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European Energy Network Unbundling: the Rationale

By Jean-Michel Glachant, François Lévêque and Marcelo Saguan

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## **European Energy Network Unbundling: the Rationale.**

Jean-Michel Glachant, Loyola de Palacio Chair at RSCAS - European University Institute in  
Florence and Université Paris –Sud XI

François Lévêque, CERNA, Mines ParisTech

Marcelo Saguan, Jean Monnet Fellow at RSCAS - European University Institute in Florence

### **Abstract**

Electricity transmission arrangements have to be ranked according to several criteria like: transaction cost saving, performance based regulation implementation, conflicts of interest, non-discriminatory access and benefits from regional integration. It explains why, when accounting the benefits from regional market integration, a basic unbundling arrangement like the one proposed by the Third Package (the “Independent TSO”) is not necessarily the best one for the European internal energy market achievement.

**Keywords:** Energy Internal Market; Ownership unbundling; Third Package; Transmission System Operators.

## 1. Introduction

The publication of the EU Commission's proposal for the 3<sup>rd</sup> legislative energy market package in September 2007 reopened a much debated issue about the pros and cons of different electricity transmission institutional arrangements.<sup>1</sup> Since then the EU Commission and Member States have mainly debated on the advantages and drawbacks of three arrangements: the Independent Transmission System Operator (ITSO), the Legally unbundled Transmission System Operator (LTSO) and the Independent System Operator (ISO). The discussions have been focused mostly on the "Ownership Unbundling" issue which represents how transmission companies are completely separated or not from generation and retailing activities. ITSO arrangement corresponds to a complete ownership unbundling of transmission assets from generation and retailing companies. By contrast, in LTSO arrangement, transmission assets are just legally unbundled. In a nutshell, the ISO is responsible for the system operation. It is independent from generation and retail but does not own the transmission assets.

The EU Commission considers that ITSO is the first-best option because it ensures the independence of the transmission company, an independence that is viewed as critical to guarantee a non-discriminatory access to the network.<sup>2</sup> Even if the LTSO option was not considered in the first proposal, now it appears to be a second-best option supported by the "third way" proposal of several Member States (France, Germany, etc.) including additional implementation requirements to address the non-discriminatory access issue. Surprisingly until now, the Commission has seemed to pay little attention to a third transmission arrangement: the Independent System Operator (ISO). One of the major critics to the choices of the EU Commission has been the lack of proper consideration of the regional market integration in the Third Package debate (De Jong 2008, Moselle 2008). This is because there have been said that regional transmission organizations have to be considered in the debate (see for instance Eurelectric 2007a, 2007b). The reopened debate about different electricity

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<sup>1</sup> See the Commission Web site at [http://ec.europa.eu/energy/electricity/package\\_2007/index\\_en.htm](http://ec.europa.eu/energy/electricity/package_2007/index_en.htm) for initial drafts of the legislation, as well as additional documentation and links.

<sup>2</sup> The foundation of the preference of the EU Commission can be found mainly in two reports/studies: the "Energy Sector Inquiry" and the "Impact Assessment of the Third package". Both studies conclude that the vertical integration between transmission companies and generation (and retailing) activities and the lack of non-discriminatory access were the mayor causes of the lack of competition in European Electricity Market. Therefore, structural measures as the "ownership unbundling" and the corresponding transmission organization (ITSO) were proposed to ensure a real non-discriminatory access to the network.

transmission institutional arrangements has often been undertaken more in political than in rational terms. Very often the different features of transmission organization are mixed up and no clear insights can be extracted from the debate.

How to rationally compare and rank the ITSO, the LTSO and the ISO arrangements for electricity transmission?

This article attempts to answer this question in looking for theoretical evidence. It develops a comprehensive framework that has enabled us to assess the performances of each arrangement according to five criteria: *1) Transaction cost savings, 2) performance based regulation implementation, 3) conflicts of interest, 4) non-discriminatory access and, 5) benefits from regional integration.* We make two important contributions to the debate. Firstly, according to the five criteria, there is not a first-best arrangement for all the situations. The performance of different arrangements and their ranking have to be determined looking at the weight of each criterion in each particular system characteristics, i.e. these performance differences are better suited to some situation in the EU diversified networks situation. Secondly we build several rankings following assumptions on differently weighted criteria in order to identify the key issues viewed by different stakeholders and we compare viewed criterion's weights to factual evidence and national experiences.

This article is organized as follows. The comparison framework and selected criteria are presented in section 2. In section 3 we apply our framework to rank transmission arrangements depending upon the relative weight of each criterion. Section 4 concludes.

## **2. The comparison framework**

Three transmission arrangements are compared in this paper: Independent Transmission System Operator (ITSO), the Legally unbundled Transmission System Operator (LTSO) and Independent System Operator (ISO) arrangements. Figure 1 summarizes the characteristics of these arrangements following two axes: i) independence of transmission system operation from generation and retail activities and ii) integration of transmission functions. Concerning the first axis, ITSO and ISO are completely independent from generation and retailing activities while LTSO is incompletely independent from generation and retail activities. Concerning the second axis, ITSO and LTSO integrate system operation and ownership functions while in ISO arrangement system operation functions are managed

by the ISO and ownership function are separated in independent transmission owner companies (ITO).<sup>3</sup>

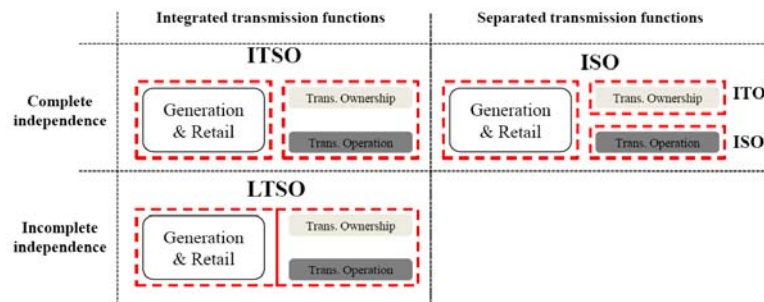


Figure 1. Institutional arrangements for transmission organizations

As identified by the economic literature (Awerbuch et al., 2000 ; Joskow, 2001 ; Oren et al. , 2002 ; Joskow, 2006 ; Pollit, 2007, Brattle 2007; Mercados 2007....), the five criteria that are the most relevant to assess the relative pros and cons of each arrangement are : 1) *Transaction cost savings* ; 2) *performance based regulation implementation* ; 3) *conflicts of interest* ; 4) *non-discriminatory access* and 5) *benefits from regional integration*.

### Criterion 1: transaction cost savings

The nature of the institutional arrangements affects the level of transaction costs. Since system operations (e.g. congestion management), network maintenance and investments are intrinsically inter-connected. The management of all these functions within the same company makes coordination easier and reduces contracting costs. That is to say that the integration of the transmission owner and the system operator reduces transaction costs or that the integrated company enjoys vertical economies. Conversely, splitting the ownership and the system operator functions increases transaction costs. Note also that transmission users' transactions are simplified when all transmission activities are integrated because they have to interact with only one entity.

ITSO and LTSO internalize operational coordination and decisions about network capacity as internal decisions within the same company (Awerbuch et al., 2000 ; Joskow,

<sup>3</sup> As we focus on the independence of system operation activities, in this paper we make no difference between ISO/ITO and ISO/LTO arrangements (in the Legally unbundled transmission owner (LTO) arrangement, the transmission owner is not completely independent from the generation and retail activities). See Lévêque et al. (2008) for a more detailed discussion.

2001 ; Oren et al. , 2002 ; Joskow, 2006 ; Pollit, 2007). We can thus conclude that ITSO and LTSO arrangements are superior to ISO arrangement regarding transaction costs savings.

### ***Criterion 2: performance based regulation implementation***

The nature of the institutional transmission arrangement affects the ease with which an efficient Performance-Based Regulation (hereafter PBR) can be applied. PBR are pragmatic applications of theoretical incentive regulation<sup>4</sup>. The goal of theoretical incentive regulation is to ensure that the transmission regulated company act as a social planner which maximizes the social welfare. So PBR basically consists in completely or at least partially disconnecting the company's regulated revenue from its actual costs. This disconnection provides the regulated company with incentives to reduce costs through efficiency gains. It also facilitates an alignment of the System Operator (SO) objectives with those of the system (reduction of losses, of balancing costs, etc.). The related costs reduction increases the profit of the regulated company. PBR strongly differs from a typical “*cost-of-service*” regulation which provides no incentive to reduce costs as revenue is equal to the actual observed costs. PBR usually consists of a periodic price or revenue cap and is more and more widely applied (e.g. United-Kingdom and Norway. See Joskow 2006, 2007; Sagem 2007). To ensure the efficiency of a PBR it is essential for the regulated company to bear the economic consequences of its decisions.

Institutional arrangements that integrate transmission functions in the same company allow for an easier application of performance-based regulation. The main reason is that under ITSO (and LTSO) arrangements, the regulated company sees the direct economic consequences of its decisions, whereas under the ISO arrangement, the ISO does not have a clear view on the economic consequences of his decisions.

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<sup>4</sup> Incentive regulation is a tool for overcoming the information asymmetry that exists between the regulated firm and the regulator (Laffont-Tirole, 1993). The regulator faces two types of information asymmetry. On the one hand, the regulator does not know the actual costs of the regulated company. The regulated company can take advantage of this asymmetry by overestimating its costs. This is an adverse selection problem. On the other hand, the regulator cannot perfectly observe the regulated company's efforts to reduce costs. This is a moral hazard problem.

For instance, while managing network congestions, if the ITSO must bear congestion costs<sup>5</sup>, he can choose between redispatching generation and supporting related redispatching cost or upgrade the network to decrease congestion cost. So, when he decides network investments, he directly sees the consequences through decrease in redispatching cost as expected for optimal investments, through increase in congestion costs for the worst investments.

Now considering the case of a not-for-profit ISO, the responsible decision-makers in the ISO do not have financial interests on their own. The ISO will not bear the direct economic consequences of its decisions. This lack of financial responsibility precludes the market “takeover” discipline (Joskow 2001). Moreover performance-based regulation presupposes that the regulated company has substantial equity, and that the return on equity is a buffer against changes in efficiency and cost development over time (Joskow 2006). More importantly, Benitez (2007) shows that an ITSO arrangement is better while considering incentive regulation under information asymmetry. To do so, Benitez (2007) makes the assumption that the information asymmetry on the TO function is only related to an adverse selection problem. This assumption is backed on the idea that the regulator has an important lack of information on the installation cost of new transmission facilities (TO functions). Benitez (2007) makes also the assumption that the information asymmetry on the SO function is only related to a moral hazard problem. This assumption is supported by the idea that measuring the performance of SO function is quite complicated for the regulator. Using this particular set-up (adverse selection TO vs. moral hazard SO), he shows that an ITSO arrangement is better because, within the single company, the negative effects from asymmetrical information can counterbalance one another and thus reduce the problem of information asymmetry. When ownership and operation functions are separate, no trade-off between adverse selection and moral hazard effects can be made. Benitez shows that an ITSO faces opposite incentives. On the one hand, the ITSO finds profitable to claim that its cost is high, when low (adverse selection). On the other hand, the effort induced by the regulator when the ITSO follows this strategy leads to lower moral hazard informational rents. The ITSO thus finds the optimal trade-off between the rents coming from the adverse selection problem and the rents derived from the moral hazard environment. It leads to a reduction in the cost suffered by the regulator when inducing efficiency. On the contrary, the allocation of

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<sup>5</sup> This applies to a well-designed ITSO. In many implementations, congestion costs are a pass-through to network users and are not borne by the ITSO.

these activities in a TO and a SO yield a lower expected welfare and efficiency since the firms do not internalize the mentioned effect.

We can thus conclude that ITSO and LTSO arrangements are superior to ISO arrangement regarding performance based regulation implementation.

### ***Criterion 3: conflicts of interest***

A conflict of interest may arise when TO and SO functions are integrated. On the one hand, the function of the SO is to efficiently manage the system to ensure the minimization of overall system costs. This leads the SO to make a trade-off between transmission and generation (or transmission and distribution) investments as these investments are partially substitutable<sup>6</sup>. On the other hand, the TO aims at maximizing the value of its transmission assets. Thus, a first conflict of interest between SO and TO objectives appears when SO and TO functions are integrated in the same company. The economic stakes of TO are much higher than those of SO: an integrated company (ITSO) will thus have an incentive to favor transmission investments even if it would have been preferable, from a social welfare point of view, to invest in generation capacities instead.

A second conflict of interest may also arise in cases of reliability problems, if the SO is not separated from generators, TO or distributors. If the well-informed entity (e.g. SO) is not separate from other participants, responsibilities may not be determined fairly. Another related conflict of interest arises when a reliability problem appears in the network (e.g. a local blackout) and authorities have to determine each actor's responsibilities (Brattle 2007; Mercados 2007). The system operator has to inform the regulator about its own responsibilities but if it is integrated with the transmission owner, information can be distorted as it seeks to avoid possible punishment of the transmission owner's activities. By separating the system operation from the transmission ownership, this kind of conflict of interest can be avoided.

Institutional arrangements allowing transmission functions (ownership and system operator) to be integrated within the same company, to minimize the costs of these functions, may lead the company to prefer transmission solutions over generation or distribution

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<sup>6</sup> For instance, congestion costs can be reduced by increasing the transmission capacity between a low generation cost zone and a high generation cost zone, or by investing in cheap generation in the high generation cost zone.



solutions. An ITSO (and LTSO) arrangement may have incentives to choose transmission solutions over generation solutions (Joskow 2006), or transmission solutions over distribution solutions (Brattle 2007)<sup>7</sup>. In contrast, the ISO arrangement does not have any incentive to choose transmission solutions over generation solutions or over distribution solutions.

We can thus conclude that regarding the conflicts of interest criterion, ISO arrangement is superior to ITSO and LTSO arrangements.

#### ***Criterion 4: non-discriminatory access***

Ensuring non-discriminatory access is essential to enable effective competition in generation and retail. Non-discriminatory access mainly requires: (i) that competitors have access to the existing infrastructure at non-discriminatory tariffs; (ii) that the network capacity be socially optimal (i.e. allow all actual or potential transmission users to make socially efficient transactions) allocated in a non-discriminatory manner (network connection); and (iii) that all market participants share an equal level of information (transparency). The choice of the institutional arrangement has contrasting impacts on non-discriminatory access depending upon the degree of separation between generation/retail and transmission activities.

Institutional arrangements that separate transmission functions from generation companies minimize the risk of a discriminatory access to the network. Full vertical unbundling makes credible in the long run the non-discriminatory access, the tariffs and the optimal expansion of the grid. Concerning the latter point, since the capacity of the network impacts on generators' profits, an integrated electricity generator/transmission faces mixed incentives when considering whether or not to extend the transmission grid. It takes into account the impact of the expansion on its transmission and generation profits and therefore the final transmission capacity of the system is suboptimal (Joskow and Tirole 2000; Léautier 2001; Cremer et al. 2006; Van Koten 2008).

We can thus conclude that ITSO and ISO arrangements are superior to LTSO arrangement regarding the non-discriminatory access criterion.

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<sup>7</sup> This kind of conflict of interest has been reported in Spain. CNE (2005) argues that REE, the Spanish TSO, has restricted the connection possibilities of new distribution facilities (e.g. high / medium voltage substation).

### ***Criterion 5: benefits from regional integration***

This fifth criterion is relevant to assess how different institutional arrangements may capture the benefits from regional integration and expansion of markets and networks. The benefits from coordinating regional interconnected power systems are mainly the increase in cross-border competition and the internalization of cross-border externalities.<sup>8</sup>

The coordination of regional interconnected power systems may be more or less easy depending upon the type of (national) institutional arrangements and the strength of the regional regulatory framework. For instance, it is easier to coordinate ISOs across their borders because they are non-profit organizations. Of course, a strong regional regulatory framework facilitates coordination whereas a weak regional regulatory framework (e.g. multilayer regulation, absence of regional regulator) will have more difficulties to generate regional integration benefits.

Institutional arrangements that integrate transmission functions in the same company are more difficult to merge and to coordinate (Oren et al 2002; Joskow 2006; Glachant and Rious 2007, Smeers 2007a; Smeers 2007b; Rious et al 2008; Moselle 2008). The reason is twofold: (1) national incentives associated with transmission arrangements and (2) transmission property aspects.

Regarding the first reason, ITSOs with strong incentives (e.g., PBR) to reduce national transmission costs have no (or very little) interest to coordinate with neighboring transmission organizations (Glachant and Pignon 2006; Smeers 2007a & b). Glachant and Pignon (2006) have shown that a TSO whose network is connected to an adjacent TSO can distort information exchange and reduce coordination in order to increase its profit. This raises several difficulties for regional coordination. The problem is compounded when a weak regional multilayer regulatory framework is in place and regulatory power fails to align national and regional incentives.<sup>9</sup> Conversely, ISOs have no interest to distort coordination with one another because they have no incentive to reduce national transmission costs and

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<sup>8</sup> Benefits derived from coordinating regional interconnected power systems are: (1) more competitive and efficient bulk power system (e.g. more accurate Available Transmission Capacity (ATC) calculations facilitate efficient congestion management and evaluation of regional planning; efficiency gains derived from jointly managing balancing and reserves, etc.); (2) a reduction in pancaking of individual system transmission tariffs; (3) an increase in power system reliability (better information and control); and (4) profits from scale economies.

<sup>9</sup> Brattle (2008) reports empirical examples of the lack of strong cooperation between ITSO without a strong regional regulatory framework (e.g. Nordic case).

because they follow some management protocols that can be changed more easily to integrate the regional perspective.

Concerning the second reason, ISO arrangements facilitate mergers of System Operators and of System Operation to obtain most of the regional coordination benefits, while the ownership of national transmission assets is more frequently blocked in the hands of national owners by their respective governments. This complicates a merger between ITSOs because it supposes that national transmission assets will have to be transferred to a multinational (or foreign) owner.

We can thus conclude that ISO arrangement is more suitable than ITSO and LTSO arrangements regarding benefits from regional integration.

<b>Institutional arrangements</b>	<b>ITSO</b>	<b>LTSO</b>	<b>ISO</b>
Criterion 1: Transaction cost savings	+	+	-
Criterion 2: PBR implementation	+	+	-
Criterion 3: Conflict of interest	-	-	+
Criterion 4: Non-discriminatory access	+	-	+
Criterion 5: Benefits of market integration	-	-	+

*Table 1: Institutional arrangement comparison: the pros and cons of each arrangement*

At first glance, according to our framework, none of the arrangement is a clear first best solution with five pluses, i.e. an arrangement that was superior no matter the weight of criteria. Our quest will be now to find which second best is adapted to key issues in the each particular system. Arithmetically, ISO seems a better option than LTSO for it scores 3 pluses against 2. However, there is no reason that each criterion enjoys the same importance and weighted average of criteria can change the final appreciation according to network problems. For instance, the savings of transaction cost can be of lower importance than the benefits owing to market integration.

As a general rule, the ranking of the arrangements ultimately depends on the relative weight of each criterion and their coherence with the main choices needed to be done in different countries and network situations<sup>10</sup>. Lastly it is important to highlight that the added

<sup>10</sup> One should bear in mind that the ranking obtained for theoretically well-designed arrangements cannot be directly transposed to rank current implementations. We may find a well-implemented LTSO that does better

value of our framework is to be able to interpret the EU Commission preferences in choosing a frame instead of another. By selecting one frame, the EU Commission assumes, voluntary or not, that the *benefits from regional and networks integration* are of less importance than *transaction costs savings* and the benefits from *performance based regulation* implementation.

### 3. Ranking of well-designed arrangements

The rankings below are based on a series of assumptions and on empirical evidence we think are of interest. We consider three cases. The two firsts correspond to the assumptions that regional integration effects can be neglected with respect to the other criteria (i.e. following a national isolated perspective). In the third case we take into account the benefits of regional integration.

In an isolated system perspective, assuming that regional and network integration are not a relevant criteria, a well-designed ITSO is the first-best institutional arrangement whenever we assume that the costs of a potential conflict of interest are lower than transaction cost savings, benefits from PBR implementation and benefits from ensuring a non-discriminatory access. However, the second and third best of the ranking depend on such assumptions. Consequently we have obtained two main rankings:

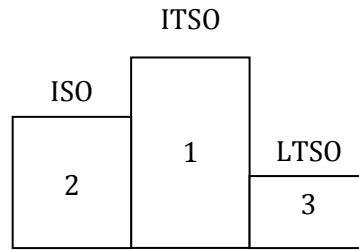
#### Case 1

If benefits from ensuring non-discriminatory access outweigh transaction costs savings and benefits from PBR implementation, ISO ranks second above LTSO. This case would correspond to a system where the discriminatory access problem is a big issue for the deployment of competition compared to the need for improving the management of the network<sup>11</sup>. This seems consistent with the EU Commission's view.

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than a badly-implemented ITSO even if theoretical well-designed ITSO always ranks above LTSO. Lévêque et al (2008) report several examples of current implementations that differ significantly from well-designed theoretical arrangements. The most important factor mentioned as a reason for badly implementation is an imperfect regulatory framework (whether it is due to regulatory capture, lack of power of the regulator, absence of incentive regulation, etc.).

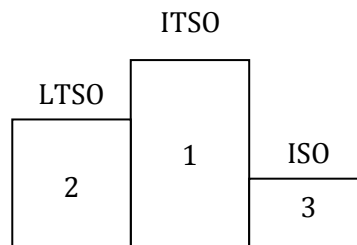
<sup>11</sup> Taking into account the conflict of interest criterion reinforces the advantage of the ITSO arrangement.



*Figure 2: Ranking according to weighted combination N°1 (EU Commission's view)*

### Case 2

If transaction cost savings and/or benefits from PBR implementation outweigh benefits from ensuring non-discriminatory access, LTSO becomes the second-best institutional arrangement, above ISO. This case would correspond to a system where the discriminatory access problem is not a big issue compared to the need to improve the network and to reduce transmission costs. An example of this situation would be a competitive market immersed in a tightly meshed and congested grid: in this case, the benefits from better coordination and an easier incentive regulation could outweigh the benefits from non-discriminatory access.



*Figure 3: Ranking according to weighted combination N°2*

To conclude, in an “isolated” power system (no interconnection or a DC interconnection associated with low externalities with the neighboring power systems) as in Great Britain, ITSO appears to be the first-best arrangement. The ranking depends on the relative weights of criteria. If transaction cost savings and/or benefits from PBR implementation outweigh the benefits from ensuring non-discriminatory access, from market and network integration and from reducing the conflict of interest, LTSO becomes the second-best institutional arrangement, after ITSO but above ISO. This case would correspond to a system where the discriminatory access problem and regional integration concerns are not

a big issue compared to the need to improve the network and to reduce transmission costs. If benefits from ensuring non-discriminatory access outweigh all other criteria, then ISO ranks second above LTSO. This may be the weighted average of criteria in the mind of the EU Commission and the justification for the EU ranking on this issue.

Case 3

In an interconnected regional system (e.g., continental Europe), a well-designed ITSO is no more the first-best institutional arrangement for all situations; the first-best and the complete ranking depend on the new weight of each criteria. If the benefits from market and network integration and from reducing conflict of interest outweigh transaction cost savings, the benefits from PBR implementation and the benefits from ensuring non-discriminatory access, ISO ranks first, followed by ITSO and LTSO. This case would correspond to a system where regional integration concerns are a more important issue than the need to improve the network and to reduce transmission costs.

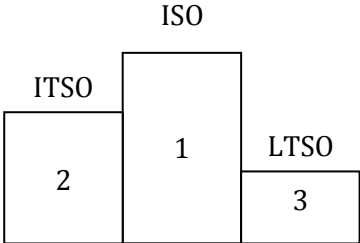


Figure 4: Ranking according to weighted combination N°3

**4. Conclusion**

We demonstrated that taking into account the potential benefit from market and network integration substantially modifies our ranking of the three different institutional arrangements: ITSO is no longer always the “one-fit all- solution”. A key result is that the benefits from a non-discriminatory access do not enable us to choose between ITSO and ISO.

Interestingly, we found the two following possibilities:

- 1- ITSOs is the best possible option if we assume that transaction cost savings and/or the benefits from PBR implementation outweigh the benefits from market and network integration and from reducing the conflict of interest. This case would correspond to a system where cross-border externalities and cross-border competition were not a big issue compared to the need for improving the (national) network and reducing transmission costs. An example would be two national systems weakly interconnected but with a tightly meshed and congested national network (and thus needing incentives to minimize costs).
- 2- ISOs become the best possible option when the benefits from regional market and network integration and from reducing the conflict of interest outweigh transaction costs savings and/or benefits from PBR implementation. This case would correspond to a system where cross-border externalities and cross-border competition are a big issue compared to the need for improving the network and reducing transmission costs. An example would be two systems with meshed interconnection and serious national generation competition concerns (e.g. Belgium, Netherlands, France and Germany). It would moreover correspond to an interconnected system where the regional regulatory and coordination framework is weak. In this situation we can conclude that ISO arrangements are better than ITSO arrangements.

The benefits from a non-discriminatory access do not enable us to choose between ITSOs and ISOs. Thus, the EU Commission ranking could not be rationally justified by the wish to ensure a non-discriminatory access. The relevant factor allowing for the ranking of ITSOs and ISOs is the relative weight of the transaction cost savings and of the benefits from PBR implementation compared to the benefits from regional market and network integration. Thus, we interpret that the EU Commission assumed in its ranking that the benefits from regional and networks integration are of less importance than transaction costs and the benefits from PBR implementation. However, we believe that these benefits could be especially valuable in the case of continental Europe that is characterized by a tightly meshed network, critical cross-border externalities and a high potential for cross-border competition in generation.

Market integration is certainly a key issue for the future of an interconnected EU power system. Moreover, the implementation of a strong EU wide regulatory framework is a challenging issue. Benefits from market integration could then be facilitated by ISOs which also efficiently ensure non-discrimination access. Conversely, proposals directly to more regional solutions (e.g. Eurelectric) appear to consider that the benefits from regional market and network integration are critical. We think that our methodology paves the way to better the understanding of the debate by revealing the order of preference of the main actors of the debate.

It is important to bear in mind that we limit our work to situations where national institutional arrangements that are connected are identical from one region to another. We did not analyze cases such as the connection of a region with an ITSO and a region with an ISO, nor the connection of a region with an LTSO and a region with an ISO. Our intuition is that connecting regions with different institutional arrangements would be even more difficult than the connection of identical arrangements. That is why we believe that a first objective of the EU Commission should be to ensure that continental European countries adopt the same arrangement. Coordination of a hybrid combination of institutional arrangements is likely to raise additional difficulties, especially if the regional regulatory framework is weak.

## **References**

Awerbuch, Sh., Crew M., Kleindorfer P., (2000), “Transmission - Enabler of Wholesale Competition”, in *Expanding Competition in Regulated Industries*, ed. Michael Crew. Boston MA: Kluwer Academic Publishers, May, pp. 23-40.

Benitez D. (2007), “Analyzing the Transmission System in the Electricity Industry: A contract Design Approach”, World Bank Working Paper, July 2007.

Borenstein, S., Bushnell, J., Stoft, S., (2000) “The competitive effect of transmission capacity in a deregulated electricity industry”, *The RAND Journal of Economics*, 31(2):294—325, Summer 2000.

Brattle Group (2007), “Regulating Unbundled TSOs: Rules, Incentives or an ISO?”, The Brattle Group, November 2007.



Brattle Group (2008), “Independent System Operators for Power Transmission: Evidence-Based Assessment, April 2008.

CNE (2005), “Reflexiones sobre la situación actual del sector eléctrico”, Comisión Nacional de Energía, Dirección de Energía Eléctrica, January 2005.

Cremer H., Crémer J., De Donder Ph., (2006), “Legal vs Ownership Unbundling in Network Industries”, Working Paper, University of Toulouse (IDEI and GREMAQ), July 3, 2006.

De Jong J. J., (2008), “The third EU energy Market Package: are we singing the right song?”, Clingendael International Energy Program, February 2008.

EURELECTRIC (2007a), “EURELECTRIC’s Position Paper on the 3rd Energy Package”, Drafting Group on Energy Package, December 2007

EURELECTRIC (2007b), “Third legislative Package. Proposal for EURELECTRIC’s Position and amendments”, Presentation Markets Committee, December 2007.

Glachant J.M., Pignon V., (2006), « Nordic congestion's arrangement as a model for Europe? Physical constraints vs. economic incentives”, *Utilities Policy*, 2005, vol. 13, issue 2, pages 153-162.

Glachant J-M, Rious V. (2007), “A typical case of weak institutional complementarity in institution building: The design of transmission network monopoly in competitive electricity markets,” ISNIE Conference in Reykjavik, June 2007.

Hogan W.W., (2000), “Regional Transmission Organizations: Millennium Order on Designing Market Institutions for Electric Network Systems” May 2000.

Joskow P., (2001), “Regional Transmission Organizations: Don’t settle for Nth Best ( $N \gg 1$ )”, presentation available on-line in <http://econ-www.mit.edu/files/1148>, September 2001.

Joskow P., (2006), “Patterns of transmission investment”, in Lévêque F. (ed.), *Competitive Electricity Markets and Sustainability*, Edward Elgar, 131-186.

Joskow P., (2007), “Independent System Operators (VI + Access Rules vs. ISO vs. TSO)”, presentation 28 September 2007.

Joskow P., Tirole J. (2000), “Transmission rights and market power on electric power networks”, *Rand Journal of Economics*, 31 (3): 450-487, Autumn 2000.

Laffont, J.-J & J. Tirole (1993). A theory of incentives in regulation and procurement, Cambridge, MA, MIT Press.

Léautier T. O., Thelen V., (2008), “Optimal expansion of the power transmission grid: why not?” Discussion paper, Toulouse School of Economics, January 2008.

Léautier T.O. ,(2001), "Transmission constraints and imperfect markets for power", Journal of Regulatory Economics, 19(1): 27-54, 2001.

Lévêque F., Saguan M., (2008), “Comparing electricity transmission arrangements Revisiting the main arguments from the economic literature to shed light on the EU 3rd Directive debate”, July 2008.

Mercados (2007), “Alternativas de organizacion de las funciones de transporte y operacion del sistema”, Energy Markets International, 5 December 2007.

Moselle B., “Reforming TSOs: Using the ‘Third Package’ Legislation to promote efficiency and accelerate regional integration in EU wholesale power markets”, The Electricity Journal, Vol. 21, Issue 8, October 2008.

Oren S., Gross G., Alvarado F. (2002), “Alternative Business Models for Transmission Investment and Operation”, DOE National Transmission Grid Study Report, pp. C4-C34, May, 2002.

Pollitt M. (2007), “The arguments for and against ownership unbundling of energy transmission networks”, EPRG Working Papers, [www.electricitypolicy.org.uk](http://www.electricitypolicy.org.uk), August 2007.

Rious V., Glachant J-M., Perez Y., Dessante P., (2008). "The diversity of design of TSOs", Energy Policy 36.9, 2008, (IF 2007: 1,901), pp. 3323-3332.

Sagen J. (2007), “System Operation Functions. How to give incentives to TSOs and ISOs”, presentation Norwegian Water Resources and Energy Directorate, 2007.

Smeers Y. (2007a), “Future structure and regulation of transmission networks in Europe”, presentation in Joint Cambridge-MIT Conference, London Trinity House, 26-28 September 2007.

Smeers Y. (2007b), “Market Design in Electricity. The European mix of competition law and regulation.” Research Institute of Economy, Trade and Industry, Tokyo, October 25th, 2007.

Van Koten S., (2008) “The Causes and Effects of Imperfect Unbundling of Transmission and Generation in the European Union: Theoretical and Empirical Investigations”, PhD dissertation, CERGE-EI, 2008.