jacques Pelkmans.

BEEP briefing n° 17 (September 2007)
The Sustainability Impact of the EU Emissions Trading System on the European Industry, by Raimund Bleischwitz, Katrin Fuhrmann and Elias Huchler.

BEEP briefing n° 16 (March 2007)
Services in European Policies, by Luis Rubalcaba.

BEEP briefing n° 15 (July 2006)
European Industrial Policy**,** by Jacques Pelkmans.

BEEP briefing n° 14 (March 2006)
Has the European ICT Sector a Chance to be Competitive? by Godefroy Dang Nguyen & Christan Genthon.

BEEP briefing n° 13 (February 2006)
Testing for Subsidiarity, by Jacques Pelkmans

BEEP briefing n° 12 (November 2005)
La gestion de la transition vers la monnaie unique et l'établissement de la crédibilité de l'euro, by Jean-Claude Trichet.

BEEP briefing n° 11 (September 2005)
Does the European Union Create the Foundations of an Information Society for all?, by Godefroy Dang Nguyen & Marie Jollès.

BEEP briefing n° 10 (January 2005)
A 'Triple-I' Strategy for the Future of Europe, by Raimund Bleischwitz.

BEEP briefing n° 9 (December 2004)
The Turkish Banking Sector, Challenges and Outlook in Transition to EU Membership, by Alfred Steinherr, Ali Tukel & Murat Ucer.

BEEP briefing n° 8 (October 2004)
The Economics of EU Railway Reform, by Jacques Pelkmans & Loris di Pietrantonio.

BEEP briefing n° 7 (June 2004)
Sustainable Development and Collective Learning: Theory and a European Case Study, by Raimund Bleischwitz, Michael Latsch & Kristian Snorre Andersen

BEEP briefing n° 6 (January 2004)
Can Europe Deliver Growth? The Sapir Report and Beyond, by Jacques Pelkmans & Jean-Pierre Casey.

BEEP briefing n° 5 (April 2003)
Efficient Taxation of Multi-National Enterprises in the European Union, by Stefano Micossi, Paola Parascandola & Barbara Triberti.

BEEP briefing n° 4 (April 2003)
EU Enlargement: External Economic Implications, by Jacques Pelkmans & Jean-Pierre Casey.

BEEP briefing n° 3 (March 2003)
Mutual Recognition, Unemployment and the Welfare State, by Fiorella Kostoris Padoa Schioppa.

BEEP briefing n° 2 (December 2002)
Mutual Recognition in Goods and Services: an Economic Perspective, by Jacques Pelkmans.

BEEP briefing n° 1 (October 2002)
Economic Implications of Enlargement, by Jacques Pelkmans.