European Regulators Group for Electricity & Gas

Incentive Schemes to promote Cross-Border Trade in electricity

CALL FOR EVIDENCE

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European Regulators' Group for Electricity and Gas
Contact: Council of European Energy Regulators ASBL
28 rue le Titien, 1000 Bruxelles
Arrondissement judiciaire de Bruxelles
RPM 0861.035.445

INFORMATION PAGE

Abstract

This document (E08-ENM-07-04) is an ERGEG call for evidence on incentive schemes to promote cross-border trade.

This paper should be considered as a first step in discussions with TSOs and other stakeholders. The ideas presented in this discussion paper should not be considered to represent a definitive ERGEG position on the subject. In addition, ERGEG considers the issue of incentives to promote cross-border trade as a long term goal and will concentrate in the short and medium term on the issue of designing good performance indicators that will be transparently published.

Target Audience

Transmission system operators, energy suppliers, traders, electricity customers, electricity industry, consumer representative groups, power exchanges, academics and other interested parties are the target audience of this discussion paper.

How to respond to this call for evidence

Deadline: **29 March 2010**

Comments should be sent by e-mail to **incentive_schemes@ergeg.org.**

If you have any queries relating to this consultation paper, please contact Mrs. Fay Geitona, Tel. +32 (0) 2788 73 32, Email: fay.geitona@ceer.eu.

All responses (except for those parts which are explicitly stated as confidential) will be published on the website www.energy-regulators.eu.

Treatment of Confidential Responses

In the interest of transparency, ERGEG:

- will list the names of all respondents (whether confidential or not) or, alternatively, make public the number (but not the names) of confidential responses received;

- requests that any respondent requesting confidentiality submit the confidential sections of their response in a “confidential appendix”. ERGEG will publish all

sections of responses that are not marked confidential.

For further information on ERGEG's rules, see the ERGEG Guidelines on Consultation Practices[1].

Related Documents

CEER/ERGEG documents

- "ERI Coherence and Convergence Report - An ERGEG Conclusions Paper", ERGEG, 15 February 2008, Ref. E08-ERI-12-04, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/ERI%20Coherence%20and%20Convergence/CD/E08-ERI-12-04_CCR-CP_2008-02-15.pdf.

- "ERI Coherence and Convergence Report - An ERGEG Public Consultation Paper", ERGEG, 10 September 2008, Ref. E08-ERI-13-03, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/2008%20ERI%20Coherence%20and%20Convergence/CD/E08-ERI-13-03_2nd%20ERI%20Coher%20and%20Converg_10%20Sept%202008.pdf.

- "Regulation (EC) 1228/2003 Compliance Monitoring Second Report, 2008", ERGEG, 10 September 2008, Ref. E08-ENM-03-05, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/2008%20Compliance%20Monitoring/CD/E08-ENM_03-05-Second_Compliance_Report_10%20Sept%202008.pdf.

- "ERI Coherence and Convergence Report – An ERGEG Consultation Paper", ERGEG, 18 July 2007, Ref. E07-ERI-05-03, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_INITIATIVES/Progress_Reports/2007/RI_Coherence_Convergence_Reports/E07-PC-21-01_E07-ERI-05-03_final.doc

External documents

- Regulation (EC) 1228/2003 on conditions for access to the network for cross-border exchanges in electricity, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:176:0001:0010:EN:PDF

- Commission Decision of 9 November 2006 amending the Annex to Regulation (EC) No 1228/2003 on conditions for access to the network for cross-border exchanges in electricity, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:312:0059:0065:EN:PDF

[1] http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/E07-EP-16-03_PC-Guidelines_2009-Mar-11.pdf

- "Report on electricity interconnection management and use", CRE, June 2008, http://www.cre.fr/en/content/download/5677/122968/file/080708Rapport2008InterconnexionsUK.pdf.

- "Implementation Study - A report for the MoU signatories on the design of the market coupling solution in the Central West European (CWE) region, by the CWE MC Project", APX, Belpex, Cegedel, EEX, Elia, EnBW, E.ON Netz, Powernext, RTE, RWE and TenneT, August 2008, http://www.rte-france.com/htm/fr/offre/telecharge/Implementation_Study.pdf.

- "Implementation Study Addendum - Addendum to the report for the MoU signatories on the design of the market coupling solution in the Central West European (CWE) region, released by the CWE MC Project", APX, Belpex, Cegedel, EEX, Elia, EnBW, E.ON Netz, Powernext, RTE, RWE, TenneT, November 2008, http://www.rte-france.com/htm/fr/offre/telecharge/CWE_MC_Addendum_PLEF.pdf.

- "Economic assessment of different congestion management methods - Report for the Federal Network Agency", Frontier Economics, Consentec, IAEW, November 2006, http://www.bundesnetzagentur.de/media/archive/8652.pdf.

- "Congestion Management Guidelines - Implementation within the Nordic market", NordREG, Report 4/2008, https://www.nordicenergyregulators.org/upload/Reports/CMGuidelinesImplementation.pdf.

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EXECUTIVE SUMMARY

ERGEG is working on three areas of congestion management in electricity: firmness, transparency and incentives. The three ERGEG papers being prepared on these issues aim to deal with the current gaps in the Regulation (EC) 1228/2003 and the Congestion Management Guidelines (Decision 2006/770/EC). This paper focuses on approaches for addressing congestion management and cross-border capacity issues with TSOs.

The paper addresses the issue of designing incentive schemes to promote cross-border trade in electricity. The scope of this paper is also supported by the Third Package which clearly calls on national regulators to ensure that network operators are granted adequate incentives, over both short and long terms, to increase efficiencies and foster market integration.

The paper discusses the complexity of designing efficient and coherent incentive schemes to promote cross-border trade. This complexity mainly stems from the fact that the legal, regulatory and institutional framework is not well-suited for such cross-border incentive schemes. In particular, it has been emphasised that there is not currently a sound legal basis to implement incentive schemes to promote cross-border trade. The regulatory gap and the multiplicity of parties involved also constitute important obstacles.

The paper concentrates on “short-term” incentives to promote cross-border trade given the existing electricity network infrastructure. For this reason, promoting cross-border trade equates by and large to improving congestion management methods. This includes all steps from capacity calculation to capacity allocation and capacity use. The investments in new network infrastructures are not considered in this document. This is because the timeframe for the infrastructure investments is much longer than the timeframe for implementing efficient capacity calculation methods and allocation mechanisms. In this context, two different approaches to improving congestion management methods are presented. The first approach consists of an incentive scheme based on a single indicator of performance which reflects the efficiency of congestion management as a whole. The second approach consists of one or several incentive schemes which aim at fostering specific projects or issues related to congestion management.

The European Regulators Group for Electricity and Gas (ERGEG) considers this paper as a first step in discussion with Transmission System Operators (TSOs) and other stakeholders. The ideas presented in this paper should not be considered to represent the definitive position of ERGEG on the subject. This call for evidence is intended as a fact-finding exercise to further develop ERGEG’s analysis of the issue. In addition, ERGEG considers the issue of incentives to promote cross-border trade as a long term goal. In the short and medium term, the focus will be on the design of good indicators which reflect the efficiency of cross-border trade. ERGEG will not consider launching any incentive scheme to promote cross-border trade until - through experience - reliable indicators have been agreed upon.

1 Introduction

1.1 Problem identification

1.1.1 Aims of market integration

Market integration is the prerequisite for the creation of a single European electricity market. This objective has been adopted by the European Union for several reasons, all of which aim to optimise the efficient use of European electricity infrastructures. The first reason is that market integration allows for the use of resources at a European level. This leads to several types of efficiencies, since national consumption curves as well as national generation parks are complementary and reserve capacity can be shared. The second reason is that market integration fosters competition between suppliers as well as between producers. Third, market integration provides for greater security of supply.

Regulators believe that market integration and the creation of a single electricity market will allow for a more efficient use of resources and consequently lower prices, whilst improving grid security and services to final consumers.

This paper focuses on two main elements of market integration, namely:

- Maximising the use of existing interconnectors (e.g. increasing available capacity to the market where possible); and

- Efficient use of existing interconnector capacity (e.g. efficient capacity allocation and management).

1.1.2 Role of TSOs and regulators regarding market integration

TSOs are major actors in the process of market integration, responsible for improving the efficiency in the use of existing infrastructure as well as for developing new infrastructure. With regard to the use of existing cross-border infrastructure TSOs are, according to Regulation (EC) 1228/2003, in charge of:

- calculating the maximum cross-border capacities complying with standards of secure operation (cf. Annex 3 for the duties of TSOs regarding cross-border capacity maximisation);

- allocating these capacities to the market; and

- publishing the data related to these capacities.

The amended Annex to Regulation (EC) 1228/2003, i.e. the Congestion Management Guidelines (Decision 2006/770/EC), gives further details on the role of TSOs regarding the use of cross-border transmission capacity. For example, TSOs are requested:

- to adopt congestion management methods which give efficient signals to them and to market participants;

- to coordinate with each other regarding capacity calculation and optimisation of allocation to secure operation of the network; and

- to optimise the degree to which capacity is firm.

According to the Regulation, National Regulatory Authorities are responsible for reviewing and evaluating capacity allocation methods and of approving capacity calculation schemes. According to the different national legal frameworks, regulators may have additional powers (e.g. formally approving capacity allocation methods).

This paper looks at whether incentive schemes may have a place in encouraging TSOs to achieve the above objectives. This would not seek to replace the regulators' mandate to evaluate and review the actions of TSOs in this area but may provide a more efficient means of achieving the outcomes required by the Regulation and annexed Congestion Management Guidelines.

1.1.3 Current state of market integration

ERGEG launched the process of the electricity Regional Initiatives (ERI) in February 2006 to contribute to market integration. In this process various regional projects aiming to improve congestion management methods are being elaborated by TSOs with the support of regulators and, in certain cases, in cooperation with Power Exchanges.

In 2007, ERGEG published its ERI Coherence and Convergence Report – An ERGEG Public Consultation Document, which presented the principles of efficient congestion management mechanisms and included the following issues:

- *A common transmission model:* the calculation of cross-border transmission capacities using load-flow calculations based on a common network model is an essential contribution to maximising available transmission capacities under secure network conditions and dealing efficiently with interdependent physical loop flows, especially for regions with highly meshed networks;

- *A single explicit auction platform* with harmonised auction rules, IT interface and products for long and medium-term allocation;

- *An implicit auction model for the day-ahead timeframe* (market coupling or market splitting);

- *An intra-day mechanism with an option for continuous trading*; and

- *The development of cross-border balancing exchanges* (e.g. TSO to TSO model as a first step) aiming to facilitate balancing market integration.

However, whereas the ERI process has significantly contributed to market integration, the process has also encountered some delays in several regional projects. The differences in market designs, the regulatory gap and the lack of human and financial resources are among the most severe obstacles to market integration as was shown in coherence and convergence reports published by ERGEG in 2007 and 2008.

1.1.4 The purpose of incentives schemes to promote cross-border trade

1.1.4.1 The information problem

Some of TSOs' legal duties related to market integration are not easily verifiable by regulators. This problem was pointed out in the Second Compliance Report published by ERGEG in September 2008. For example, regulators can not evaluate to what extent TSOs are coordinating with each other and are not able to evaluate whether cross-border capacities are maximised (except to some extent in some particular cases like DC cables.) Neither can regulators evaluate the degree to which the firmness of capacity is optimised. The efficiency of congestion management methods is also subjective, because of the lack of predefined criteria.

In fact, for many aspects of congestion management which make up the core business of TSOs, there is an asymmetry of information between TSOs and regulators (as well as market players, the European Commission and Member States).

The most striking example of this kind is the maximisation of available commercial capacity requested by Regulation (EC) 1228/2003. Regulators cannot know, in general, if cross-border capacities are maximised because:

- Regulators do not know to what extent TSOs coordinate with each other, for instance in order to take into account loop flows in the most appropriate way;
- Regulators do not know the precision of and reasons for the security margins kept by TSOs;
- Even if regulators were aware that capacities are not maximised, they do not know to what extent this is so. Neither can they know the cost of increasing available capacity or what the implications of doing so would be on operational security.

In the context of regulated entities, incentive schemes designed to overcome this lack of information are well developed in economic literature. Annex 4 provides a summary of this economic background.

1.1.4.2 The lack of adequate incentives to promote cross-border trade

Whilst setting incentives related to the performance of TSOs (e.g. as regards transmission tariff regulation and the inbuilt incentives to improve cost efficiency and quality) has become a common feature all over Europe, regulators are aware that similar incentive regulation to promote cross-border trade has not yet been implemented.

Regulators and TSOs have in the past focussed more on nationally-oriented priorities (e.g. reduction of network tariffs, security of supply, etc.) due to the powers and clear mandates given by the national legislation. This could be seen as an impediment to the creation of an internal market.

ERGEG is of the view that market integration should be an integral part of the objective duties of each national regulator. Further, national regulators should be encouraged, where appropriate, to put this duty at least at the same level as national priorities when setting national network tariffs.

Moreover, ERGEG is of the view that TSOs play a critical role in the market integration process. This role could be enhanced by providing them with adequate incentives to promote cross-border trade and thus also effective market integration.

To the extent that it both reduces the regulatory gap and clearly calls on national regulators to ensure *"that network operators are granted adequate incentives, over both short and long terms, to increase efficiencies and foster market integration",* the Third Package could significantly help regulators to achieve progress in this area.

An incentive could take the form of benchmarks and targets linked to financial payments or penalties. Several examples of such incentives are presented in Chapters 2 and 3.

1.1.5 Challenges for regulators in implementing incentive schemes to promote cross-border trade

A number of different factors can play a critical role in the elaboration of incentive schemes in general. They include in particular:

- *The cost of reducing lack of information ex ante*: Before defining an incentive scheme, the regulator could decide, for instance, to hire experts to order benchmarking analyses or to conduct very detailed and intrusive audits of TSOs' activities. Nevertheless, all these actions have a cost for the regulator, which needs to be evaluated and compared to their expected benefits;

- *The dynamic aspects of regulation*: For instance, the duration of the incentive scheme, as well as the regulator's ability to credibly commit itself not to renegotiate the terms of the incentive scheme in the middle of a tariff period, can have an impact on the design and the efficiency of an incentive scheme;

- *The multiplicity of parties (mainly regulators and TSOs), combined with the multiplicity of objectives pursued by each of these parties*: this could introduce significant complexity in the design of efficient incentive schemes;

- *The undesirable incentives that may be created by financial incentives to promote cross-border trade*: under no circumstances should an incentive scheme to promote cross-border trade be detrimental to grid security.

The objective of a regulator is therefore to define an incentive scheme(s) that will achieve an optimal trade-off between all these different factors. The difficulty and hence cost of the exercise has to be weighed against the expected benefits (i.e. efficiency increase) of the optimal incentive scheme.

1.1.6 Features of an "ideal" incentive scheme to promote cross-border trade

The definition of an incentive scheme is a complex task as it should simultaneously have the following features. It should be:

- *Designed to maximise consumer benefit:* The incentive scheme should encourage the TSO to undertake measures that maximise social welfare / benefit e.g. by linking the financial rewards accrued by the TSO to the increase in welfare thus providing an incentive for it to maximise the benefit to society;

- *Simple and easily understandable to all stakeholders:* Ideally the incentive scheme should consist of a single indicator of performance, reflecting the degree of market integration as a whole. This indicator should be designed in such a way that it would show if the available capacity calculated by TSOs increases, or if more efficient allocation mechanisms become established, or if the compatibility of the different national market designs is improved. In other words, the indicator shows if TSOs succeed in improving the efficiency of cross-border trade;

- *Objectively measurable:* A well-defined quantitative target with a straightforward interpretation must be determined. The rule for the split of savings and costs between TSOs and final consumers has also to be clearly defined in advance;

- *Controllable by TSOs:* The indicator of performance should not be sensitive to external factors which are not under the control of TSOs (typically market behaviours). The indicator should be measured over a relatively long period in order to balance out positive and negative impacts of external factors. Moreover, TSOs should be left with a maximum degree of freedom as regards how to improve market integration and hence the indicator of performance;

- *Challenging and attractive for TSOs:* The target of performance has to be reasonably ambitious. At the same time the financial agreement concerning rewards and penalties applied to TSOs has to provide TSOs with strong enough incentives;

- *Applicable EU-wide:* The incentive scheme should be applied as widely as possible (ideally EU-wide, not only region-wide) to avoid creating distortions between borders and countries. Switzerland, being at the centre of the European network, should be within the scope of the incentive scheme;

- *Compatible with other national and European priorities:* The incentive scheme has to be compatible with regulators' other priorities, such as the reduction of grid access tariffs, network security or development of renewable sources of energy.

1.2 Structure of paper

This rest of the Paper is structured as follows:

Chapter 2 proposes indicators which could be used as proxies to promote cross-border trade. A reference value would be set by the Regulator and the TSO would be free to choose the most efficient approach to influence this indicator in a positive way.

Chapter 3 focuses on incentivising specific projects (e.g. market coupling, balancing market integration, capacity product optimisation) as opposed to allowing the TSO to choose from a suite of measures as in Chapter 2.

Chapter 4 looks at the process for establishing the incentive scheme. This includes looking at historical value of the indicators; the determination of the target performance as well as the source of income for the incentives.

Chapter 5 evaluates the approaches outlined in Chapters 2 and 3. In particular, it discusses the expected acceptance by different stakeholders (TSOs, power exchanges, regulators etc) of each approach to incentivising TSO behaviour.

Chapter 6 provides some general conclusions.

Annexes 3 to 6 cover respectively:

- Duties of TSOs regarding cross-border transmission capacity maximisation;
- Economic background on incentive schemes;
- Determination of the Net Export Curves of French and Spanish markets;
- Distribution of surplus generated by cross-border flows.

1.3 Technical meeting on cross-border trade in September 2009

ERGEG arranged on 21 September 2009 a closed technical meeting to discuss this document with stakeholders. The meeting was attended by representatives from the European Network of Transmission System Operators for Electricity (ENTSO-E), EuroPEX, Eurelectric and the International Federation of Intensive Energy Consumers (IFIEC).

The following points were raised during the meeting:

- Targets should be clear, well-defined, observable and measurable. These targets need to be achievable and realistic;
- Incentives can be a powerful way to improve performance over time but further work on basic principles is needed before practical regimes can be designed and implemented;
- Cross-border incentive regimes should not conflict with national regimes. In particular, incentive schemes should not lead to perverse signals regarding system security, which should be a priority at all times;
- Consistency is required between countries/regions, such that harmonisation (both targets and mechanisms) should apply where geographically appropriate e.g. supra-national targets to incentivise cooperation;
- As far as possible, indicators need to neutralize externalities beyond the control of TSOs. Wherever this is not wholly possible, a risk assessment (with appropriate capping) could help in the design of financial incentives;
- Regimes developed should be relevant to both “long term” grid investments and “short term” congestion management requirements and both these aspects should be considered in further work;
- Regulators should start by developing and publishing performance indicators, and later adopt meaningful financial incentives linked to these indicators;
- Publication of the performance indicators proposed in the document was supported by the stakeholders;

- The use of social welfare as an indicator is acceptable, but could include potentially severe limitations that must be recognized and taken into account;

- Some of the indicators proposed by NordREG or the indicators published by CRE in the annual report on the use and management of cross-border capacities should be promoted and published on a wider scale;

This useful input from stakeholders will be applied when ERGEG prepares conclusions after public consultation. ERGEG would now like to invite views from all stakeholders before further proposals are developed.

1.4 Questions to be considered during the call for evidence

In the discussions with the TSOs and other relevant stakeholders including, among others, the organisations that represent electricity suppliers, buyers, traders and power exchanges, ERGEG is looking to canvas the opinion of respondents on a number of specific issues related to the scope and applicability of the document.

The respondents are therefore invited to reply and provide comments on the following questions:

- In the current regulatory and institutional framework could incentive schemes be a useful tool for promoting cross-border trade? If so, why?

- If not, which regulatory or other framework would be more suited to promoting cross-border trade?

- Do you agree with the features of an “ideal” incentive scheme? If not, why not? What features should an “ideal” scheme have?

- This paper presents “short-term” incentive schemes for improving capacity calculation and allocation methods. Should an incentive scheme address these short-term incentives together with longer-term incentives, e.g. for infrastructure investments? If so, how?

- Which approach presented in this paper do you favour: an incentive scheme based on a single indicator of performance reflecting the efficiency of congestion management as a whole (Chapter 2), or one or several incentive schemes aiming at fostering one or several specific projects or topics related to congestion management (Chapter 3)? Why?

- Which, if any, of the indicators presented in Chapter 2 do you favour? Why? Do you have any alternative proposals for a single indicator of performance?

- Which, if any, of the incentive schemes presented in Chapter 3 do you favour? Why? Do you have any alternative proposals for a specific project or combination of projects which could usefully be incentivised?

- Despite the potential limitations of all indicators for implementing an incentive scheme, do you share the view that their publication before any incentive scheme is set could help promote the development of cross-border trade and represent a step towards increased transparency?

- If so, at which frequency and on which geographical scope (bilateral/regional/European) should these indicators be designed and published?

- What would be alternative options for promoting cross-border trade?

ERGEG welcomes any additional contributions that could help regulators to define an incentive scheme aimed at promoting cross-border trade.

2 Proposals for a single indicator of performance to promote cross-border trade

This section presents different potential indicators of performance, each attempting to reflect the level of cross-border trade as a whole. The reference value of the indicator would be set by the regulator and the TSO would be free to choose the most efficient approach to influence the indicator.

2.1 Number of congested hours

Consider two markets A and B, quoting day-ahead hourly prices. A congested hour between the two markets is an hour during which the prices of both markets are not the same (or the magnitude of the price differential is greater than a certain amount, e.g. 0,10 €/MWh).

The number of congested hours per year could be an indicator of performance which reflects the level of cross-border trade. Indeed, the more markets are integrated, the smaller the number of congested hours should be.

However, it has to be kept in mind that this indicator may not be precise enough. The indicator does not indicate the level of congestion in any given hour and thus does not differentiate between slight and extreme congestion (e.g. 10 €/MWh, or 100 €/MWh…).

Despite this, the great advantage of such an indicator is its simplicity: the only parameters used to compute the indicator are the day-ahead hourly prices quoted in each market. Thus, calculating this indicator of performance would be easy.

TSOs could act by several means to improve this indicator of performance. For example, implementing the trilateral coupling (TLC) between France, Belgium and the Netherlands caused a successful price convergence:

- In 2006, there were about 90% of congested hours between APX and Powernext (before the launch of the coupling in November 2006);
- In 2007, the number of congested hours fell to about 37%.[2]

2.2 Congestion costs

Another potential indicator reflecting the degree of cross-border trade at a specific border could be the congestion costs at this border. This indicator would be more complete than the previous one because it also takes into account the financial value of congestions.

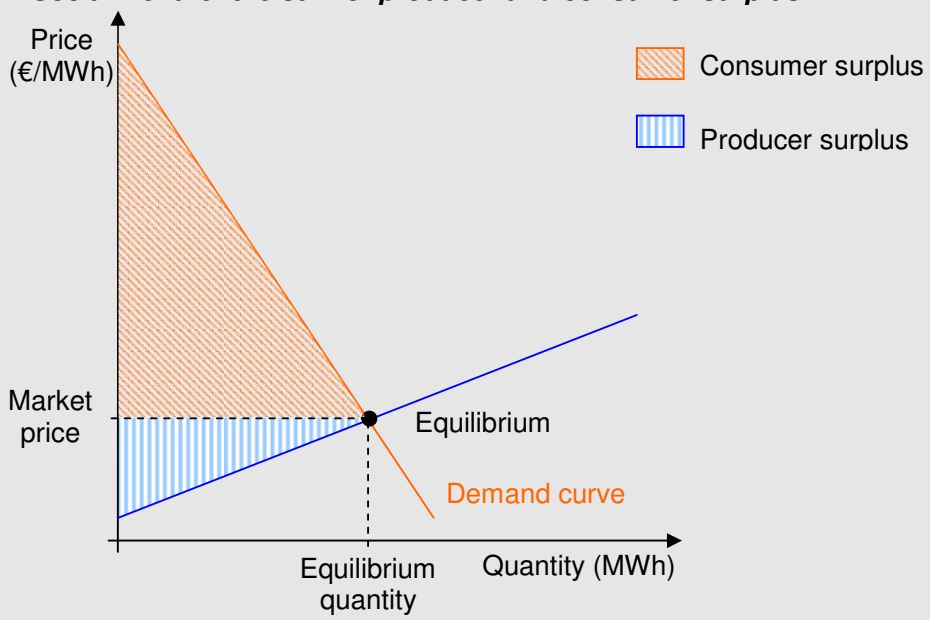
[2] Source: CRE's report on electricity interconnection management and use, published in June 2008. Unfortunately, it is not possible to give an indication of the impact of the TLC on the number of congested hours at the Belgian borders because of lack of data for the Belgian market before the implementation of TLC. Indeed, the Belgian organised wholesale market has been created concomitantly to the implementation of market coupling.

The congestion costs are the costs to society of having different prices in power markets. In other words, the congestion costs are the loss in social welfare due to the congestion.[3]

The congestion costs can be measured using the net export curves (NEC) of each market as follows:

At a national level, a well-functioning and competitive electricity wholesale market maximises social welfare (or total surplus) of the market as a whole (Figure 1). The lowest energy offers as well as the highest energy bids are satisfied first as long as bids and offers match. This results in producers' and consumers' surplus (the sum of the two being the total surplus).

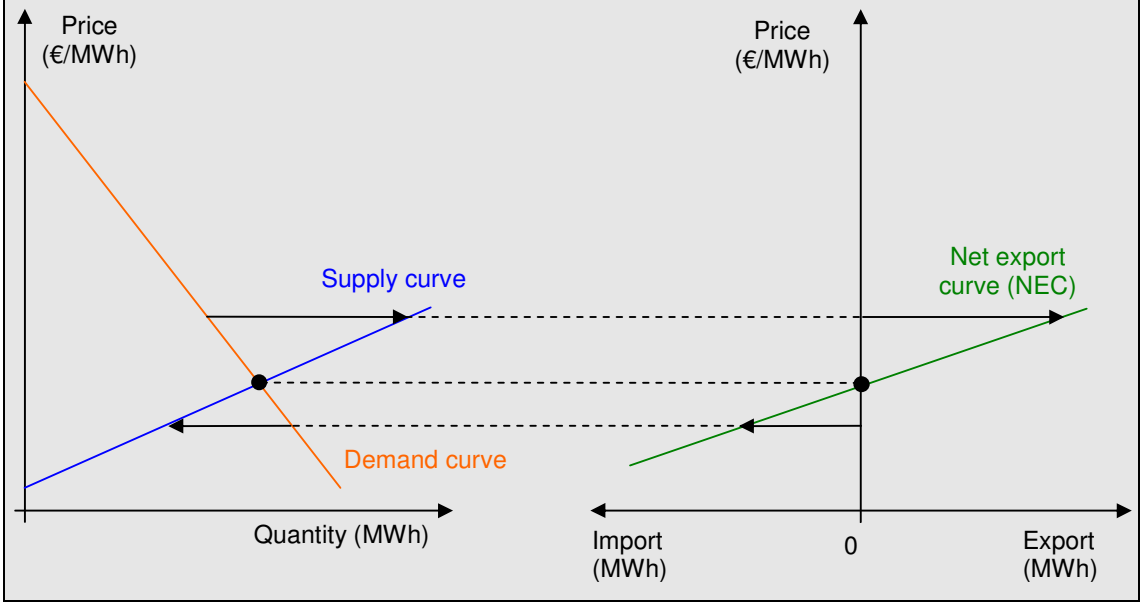
Figure 1 – Social welfare: the sum of producer and consumer surplus



To translate this concept to two interconnected markets A and B, the net export curve (NEC) of each market can be considered (Figure 2). For a given hour, the NEC of each market is constructed from demand and supply curves of the market: for each price P there is a given demand for imports (excess domestic demand) or supply of exports (excess domestic supply). These quantities represent the difference between offer and bid corresponding to each price P. In other words, the NEC of a market gives, for each additional megawatt exported or imported by the market, the price that would be observed in this market.

[3] It is important to make the difference between the terms "congestion costs" and "congestion rents" or "congestion income", where the two latter refer to the income that is created to the TSOs when the cross-border capacity is congested and either explicit or implicit allocation is applied to allocate the scarce capacity.

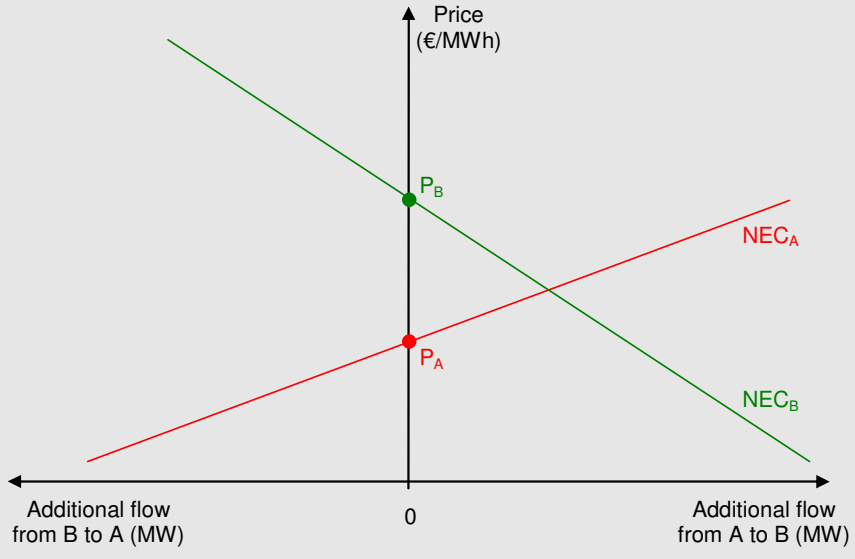
Figure 2 – Net export curve (NEC)



In Annex 5, the actual NECs of the French and Spanish markets are presented for a given hour.

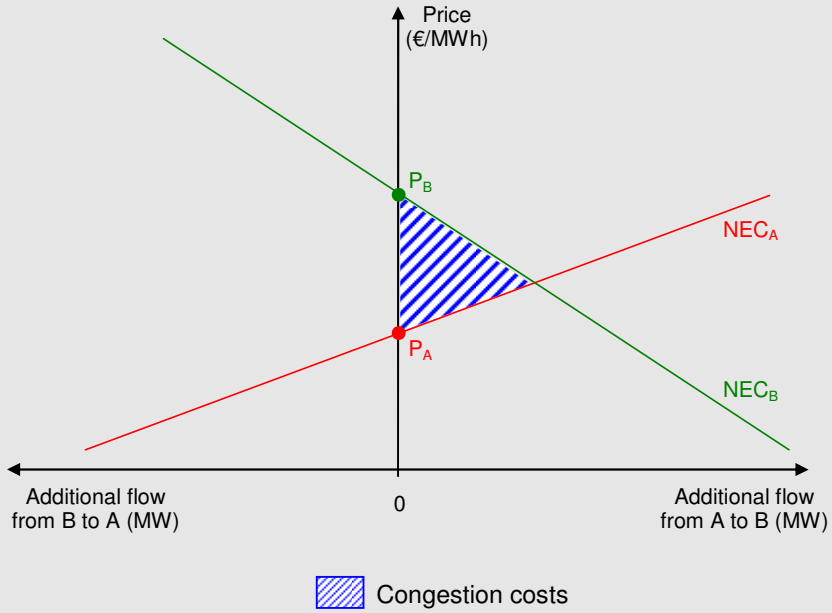
Consider in a single graph the NECs of both markets A and B for a given hour, after the closure of both markets (Figure 3).

Figure 3 – NECs of two markets A and B on the same graph



The congestion costs can be represented on such a graph. This is shown in Figure 4. Had sufficient interconnection capacity been available the market would have cleared at the intersection of NEC_A and NEC_B. If no sufficient interconnection capacity was available, the two separate markets cleared at P_B and P_A. The foregone surplus (congestion costs) is represented by the shaded area.

Figure 4 – NECs of two markets A and B and congestion costs



In order to consider the full picture, the indicator of performance should be the sum of:

- the congestion costs calculated with the NECs of each market;
- the costs of implementing and operating congestion management methods;
- the costs of ensuring the quality of transmission rights, i.e. redispatching[4] and countertrading to guarantee the firmness of programmes; and
- the costs of compensation schemes in case of curtailment, etc.[5]

Example 1 below shows how maximising cross-border capacities or implementing efficient allocation mechanisms could decrease the congestion costs.

[4] As it is difficult, if not impossible, to distinguish between redispatching costs due to internal versus international congestions, we recommend here to use the redispatching costs as a whole.

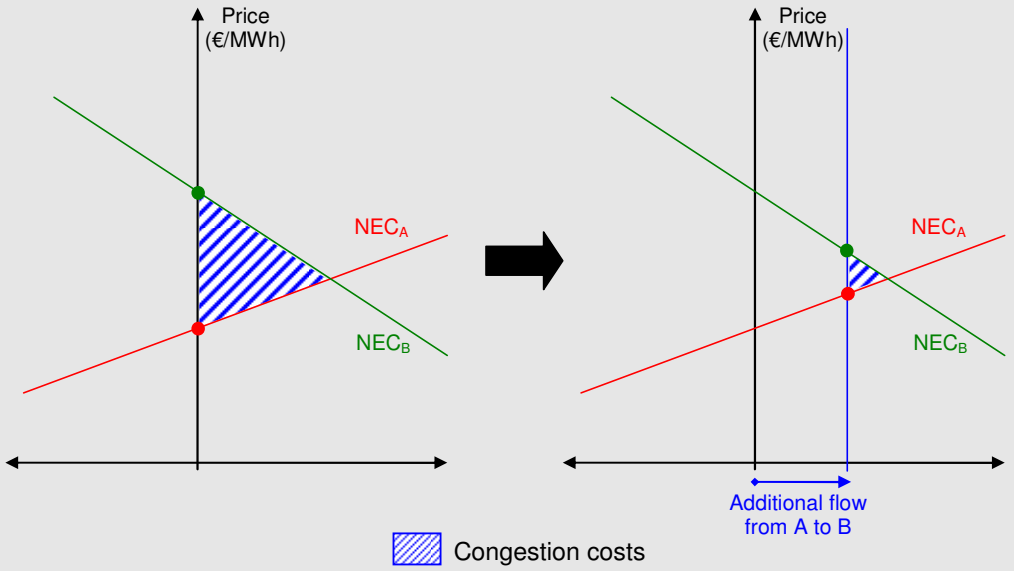
[5] Investment costs in new network infrastructures are not considered here (cf. Executive Summary, page 6).

Example 1 – Impact on the proposed indicator of performance of maximising capacities or implementing implicit allocation methods

Assume TSOs act in such a way that the flow towards the higher priced market increases:

- for example, by increasing the cross-border capacity among the two markets;
- or, by implementing an implicit allocation method.

These actions have the following impact on congestion costs:



The fact that the costs of implementing and operating allocation and calculation tools are added to the congestion costs incentivises TSOs to maximise capacities and/or implement implicit allocation methods at the lowest cost.

In Figure 4 and Example 1, the congestion costs between only two interconnected markets are represented. But this indicator of performance could be considered on a larger scale. The congestion costs within a region with several markets would be the sum of the congestion costs at each border within the region.

2.3 Social welfare generated by cross-border flows

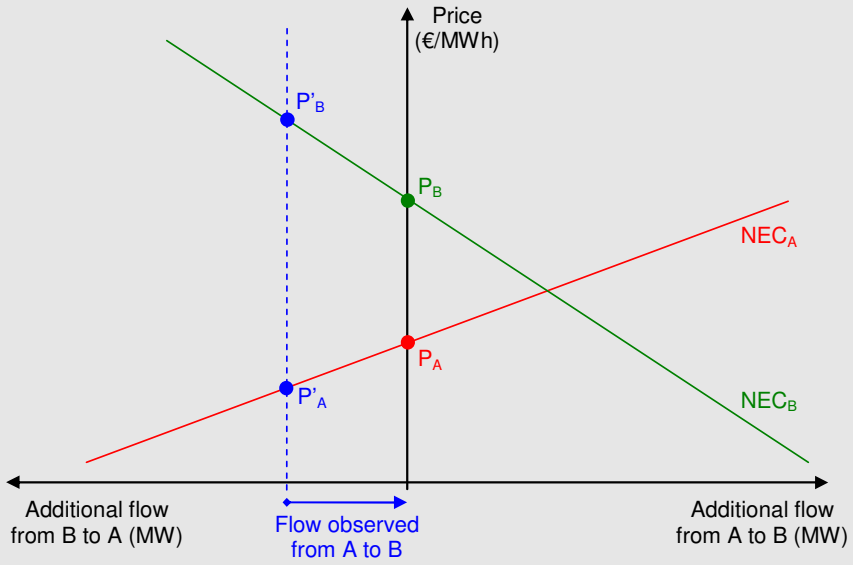
To the extent that cross-border trade aims to improve efficiency in the use of the European electricity grid with respect to the supply and demand of each market, the social welfare generated by cross-border flows could also be a good candidate for an indicator of performance on which an incentive scheme aimed at promoting cross-border trade could be based.

Consider two interconnected markets A and B. The marginal prices of markets A and B (P_A and P_B) are derived from the supply and demand equilibrium in each market, including the

net electricity commercial flow from A to B. The latter is the difference between the nominations from A to B, and the nominations from B to A.

Define P'_A and P'_B as the prices of markets A and B if they were isolated (i.e. if the cross-border flow between A and B was zero). These "virtual" prices can be shown on the NECs of market A and B (Figure 5).

Figure 5 – Prices of both markets if no cross-border flows



The cross-border flow between A and B directly generates surplus for each market.

Additionally, it generates a surplus for grid users: this is the auction revenue, gained by TSOs and used for decreasing grid access tariffs, maintaining the existing cross-border capacity or investing in the grid. [6]

Finally, in the case of explicit auctions, it generates arbitrage revenue for interconnection users. Indeed, the hourly price paid by interconnection users for the cross-border capacity rarely reaches the theoretical price of the capacity (i.e. the price differential between the two markets), because of the arbitrage revenue kept by interconnection users.

These different surpluses are roughly schematised in Figure 6.

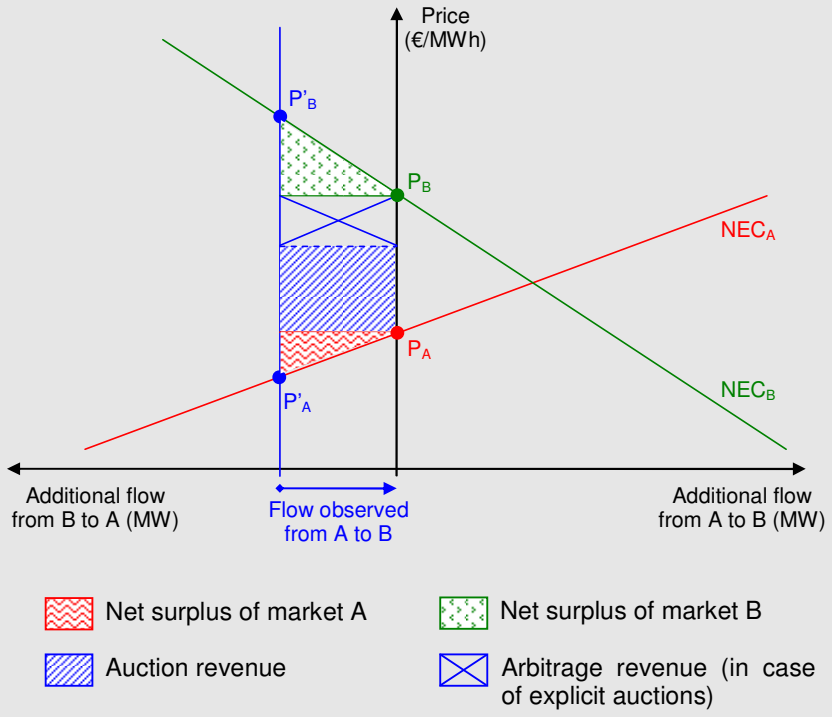
[6] It should be noted that auction revenue is not recommended to be used separately as a single indicator of performance, since non-congested interconnections provide low or zero auction revenue. However, auction revenue can be included in a sum of interdependent elements, providing a monotonous function with respect to cross-border trade. Applying auction revenue as a single indicator does not meet this requirement as it has value of zero both in a fully integrated market and also in a totally isolated market.

When the cross-border flow is from the low-priced to the high priced market, the result will always be a net surplus in both markets A and B, even if some market participants lose out.

Indeed, if A is the exporting market, then an export from A is detrimental to consumers in market A, while it is beneficial to producers in market A. The opposite situation results in the importing market B: due to the cross-border flow producers make less profit while consumers benefit from the low-price energy imported. However, the overall surplus, for each market, is positive. This is explained in more detail in Annex6.

In addition, it should be highlighted that, at borders where the price differential direction regularly changes, the “winners” and “losers” of cross-border flows change at the same time. When a market exports, its consumers lose out but when the flow direction switches the same consumers will gain. If over time the level of imports equals the level of exports, consumers will gain overall.

Figure 6 – Surpluses generated by a cross-border flow



An indicator of performance, reflecting the benefits of cross-border trade for a given hour, would be the sum of

- the net surplus of market A generated by the cross-border flow;
- the net surplus of market B generated by the cross-border flow; and
- the auction revenue.

This value could be called the social welfare generated by cross-border flows. In order to

consider the full picture, a cost benefit analysis of the social welfare generated by cross-border flows could be calculated from:

- the costs of implementing and operating congestion management methods;
- the costs of ensuring the quality of transmission rights, i.e. redispatching[7] and countertrading to guarantee the firmness of programmes;
- the costs of compensation schemes in case of curtailment, etc.[8]

As for congestion costs, this indicator of performance could be calculated for several interconnected markets: the social welfare generated by cross-border flows within a region with several markets would be the sum of the social welfare generated by cross-border flows at each border within the region.

This type of indicator of performance has been used to evaluate the benefits of cross-border flows in studies examining possibilities for better market integration. For example, TSOs and power exchanges (PXs) of the Central-West region (Belgium, France, Germany, Luxembourg and the Netherlands) have used this type of indicator to evaluate the benefits of regional market coupling.[9] In particular, they have calculated, for each hour of the year 2007, the total surplus generated by the cross-border flows if market coupling were in place, compared with the surplus generated by the cross-border flows with the current day-ahead explicit auctions.

In 2006, the Federal Network Agency (the German national regulatory authority) commissioned Frontier Economics, Consentec and IAEW to provide an economic assessment of different congestion management methods.[10] One part of this assessment was to analyse the potential welfare increase that could be achieved by an "Open Market Coupling" (OMC) relative to an explicit auction system. The results of the quantitative assessment indicate that the introduction of OMC allows welfare gains, since the benefits of a change in regime outweigh the costs. The quantitative assessment of welfare was based on the assessment of the additional trading profits under OMC relative to a reference scenario with explicit auctions and efficient intraday cross-border trading. However, it was not within the scope of this report to assess how the welfare derived from OMC should be distributed among the various stakeholders.

As the NECs used already take into account the energy transactions done based on long-term nominations, the "flow from A to B" should be only the daily netted nominations. Consequently, except in situations where the whole cross-border capacity is reserved for the day-ahead timeframe, the surplus represented in Figure 6 is only a part of the total surplus generated by all cross-border flows (which includes long-term netted nominations). One

[7] As it is difficult, if not impossible, to distinguish between redispatching costs due to internal versus international congestions, it seems appropriate to use the redispatching costs as a whole in this context.

[8] Investment costs in new network infrastructures are not considered here (cf. Executive Summary, page 7).

[9] Cf. Implementation Study (August 2008) and its Addendum (November 2008) released by CWE MC project.

[10] Cf. Economic assessment of different congestion management methods (November 2006).

possible way to better reflect the total social welfare generated by all cross-border flows could be to add to the daily auction revenue (represented by the dashed area in Figure 6) the net long-term auction revenue.[11] However, if long-term nominations are not taken into account in this indicator, the distribution rule of capacities among the different timeframes has to be determined ex ante (otherwise TSOs might be tempted to allocate more capacity to the day-ahead timeframe in order to increase the social welfare generated by the cross-border flows operated within this timeframe).

Remark 2: On interconnectors where implicit auctions are not in place for the day-ahead timeframe, the use of NECs to measure social welfare can only be acceptable under the assumption of perfect arbitrage between the organised market and over-the-counter (OTC) trade.[12]

Examples 2 and 3 show graphically how the different actions that TSOs could take to improve the efficiency of cross-border trade may impact this indicator of performance.

[11] "Net" means that the revenue from the resold capacities is deducted from the total auction revenue (resale on request of long-term capacities to monthly or daily auctions, or use-it-or-sell-it mechanism).

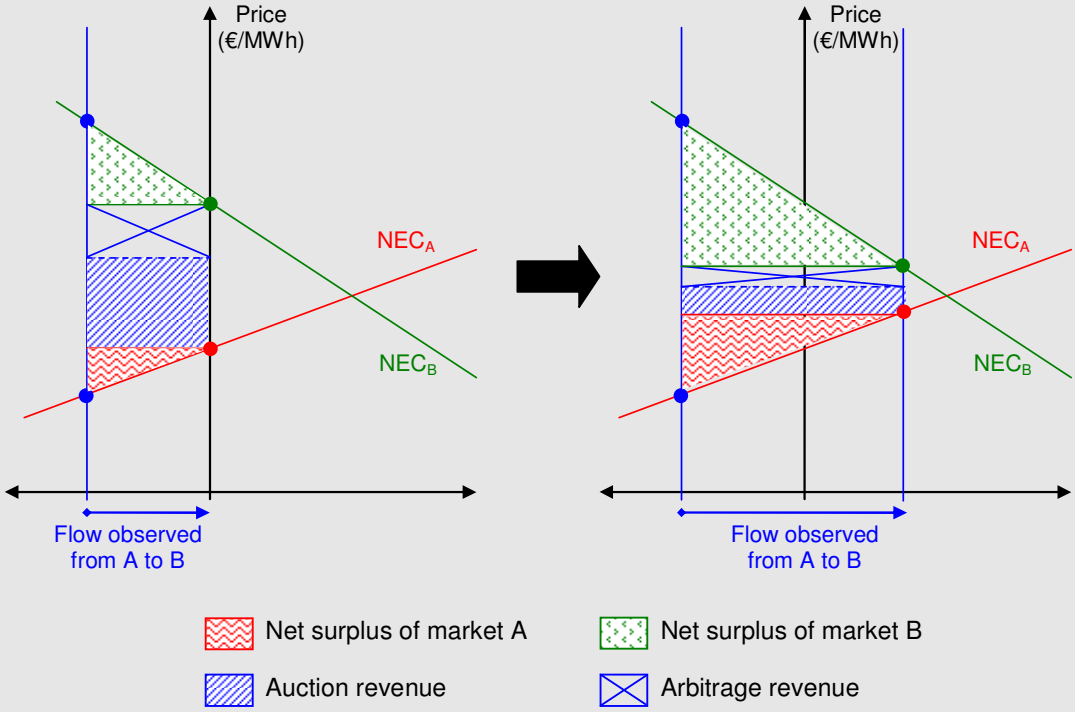
[12] This hypothesis is also taken in the Implementation Study and its Addendum for the market coupling project in the Central-West region.

Example 2 – Impact on the proposed indicator of performance of maximising capacities or implementing implicit allocation methods

Assume TSOs act in such a way that the flow from the lower priced to the higher priced market increases:

- for example, by increasing the cross-border capacity between the two markets;
- or, by implementing an implicit allocation method.

These actions have the following impact on the surplus of market A, market B and grid users:



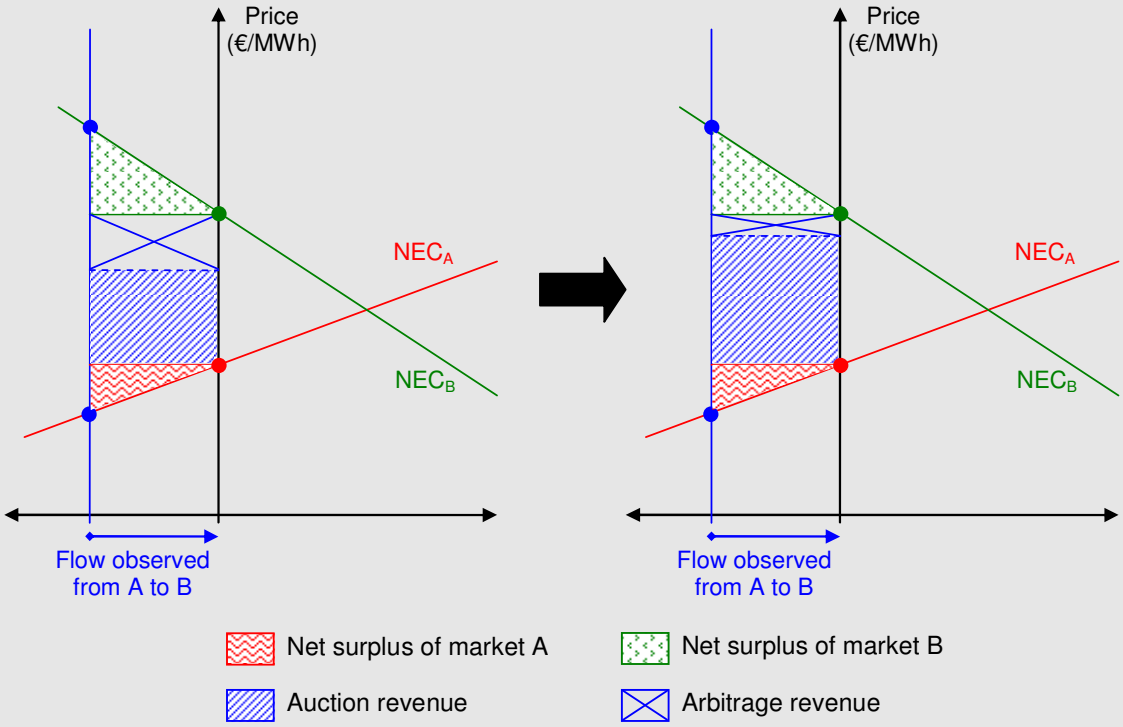
The fact that the costs of implementing and operating allocation and calculation tools are deducted from the surplus generated by cross-border flows incentivises TSOs to maximise capacities and/or implement implicit allocation methods at the lowest cost.

Example 3 – Impact on the proposed indicator of performance of improving the quality of the products allocated

TSOs could improve the quality of the products allocated by, for example by:

- improving the firmness of the capacity rights;
- improving the features of the secondary market;

These actions would tend to increase the market's willingness to pay for capacities. Consequently, they would have the following impact on the surplus of market A, market B and grid users:



The fact that the costs of, for example, ensuring the firmness of capacities and operating allocation tools are deducted from the surplus generated by cross-border flows incentivises TSOs to improve the quality of the products allocated at the lowest cost.

3 Proposal for several incentive schemes aiming at promoting specific aspects of cross-border trade

Instead of designing one single indicator of performance reflecting the level of cross-border trade as a whole and thus leaving the TSO to choose which measure it will implement to positively influence the indicator, several incentive schemes could be launched (in parallel or sequentially), each addressing a particular issue. A few examples of such topics and possible related approaches are given in this chapter.

The examples given in this part could apply simultaneously or sequentially, depending on the priorities chosen by the regulators involved. Each country or border would have its own selection of incentive schemes.

3.1 Maximisation of cross-border capacities

With no prejudice to network security standards, maximising cross-border capacities offered to the market is a binding requirement of Article 6.3 of Regulation 1228/2003. However, even if regulators have to approve the calculation methodology of TSOs according to Article 5.2 of Regulation 1228/2003, regulators cannot guarantee that capacities are being maximised by TSOs. Indeed, capacity calculation relies on several factors (including treatment of loop flows, lack of information about generation schedules due in particular to intermittent renewable generation, the firmness of the capacity being offered etc.) about which TSOs' assessments are not controllable by regulators.

An incentive usually takes the form of benchmarks and targets linked to financial payments or penalties. For example, a TSO might receive a financial payment if it increased physical capacity by a certain amount for a sustained amount of time. As many TSOs currently pass through all costs and receipts to end users it may sharpen their incentive to release additional capacity if they retained a direct financial reward. Therefore, an approach for achieving the goal of maximising capacity could be based on the following steps:

1. Determination of the total level of interconnection capacity across a particular border;

2. Determination of a target value for the capacity to be offered on the interconnection (or alternatively, a target in terms of additional capacity to be offered), to be set as a goal for the TSOs. This value must still allow for the secure operation of the system;

3. Annual determination of whether the goal determined in point 2 has been met by the TSOs and a decision on whether a reward in terms of a certain percentage of the additional congestion income may be kept by the TSO. For example, if at a certain border TSOs have exceeded the threshold value of interconnection capacity by 200 MW, then they would be rewarded. The reward could be permission to retain a part of the auction revenue corresponding to this additional capacity of 200 MW. Should the amount of capacity be below the threshold value as set by the regulator, then the TSO would be penalised.

The TSO can undertake a number of measures to increase capacity available to the market. These could involve the implementation of efficient congestion allocation methods (e.g. implicit auctions, secondary market reform) or simply offering more capacity in auctions.

By applying this method, regulators would have to be aware of several difficulties:

- Interactions with other objectives in terms of redispatching, countertrading and curtailments need to be taken into account as to some extent there can be trade offs between these objectives;

- Incentives should avoid rewarding TSOs for poor past performance. For example the worse a TSO has performed in the past in terms of offering capacity the easier it will be for it to offer more. Therefore incentives needs to be tailored to the specific situations;

- Coordination is needed, at least at regional level, when defining the target. This will avoid a situation where capacity is simply shifted from one interconnection to another without real overall maximisation.

3.2 Implementation of market coupling and/or cross-border balancing

Market coupling has been identified by stakeholders as the target mechanism for day-ahead capacity allocation. However, it is not a binding requirement under Regulation (EC) 1228/2003 or the annexed Congestion Management Guidelines (Decision 2006/770/EC).

Furthermore, balancing market integration is one of the top priorities identified by the European Commission, as well as in the European Regional Initiatives. Indeed, cross-border balancing exchanges contribute to increased competition and efficiency in national balancing markets. However, cross-border balancing exchanges are not fully implemented.

An incentive scheme to foster the implementation of market coupling or/and cross-border balancing exchanges could consist of an agreement between regulators and TSOs, stipulating:

- a target date for the implementation;

- a list of prerequisites about the features of the model (e.g. possibility of extending of the model to other markets);

- maximum implementation and operational costs; and

- a reward if the above mentioned conditions are met, and a penalty if they are not.

3.3 Optimisation of the distribution of transmission capacities among the different timeframes

TSOs provide interconnection capacity products at different timeframes, which are usually annual, monthly and daily, but may also be seasonal, quarterly, etc. The distribution rule among the different timeframes is usually quite arbitrary.[13]

If a defined level of interconnection capacity is agreed as a target (cf. Part 3.1) or on DC-cables where capacity is constant, TSOs should be encouraged to offer the optimal mix of product maturities, for example by actively responding to user demand. However, this is not

[13] For the intraday timeframe, there is in general no reservation of capacity.

a binding requirement under Regulation (EC) 1228/2003 or the annexed Congestion Management Guidelines (Decision 2006/770/EC).

If the mix of product maturities is improved, overall interconnection revenue should theoretically increase (ceteris paribus). Where this occurs, the interconnection revenue shall be netted from the resale of capacities and the compensation costs for curtailments. Consequently, when interconnection capacity is defined in advance, if TSOs change the mix of product maturities and can prove that this change caused an increase of the interconnection revenue, then they could be financially rewarded. Such reward may be a function of the increase of the net interconnection revenue.

In order to further improve their risk/return relationship, TSOs would be incentivised to put in place a capacity buy-back system. This would allow the market to signal the value they place on being curtailed and would therefore provide TSOs with another option for managing changes to system and generation load. TSOs would be able to better optimise the balance between the value they received by releasing additional long-term capacity to the market and the cost of curtailments.

3.4 Other possible options for specific incentive schemes to promote cross-border-trade

Other possible options for several parallel incentive schemes come from the Nordic market, where Nordic energy regulators (NordREG) have discussed how to use indicators to monitor efficiency of congestion management methods.[14]

The following indicators have been mapped:

- Details on price areas, including the existence or duration of price areas, percentage of time per year for every price area (e.g. existing in Nordic market);
- annual congestion income for every TSO;
- annual countertrade costs for every TSO;
- annual duration of normal transmission capacity per interconnection, percentage of time;
- annual price difference between bidding areas;
- price differences across the interconnections compared to transmission capacity;
- reasons for capacity reductions per interconnection.

These indicators may be used to monitor the efficiency of congestion management methods. They could also be applied in parallel for incentive schemes or combined into one index as proposed in Part 3.6. These indicators (or a combination of some indicators) may be used to

[14] "Congestion Management Guidelines – Implementation within the Nordic market", NordReg.

incentivise implementation of market coupling (i.e. implicit auctions) or maximisation of cross-border transmission capacity.

It is important to note that it is unwise to use indicators in isolation because a good indicator of performance needs to have a clear relationship with cross-border trade and this might not be the case with some indicators mapped above. For example, using the congestion income indicator in isolation is unwise because it has a value of zero both in a fully integrated market (with no congestions) and also in a totally isolated markets. Thus if congestion income is used as an indicator it must be used in parallel with other indicators to overcome this problem. Alternatively it should be used in combination with transmission capacity where the congestion income is decreasing with more integrated market (i.e. with more transmission capacity made available for the market).

3.5 Combination of incentive schemes into one index for cross-border trade

Setting up the above incentive schemes could be done by treating each of them separately as explained earlier. The main drawback of this approach is potentially undesirable interactions of parallel incentive schemes. Indeed, due to the asymmetry of information between TSOs and regulators, regulators experience difficulties in correctly balancing the targets, the amount of the rewards and penalties, etc., of the different incentive schemes running in parallel.

Consequently, an alternative approach could be to combine the different incentive schemes into a single indicator or index. With such an approach, the weighting and normalisation for every indicator should be applied to produce one figure for an incentive, such as:

$$Index\ for\ market\ integration = \sum_{i=1}^{n} weight_i * indicator_i$$

Obviously, the definition of the weights and target values for the indicators are crucial to achieving a proper incentive scheme which will foster marker integration.

One option would be to start with an index including only a few indicators and possibly introduce more indicators later on when some experience concerning practical application of the index has been gained.

Furthermore, with this approach it would also be possible to introduce slightly different incentive schemes across the European markets with different weightings of the respective combined indices, to take into account the specificities of different markets.

4 Setting up the incentive schemes

4.1 Historical value of the performance indicator

The value of the performance indicator on a given interconnection has to be computed for a historical period, e.g. the last three to five years. This value will serve as a reference value for the incentive scheme.

The value and the volatility of the indicator will have to be carefully evaluated before use when defining the performance target of the incentive scheme.

4.2 Determination of the performance target

The potential impact on the performance indicator of the different actions that TSOs can take to improve the efficiency of cross-border trade should be assessed by the regulators. However, this assessment is very difficult to do: if it was feasible for regulators to assess precisely the impact of TSOs' actions on these indicators of performance, then incentive schemes would not be needed. If relevant, this assessment could be based on the experience gained from the existing projects aiming at improving congestion management methods (e.g. market coupling projects already implemented).

After such a (rough) assessment has been done, the performance target must be defined in view of the historical trend of the performance indicator. Any future changes or growth in generation facilities, consumption and the grid must be taken account as far as possible when setting the target.

The duration of the incentive scheme must also be defined (e.g. four years, beginning one year after the definition and publication of the incentive scheme).

4.3 Determination of the effect of the incentive scheme

The effect (i.e. the level of the financial reward/penalty) of the incentive scheme has to be defined. In principle, the incentive scheme could either be a binary decision (e.g. a financial reward or penalty of a certain amount of Euros if the realisation is above or below the target value agreed ex-ante) or a continuous function of the realisation of the indicator.

Many different scenarios could be imagined to shape the effect of the incentive scheme. Example 4 below provides a possible method for congestion costs as an indicator.

Example 4 – How to set up the incentive scheme

Assume that the congestion costs are taken as the indicator of performance for an incentive scheme to promote cross-border trade over the period 2010-2013 within a given region.

Furthermore, assume the historical value CC_{past} of congestion costs within the region has been calculated, for example over the period 2006-2009.

To determine the performance target, assume that the objective negotiated between TSOs and regulators is to decrease the congestion costs by 10% per year over the period during which the incentive scheme applies (in this example, 2010-2013):

$$CC_{target} = 90\% \times CC_{past}.$$

To define the effect of the incentive scheme, assume that the financial reward and penalty chosen are linear functions of the difference between the actual value of the indicator of performance observed over the period 2010-2013 ($CC_{2010\text{-}2013}$) and the target performance CC_{target}. For example, an asymmetrical function can be chosen:

$$\text{reward} = 30\% \times (CC_{target} - CC_{2010\text{-}2013}) \quad \text{if } CC_{2010\text{-}2013} \text{ is smaller than } CC_{target},$$

$$\text{penalty} = 20\% \times (CC_{2010\text{-}2013} - CC_{target}) \quad \text{if } CC_{2010\text{-}2013} \text{ is higher than } CC_{target}.$$

The parameters of this function would also be negotiated by TSOs and regulators. The paramters may also cap the rewards and penalties.

At the end of the period during which the incentive scheme applies (here, at the beginning of 2014), the actual value $CC_{2010\text{-}2013}$ of the indicator of performance has to be computed. Then the reward or penalty can be computed and applied to both TSOs for the next tariff period.

For example, if TSOs have succeeded in decreasing the congestion costs by 25% (while the target was 10%), then they will be rewarded the amount of:

$$\text{reward} = 30\% \times (90\% \times CC_{past} - 75\% \times. CC_{past}) = 4.5\% \times. CC_{past}.$$

If, by contrast, the congestion costs have decreased by 5% only (while the target was 10%), then TSOs will be penalised the amount of:

$$\text{penalty} = 20\% \times (95\% \times CC_{past} - 90\% \times CC_{past}) = 1\% \times. CC_{past}.$$

4.4 Source of income for the incentives

Whatever the indicator chosen, the financial rewards given to TSOs if performance measured by the indicator exceeds the target would constitute an additional charge for network users that must be reflected in the grid access tariffs. In the same way, the penalties applied to TSOs if the target is not reached would need to be redistributed to network users through adjustment of the grid access tariffs. However, the legal basis for such use of grid access tariffs has to be analysed with regards to Article 6 (6) of Regulation 1228/2003.

Since the scope of the incentive scheme may include many countries (cf. Part 5.1.4), an agreement would need to be reached between regulators regarding the sharing rule to apply to determine to what extent each country would finance the reward or receive the penalty. This will be a very complex task, since it will require a high degree of coordination between regulators. In addition, the reward which shall be given to TSOs if they exceed the target has also to be shared among them. Consequently, one part of the grid access tariff in one country may be devoted to pay TSOs of other countries. The legal feasibility and the political

acceptability of this transfer will have to be studied carefully. The pre-requisites for this approach may be the creation of a single entity representing TSOs at regional or European level.

Those issues would have to be dealt with through more detailed provisions and implementation of such incentives.

5 Evaluation of both approaches: expected acceptance of the proposed incentive schemes

With both approaches (incentive scheme based on a single indicator of performance and incentive schemes aimed at fostering specific projects), regulators face common challenges in implementing incentive schemes to promote cross-border trade.

Indeed, the four above-mentioned difficulties (cf. Part 1.1.5) remain with both approaches:

- the cost of reducing lack of information ex ante;
- the dynamic aspects of regulation;
- the multiplicity of parties, combined with the multiplicity of objectives pursued by each of these parties; and
- the undesirable incentives that may be created by financial incentives to promote cross-border trade.

In addition the expected acceptance of each approach by the different categories of stakeholders may vary significantly.

5.1 Expected acceptance of an incentive scheme based on a single indicator of performance reflecting cross-border trade

5.1.1 TSOs

The number of congested hours, the congestion costs and the social welfare generated by cross-border flows are simple, easily understandable to all stakeholders and objectively measurable. Furthermore, as illustrated in the examples above, TSOs' actions can have a significant impact on the value of the proposed indicators.

However, it must be recognised that the proposed indicators of performance are not fully controllable by TSOs to the extent that their value greatly depends on market fundamentals and on market players' behaviour.

In order to mitigate this fact and make these indicators acceptable for TSOs in spite of their only partial control over them, a fair balance has to be defined between the target, the period covered by the incentive scheme and the effect of the incentive scheme (cf. Part 4).

It should also be noted that the proposed indicators give TSOs some degree of freedom to choose which actions they take to improve the efficiency of cross-border trade congestion management. Moreover, if implementation and operational costs to improve the efficiency of cross-border trade are taken into account in the indicator of performance, TSOs also have the freedom to prioritise the projects with the best benefit/cost ratio.

5.1.2 Market participants

The third proposed indicator of performance (social welfare generated by cross-border flows) has the advantage of including several issues on which market players regularly express concern:

- *Maximisation of capacities*: Whereas TSOs are free to choose how they would enhance the efficiency of cross-border trade, the proposed incentive scheme, at least indirectly, addresses the issue of maximising cross-border capacities (through improved load-flow calculation as well as through application of netting, etc.) as this is one means for TSOs to improve the indicator.

- *Firmness of capacities*: As the auction revenues as well as the costs of ensuring firmness are included in the target of performance, TSOs are incentivised to optimise the level of firmness.[15]

The first and second potential indicators of performance (number of congested hours and congestion costs) do not address, for example, firmness. However, an incentive scheme based on one of these indicators could be complemented by other actions aimed at improving firmness.

5.1.3 Power Exchanges (PXs)

The net export curves, or prices, used to calculate the indicators of performance under consideration would necessarily be the ones derived from the Power Exchanges (PXs). This raises several questions to be analysed in more detail:

- Is a Power Exchange quoting hourly products in place in each market?

- Is the liquidity of the PXs sufficient to provide NECs which are reliable and representative of the whole market?

- Are PXs willing to cooperate with regulators for calculating such indicators of performance for every hour of the year?

If the principle underlying one of these indicators of performance proposed in this document is welcomed, then in each country in-depth studies should be launched to evaluate the feasibility of an incentive scheme based on such an indicator. In particular, the sensitivity to external factors as well as the volatility of the indicator should be assessed in order to evaluate the extent to which it would be appropriate to use it to develop an incentive scheme to promote cross-border trade.

With the congestion costs and social welfare indicators, PXs will need to commit to providing their net export curves to the public or only to the regulators. Because supply and demand curves are published by some PXs on a day-by-day basis, providing the information to regulators covering a larger period should probably not be a problem. However, due to the large amount of data this requires some form of IT system to deliver the required indicators.

Moreover, as these performance indicators are based on PXs' data the power exchanges will have a central position in the cross-border trade process. PXs could certainly use their expertise to calculate the respective net export curves, to assess their volatility to different factors and to help regulators to fix the performance target (cf. Part 4.2).

[15] Alternatively, a precise level of firmness could be indefinitely fixed ex-ante.

However, a minimum level of harmonisation would probably be required concerning the standard products exchanged. At a minimum, PXs must fix hourly prices day-ahead. This can be a problem for Member States without such a market design.

5.1.4 Regulators

Implementing an incentive scheme based on a single indicator of performance does not solve all problems and may even create new ones:

- One difficulty for regulators may be the extent to which TSOs are allowed to choose which actions to take to meet their target.

- Another problem for regulators may be that these indicators of performance are concentrated on the use of the European grid at the day-ahead stage. They do not address other issues like intraday cross-border exchanges or balancing integration which are also important components of cross-border trade. It would be possible to develop a complementary incentive scheme for these issues, keeping in mind that separate incentive schemes running in parallel may have undesirable interactions.

Implementing such an incentive scheme also creates additional responsibilities for regulators:

- Regulators would be responsible for defining the performance target and the rule for sharing the savings or costs among TSOs and grid users (cf. Part 4.4). This could have a direct impact on the grid access tariffs and, consequently, be seriously questioned by final consumers. Therefore, regulators should be prepared to address this issue.

- Moreover, the regular review and calculation of the performance indicator, at least at the end of the period covered by the incentive scheme, is for the responsibility of regulators, who may not have the required budget, human resources or IT systems. This would be of particular concern if congestion costs or social welfare performance indicators were used, because in both cases their calculation is much more complex than that of the number of congested hours indicator.

- Regulators could also have a greater market surveillance role. For example, in markets where TSOs can buy their losses on PXs, they might have a dominant position which they might use to manipulate the demand curve. Moreover, whenever TSOs are owned by vertically integrated groups, there is potential for price manipulations by the producers or traders of the same group in order to increase the indicator of performance.

- Another issue for is the scope and effect of incentive schemes. In particular, as soon as several countries in the meshed network implement such schemes, then the performance target shall be defined globally for all the countries covered by the incentive scheme and for every border. This is because some actions by TSOs to improve the performance indicator have to be taken on several borders simultaneously (typically distributing capacities among several borders more efficiently). The coordination between regulators and between TSOs, and possibly the reduction of the number of involved parties, would facilitate the definition and implementation of any such incentive scheme dealing with cross-border issues.

For all these reasons, implementing an incentive scheme based on a single indicator is a challenging task for regulators. Thus, full commitment to improve congestion management methods is needed.

5.1.5 Non-participating countries and the European Commission

The incentive scheme based on a single indicator shall be applied as widely as possible, including to non Member States such as Switzerland. Indeed, if this scheme is applied to a few countries only, then TSOs of these countries will concentrate their efforts on integrating markets of these countries and the projects aiming at integrating other markets will be delayed. For example, in highly meshed networks, TSOs may easily increase the commercial capacity on a given border, if they are incentivised to do so, to the detriment of other borders. Hence, the single indicator of performance should include as many markets as possible.

Therefore, such an incentive scheme should ideally be adopted by all Member States. Thus full support of the European Commission would be needed in order to encourage Member States to implement such a scheme.

5.2 Expected acceptance of several incentive schemes aiming at fostering specific aspects of cross-border trade

5.2.1 TSOs

With this approach, TSOs do not have the freedom to prioritise the different projects aiming at promoting cross-border trade, according to their own cost/benefit analyses. This can be seen, by TSOs, as a drawback of this approach.

By contrast, the incentive schemes designed with this approach are likely to be more easily controllable by TSOs, compared with the incentive schemes based on a single indicator of performance, which can be affected by external factors such as market behaviour.

5.2.2 Market participants

This approach may be less efficient than the previous one, because it does not let the TSOs choose between the different actions that could improve the efficiency of cross-border trade. This sub-optimality may be criticised by market participants.

However, with this approach, all aspects of cross-border trade could be tackled individually. This is in contrast to the approach which uses one of the single indicators of performance (e.g. distribution of capacities among different timeframes, implementation of efficient intraday mechanisms, etc.).

5.2.3 Power Exchanges (PXs)

With this approach, PXs do not have such a central role, compared with the single indicator of performance approach which is based on the prices and demand and supply curves of PXs. However, this approach also requires some interaction with PXs as shown in the example from the Nordic market.

However, for projects aiming to promote cross-border trade involving PXs – typically market coupling projects – PXs would be involved indirectly in the incentive scheme. In general, for

market coupling projects, PXs act as service providers for TSOs. The service contract between TSOs and PXs could stipulate a sharing of the financial reward given to TSOs, in case the market coupling project meets the requirements agreed between TSOs and regulators when designing the incentive scheme (cf. Part 3.2). In that sense, TSOs would incentivise PXs to meet the target performance (implementation date, costs, etc.) decided by regulators.

5.2.4 Regulators

In appearance, the approach using several incentive schemes is less challenging for regulators than the one with a single indicator of performance. Indeed, the advantage of such "simpler" incentive mechanisms is that they would be more easily understood by all stakeholders and are independent from each other. In addition, as already stated, this approach addresses topics not included in the proposed single indicators (intraday etc.).

But, for regulators, this approach also presents difficulties:

- First, the lack of information makes it difficult for regulators to define the weight allocated to each project. With this approach, regulators have to determine the "best" actions that TSOs could take to improve the efficiency of cross-border trade. As already explained, this is a difficult task mainly because regulators might not know what the best actions are to promote cross-border trade. As such the main risk raised by this approach is the possible "wrong incentive" that regulators may give when defining the different incentive schemes and the weight applied to each of them. If such a situation occurs, then cross-border trade might not be promoted in the most efficient way, and, in the worst case, may even be slowed down.

- In addition, the scope of the incentive schemes remains an issue, with additional difficulties particular to this approach. Indeed, the existence of different performance targets on different borders might be incompatible. For example, in a meshed network, assume that at two different borders, involving different TSOs (e.g. Belgium-The Netherlands and France-Germany), the TSOs are incentivised to increase cross-border capacities. The actions that the first two TSOs could take to reach their performance target could impede the other two TSOs from reaching their own target, due to the complex interactions of the flows in a meshed network. By contrast, with a single performance indicator, all TSOs would work at improving the single indicator and as such would coordinate to take the most efficient actions (in this example, by maximising capacities where it is the most economically efficient).

- Finally, in terms of workload and responsibility for regulators, this approach might not be lighter than the one based on a single indicator. Indeed, if the design of the incentive schemes could be made simpler, the coordination needed between regulators and the follow up of the possible undesirable interactions between "competing" incentives would remain a challenging task.

5.3 Evaluation of the different schemes against the features of an "ideal" incentive scheme to promote cross-border trade

The general acceptance of the incentive schemes for both approaches may be evaluated against the features of the "ideal" incentive scheme given in Part 1.1.6 (Table 1).

Table 1 shows that both proposed approaches have their strengths and weaknesses when compared with each other. No incentive scheme has all the ideal features simultaneously. Incentive schemes based on a single indicator of performance could be efficient but non-transparent and might be difficult for TSOs and even regulators to accept. By contrast, incentive schemes based on several distinct indicators could be less efficient but transparent and more easily acceptable.

Table 1 – Evaluation of the proposed approaches against the features of an "ideal" incentive scheme

Features	Scheme based on a single indicator[16]	Scheme based on several project-based indicators[17]
Simple and easily understandable to all stakeholders	+	+++
Objectively measurable	+++	+
Controllable by TSOs	+	++
Incentivising for TSOs	+++	+
Applicable EU-wide	++	++
Compatible with other national and European priorities	++	++

[16] Schemes as in chapter 2.

[17] Schemes as in chapter 3.

6 Conclusions

Setting the objective for improving congestion management methods could be a clear signal to TSOs that this objective is given at least the same priority by the national regulators as their other, generally more nationally-oriented objectives. This could further motivate TSOs to collaborate and coordinate with each other.

Finding an incentive scheme for cross-border trade is a challenging issue for regulators. This discussion paper proposes concrete and pragmatic ways to implement incentive schemes to promote cross-border trade. ERGEG is aware that these proposals raise a number of questions and difficulties that need further discussion with stakeholders. Consequently ERGEG welcomes and will carefully analyse the responses received from stakeholders.

Before considering the effective implementation of incentive schemes to promote cross-border trade in practice, ERGEG welcomes views on whether the regular calculation and publication of the proposed performance indicators would be useful. The monitoring of the evolution and volatility of these indicators over time would allow regulators to fine-tune them. Using one of these indicators for an incentive scheme to promote cross-border trade could not be considered before its robustness has been proven through a monitoring process lasting several years.

In addition, ERGEG considers that publishing such indicators (before considering them for an incentive scheme) could be a useful tool to convince stakeholders of the benefits of cross-border trade.

In parallel to this monitoring, the evolution of the regulatory framework – with the creation of the Agency and ENTSO-E – is likely to be more accommodating to incentive schemes aimed at promoting cross-border trade at the European level.

Annex 1 – ERGEG

The European Regulators for Electricity and Gas (ERGEG) was set up by the European Commission in 2003 as its advisory group on internal energy market issues. Its members are the energy regulatory authorities of Europe. The work of the CEER and ERGEG is structured according to a number of working groups, composed of staff members of the national energy regulatory authorities. These working groups deal with different topics, according to their members' fields of expertise.

This report was prepared by the Electricity Network and Market Task Force of the Electricity Working Group.

Annex 2 – Abbreviations

Term	Definition
CEER	Council of European Energy Regulators
ENTSO-E	European Network of Transmission System Operators for Electricity
ERGEG	European Regulators Group for Electricity and Gas
IFIEC	International Federation of Industrial Energy Consumers
NEC	Net Export Curve
NRA	National Regulatory Authority
NordReg	Nordic Energy Regulators
OMC	Open Market Coupling
OTC	Over-the-counter
PX	Power Exchange
TSO	Transmission System Operator

Annex 3 - Duties of TSOs regarding cross-border capacity maximisation

TSOs are very important actors in the field of market development and integration, as they are expected to ensure security and, among others, to:

1. **Build and guarantee the necessary capacity for market functioning without permanent or structural congestions**

Build and guarantee the necessary transmission capacity is the object of specific studies and incentive schemes presently carried out under the scope of 2008 ERGEG Working Programme.

Based on the 2007 deliverable "ERGEG Conclusions paper on a Cross-Border Framework for Electricity Transmission Network Infrastructure" and a consultancy study on electricity infrastructure, an analysis of barriers to transmission infrastructure investments will be carried out, leading to an ERGEG Discussion Paper on electricity infrastructure.

2. **Maximise the transmission capacity offered to the market**

Maximisation of the capacity offered to the market is an obligation imposed by the existent EC Regulation and ERGEG recommendations, i.e.:

- TSOs have to publish a methodology to calculate the capacity available for commercial purposes.

Regulation (EC) 1228/2003, Article 5.2: *(...) The information published shall include a general scheme for the calculation of the total transfer capacity and the transmission reliability margin based upon the electrical and physical features of the network.*

Annex of Regulation (EC) 1228/2003, point 5.2: *TSOs shall publish (...) a general scheme for the calculation of the interconnection capacity for the different timeframes, based upon the electrical and physical realities of the network.*

- This methodology has to be approved by the regulators.

Regulation (EC) 1228/2003, Article 5.2 *(...). Such schemes shall be subject to the approval of the regulatory authorities.*

Annex of Regulation (EC) 1228/2003, point 5.2: *(...). Such a scheme shall be subject to review by the Regulatory Authorities of the Member States concerned.*

GGP-Operational Security, point 6.2.1: *Given the importance of transmission capacity for promoting international trade, it is critical that TSOs perform their calculation in the most correct and transparent way, using definitions, principles, security criteria and methods understood by market players and approved by regulatory authorities.*

GGP-Operational Security, point 6.2.2.4: *As stated in article 5(2) of Regulation (EC) 1228/2003, the general scheme for the calculation of the total interconnection capacity and necessary margins based upon the electrical and physical features of the network shall be published and subject to the approval of the regulatory authorities.*

- TSOs must maximise the capacity offered to the market

Regulation (EC) 1228/2003, Article 6.3: *The maximum capacity of the interconnections and/or the transmission networks affecting cross-border flows shall be made available to market participants, complying with safety standards of secure network operation.*

Annex 4 - Economic background on incentive schemes

In this section, we discuss the economic background of incentive schemes. First, we define the principal-agent problem of incentive regulation. Second, we look at the theory to discuss the meaning and the use of incentive schemes. Third, we explain in more detail several aspects of this problem such as, dealing with information asymmetries, and the trade-off between incentives and rent extraction. Finally, we deal with aspects of uncertainty, risk sharing, the effects of the time span on an incentive scheme, the commitment problem, and the possibility of perverse effects when incentivising for multiple targets.

- The Principal-Agent problem

If you want something done right, do it yourself. This commonly known proverb is used at the beginning of Sappington (1991) to explain the greatest concerns of incentive theory.[18] Conversely, incentive theory focuses on tasks that are generally too complicated, too diverse or too costly to do oneself. For those reasons, a principal is forced to hire an agent with specific skills or knowledge for the task at hand. For example, in a labour setting the principal may be an employer, while a worker may act as an agent. In a regulated industry, the regulator may act as the principal, while the regulated firm (e.g. a TSO) may be an agent. Asymmetry of information may result in an inefficient outcome, if the principal and the agent have conflicting interests, e.g. the principal prefers the agent to work hard in a particular respect whereas the agent may prefer not to do so. The principal-agent problem can be defined as the problem of designing mechanisms that induce agents to act in the interest of the principal. In most cases, unless there is costly monitoring of agents' behaviour, the problem cannot be solved completely by overcoming information asymmetries. Moreover, in most cases, the agent is more risk averse than the principal, and the agent fully bears the consequences of failure (i.e. lower reward). Therefore, in these cases, to align the agent's interests with his own, the principal will need to offer a certain amount of rent sharing to compensate the agent for taking additional risk.

- What is an incentive scheme?

Incentive schemes may motivate an agent to choose a specific action or to prefer one choice over another which otherwise he would not have chosen. As an imported part of the 'recent' reform agenda, incentive schemes have been adopted in many countries as an alternative to traditional cost-of-service or rate-of-return regulation, because it became apparent that the latter two did not offer any incentive to reach targets in an efficient manner. This is true because as long as prices follow costs there are no strong incentives to reach targets in an efficient way. The expectation was that incentive schemes would provide more powerful incentives for regulated firms to reduce costs, improve service quality, stimulate innovation, improve market entry to regulated infrastructure services, and deliver other targets. However, the sound implementation of incentive schemes has suffered in part because of problems

[18] Sappington (1991). Incentives in Principal-Agent Relationships, Journal of Economic Perspectives, Vol. 5, 45-66.

with information gathering, auditing, and accounting institutions that are commonly associated with traditional cost of service and rate of return regulation (Joskow, 2005).[19]

- Information asymmetries

Unfortunately, fully informed regulators do not exist in reality. Joskow (2005) states that regulators have imperfect information about the cost-reducing and service quality opportunities, and characteristics of the demand for services that the regulated firm faces. Furthermore, the regulated firm usually has more precise information on these characteristics than does the regulator or third parties which have an interest in the outcome of regulatory decisions. Therefore, the regulated firm may use its information advantage strategically to increase profits to the disadvantage of consumers. Moreover, third parties may have an incentive to influence the regulator if this provides a preferable market situation. Two forms of asymmetric information can be distinguished depending on whether the regulated entity knows hidden characteristics (so-called problem of "adverse selection") or exerts hidden actions (so-called problem of "moral hazard") which are not observable to the regulator. To make things worse, both forms of information asymmetry may occur either simultaneously or sequentially. The latter may be particularly relevant for the case of TSO regulation, i.e. the regulator may at first have no precise information about cost reduction opportunities of the entity (i.e. hidden characteristics) and may later not be able to observe cost reducing effort exerted (i.e. hidden action).

To better explain the problems of adverse selection and moral hazard consider the following example: Consider a situation where a firm's cost-reducing opportunities may be high or low due to inherent production efficiencies, exogenous input variations, and differences in the cost of serving consumers, etc. Although the regulator usually is not able to become fully informed on a firm's cost-reducing opportunities, she will have some basic idea of their probability distribution. Furthermore, a firm's realised costs and expenditures will not only depend on underlying opportunities but also on the level of effort exerted by the firm: the greater the effort, the lower the firm's costs. However, cost reduction effort is costly and hence the regulated firm may prefer to exert less effort than the regulator prefers. As the regulator cannot directly observe the effort, she is uncertain about the chosen level of effort and its impacts on actual costs.

This uncertainty provides the regulated firm with a strategic advantage. It may try to convince the regulator it is a higher cost firm than it actually is, since the regulator will then set higher prices for providing services (to satisfy the firm's long-run budget-balance constraint), increasing the regulated firm's profit, and thus making the firm able to benefit to the detriment of consumers. Therefore, the regulator faces an adverse selection problem as it tries to distinguish between firms with high and low cost opportunities while still ensuring that the firm's viability constraint (budget-balance constraint) is satisfied if the firm turns out to either face high or low cost opportunities (Joskow, 2005).

One approach to solve the problem of adverse selection would be to set prices to a level equal to the firm's realised costs ex post. Auditing of costs then resolves the information

[19] Joskow, P.L. (2005). Incentive Regulation in Theory and Practice: Electricity Distribution and Transmission Networks, AEI Brookings Joint Center for Regulatory Studies, Working paper 05-18.

disadvantage of the regulator. This is the standard approach of cost-of-service regulation. However, if prices follow costs there is no incentive to exert effort. Therefore, under this scheme, the regulated firm will have an incentive to shirk which leads to realised costs above the efficient levels. Since the regulator is unable to monitor the chosen level of effort exerted by the firm, there exists a moral hazard problem associated with the response to regulatory incentives (Laffont and Tirole, 1986; Joskow, 2005).[20]

- Trade-off between incentivising and rent extraction

The social welfare maximising regulator needs to find a regulatory mechanism that takes the social costs of adverse selection and moral hazard into account and is subject to the budget-balance constraint of the firm to ensure long-run viability. This can be done by balancing the costs associated with adverse selection and moral hazard (Joskow, 2005).

A very intuitive way to discuss the trade-off between incentives and rent extraction is given in Laffont and Tirole (1993).[21] First, consider a price cap mechanism where a fixed price based on realised cost levels is set which the regulated firm is allowed to charge forever. Since prices are fixed, the regulated firm will have the highest-powered incentives[22] to fully exploit cost opportunities by exerting the optimal amount of effort in order to increase rents; the larger the gap between the fixed price and the realised costs, the higher the rents. Accordingly, the moral hazard problem is solved. However, due to the budget-balance constraint the regulator needs to take into account the possibility that the firm is inherently a high cost firm, and therefore, it needs to set the price cap high enough to ensure that if the firm indeed is a high cost firm, the price under the fixed contract will be high enough to cover the firm's realised costs. Therefore, although a price cap is very good at the solving the moral hazard problem, it potentially is very poor at rent extraction for the benefit of the consumers. The reason for this is that uncertainty about the firm's inherent costs leaves the regulator with the full costs of adverse selection.

Second, consider a cost of service contract in which the regulated firm is assured that it will be compensated for all the incurred costs of production. When the firm starts to produce it will reveal whether it is a high cost or a low cost firm, and since the regulator compensates for all costs, there is no rent left to the firm as excess profits. This solves the adverse selection problem. However, this mechanism does not provide any incentives for the regulated firm to exert optimal effort in cost reduction. If the related firm is not rewarded for increases in the level of effort exerted, it will exert the minimum level of effort it can get away with. In this case, there are no excess profits since revenues are equal to the realised costs. Consumers, however, are now paying higher prices than they would pay if the regulated firm were putting in more effort and some rent was left to the firm. Therefore, using this scheme, the adverse selection problem is solved, but the costs associated with the moral hazard problem are fully realised (Laffont and Tirole, 1993; Joskow, 2005).

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[20] Laffont, J., and Tirole, J. (1986). Using Cost Observations to Regulate Firms, Journal of Political Economy, 94, 614-641.

[21] Laffont, J., and Tirole, J. (1993). A Theory of Incentives in Regulation and Procurement, MIT Press.

[22] A high-powered incentive scheme is a scheme that offers agents the possibility to earn (large) rents if enough effort is exerted. Low-powered incentive schemes offer little (or no) possibility to earn rents and thus do not distinguish between high or low effort agents.

While the price cap is successful in providing incentives for effort maximisation and cost minimisation, it fails at extracting the benefits for consumers. The cost of service approach is good at rent extraction, but leads to a suboptimal effort level due to moral hazard. According to Laffont and Tirole (1993), the optimal regulatory mechanism will lie somewhere in the middle of these two extremes. By offering a menu of budget-balance constrained regulatory contracts with different cost sharing provisions, the regulator can do better. For example, assume that the firm can choose between either a price cap contract or a cost of service contract. Now the regulator can design a more demanding price cap. If the price cap is too demanding the firm will choose the cost of service contract. However, if the firm has the potential to be a low-cost supplier it can choose the fixed price contract. Then more rents will be acquired by the consumers. In this example the basic intuition of the trade-off the regulator faces between incentivising and rent extraction is exposed. The expected cost of the distortion of effort if the firm is a high-cost type needs to be balanced against the expected cost of leaving additional rent to the firm if it is a low-cost type.

It should be noted that in the previous examples, we discussed the static issues of incentive schemes. However, other problems arise when we evaluate the dynamic aspect of regulation. For example, in the short-run a price cap (or RPI-X) scheme gives firms the incentive to exert effort, but in the long-run, as the price cap is lowered due to the exploitation of cost opportunities, the incentive to exert effort is reduced. As has been observed by regulators, under RPI-X schemes, as long as prices follow costs, the incentives to operate efficiently remain weak (Mikkers & Shestalova, 2003).[23] For instance, OFGEM (2004) shows that during the early years of a price cap period the greatest cost reduction efforts appear, while the effort of reducing costs decreased as the date of the next price review approached.[24]

- Solving uncertainty and other issues

Another way to approach the problems of adverse selection and moral hazard is to reduce the information disadvantage by, for example, increasing the quality of information the regulator has about the firm's cost opportunities (Joskow, 2005). One way in which the regulator can reduce the information disadvantage is by using a yardstick regulation scheme. Under yardstick competition the price a firm may ask for a certain product is determined by the average cost level of (n-1) identical (or similar) non-competing firms in the industry. Since the price cannot be controlled by individual firms (unless they collude), this scheme effectively induces firms to compete against each other. A firm will have the incentive to exert effort, since it earns rents if it benefits from its cost opportunities to a larger extent than the industry average, creating a rent gap between the fixed price and the realised costs. If heterogeneity is corrected for appropriately, the scheme actually leads to the first best since the equilibrium is a price which equals the firms' efficient cost levels.

A large advantage of yardstick competition is its neutrality in terms of the degree of the inside knowledge over the firms' costs. Since under yardstick competition, if an efficiency-enhancing technology becomes available to all firms without the regulator being aware of it,

[23] Mikkers, M., Shestalova, V. (2003). Yardstick competition and reliability of supply in public utilities. CRI Technical Paper, no. 15.

[24] OFGEM (2004). Electricity Distribution Price Control Review: Final Proposals, 265/04, November, London.

this information comes to light in the process of competition. As the firms artificially compete with each other, the accounting data will show an overall decrease in costs and the regulator can conclude that opportunities that are commonly available are exploited. In effect, the benchmarking process extracts firms' private information on costs. Because the regulator in this case can search for correlation in the costs of agents, it can set a sector standard against which to measure the realised performances of individual agents. The regulator does not need to identify the most efficient way of reducing costs is. Instead determining which firm is the most efficient in doing so will suffice. By using a sector standard (benchmark costs), the information disadvantage problem is tackled at its core, reducing the uncertainty of the regulator about the cost opportunities and effort level of the regulated firms, while fully taking advantage of the use of a high incentive scheme (Schleifer, 1985).[25]

Other issues arise when there exists a commitment problem. For example, suppose that a firm is regulated using a price scheme for which the cap is renegotiated every five years. The firm will have an incentive to decrease its costs since this will lead to higher rents. However, if the regulated firm exploits cost opportunities early in the regulatory period, the regulator will have an incentive to opt for earlier price cap renegotiations, since more rents can be extracted for the consumers. This behaviour of regulator would in turn decrease the incentive of the regulated firm to exert effort. Therefore, if the regulator cannot credibly commit to the agreed upon price cap for the entire period, the the regulated firm will have less incentive to exert the optimal level of effort.

Furthermore, when a regulator deems it necessary for the regulated firm to achieve multiple targets it should be aware of the possibility that offering incentives to accomplish a specific target can have perverse effect on the fulfilment of others. For instance, when designing an incentive scheme, the regulator might want to be aware of the scheme's impact on the firm's incentives to offer quality (reliability) and to innovate. According to Mikkers and Shestalove (2003), under several incentive schemes, the incentives to reduce costs can be strong in the short run, but may have adverse effects on investments in long-run objectives. In particular, a firm can delay investments in its distribution network or network capacity, which may not affect today's performance, but can result in a deterioration of the quality of services in the future. Similar concerns apply to the incentives to innovate.

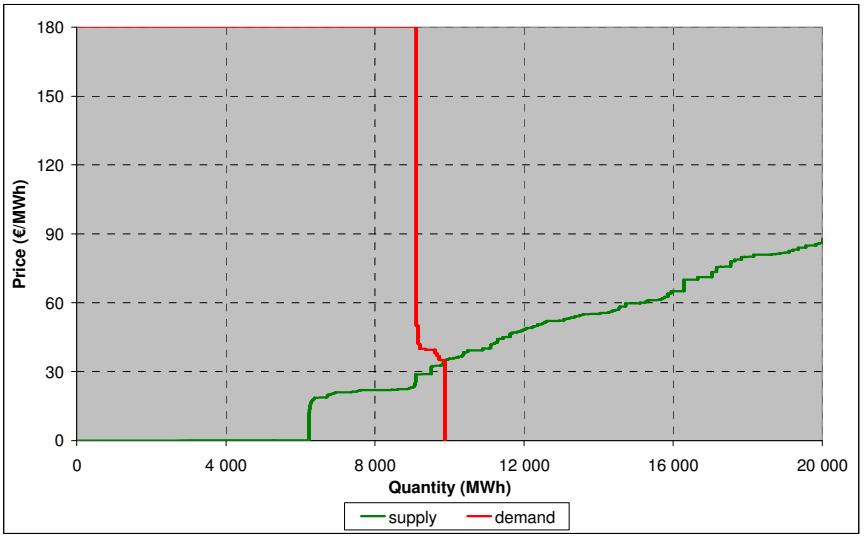
[25] Schleifer, A. (1985). A theory of yardstick competition. RAND journal of Economics, Vol. 16, 319-327.

Annex 5 – Determination of the NECs of French and Spanish markets

The availability of data from OMEL and Powernext allows their net exports curves to be determined. For example on 6th January 2007 at 11h00, the situation on the French and Spanish markets and on the interconnection is described below.

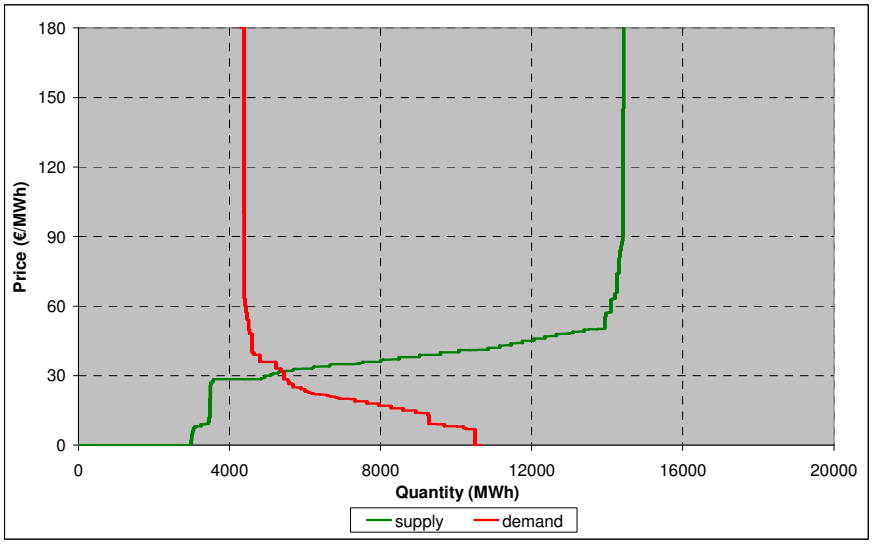
- OMEL demand and supply curves

This figure shows OMEL's demand and supply curves for energy delivery on 6th January 2007 at 11h00. The OMEL price was 35 €/MWh.



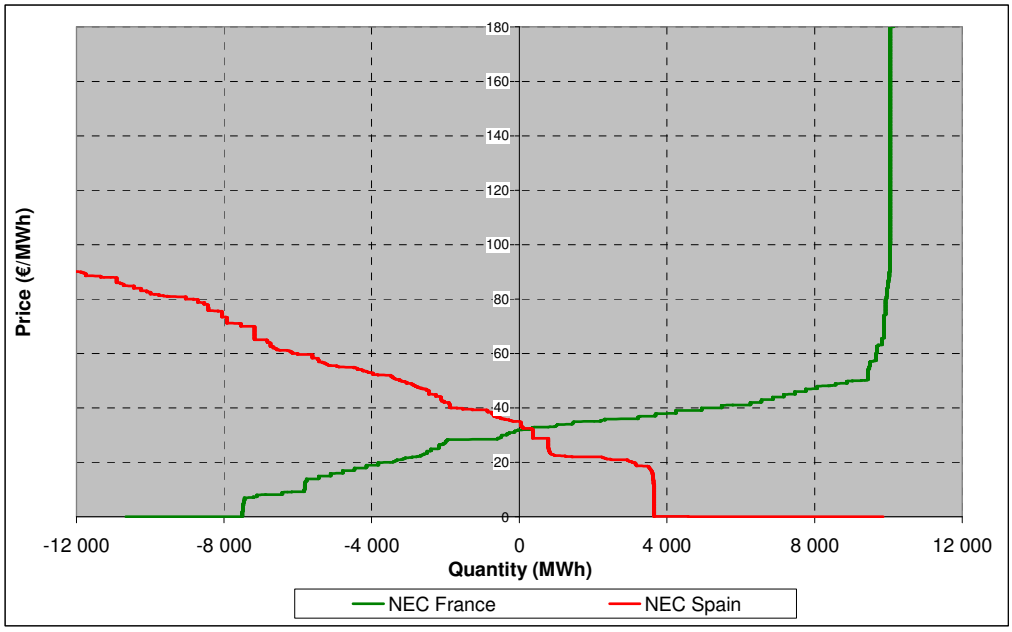
- Powernext demand and supply curves

This figure shows Powernext demand and supply curves for the same hour. The Powernext price was 32 €/MWh.

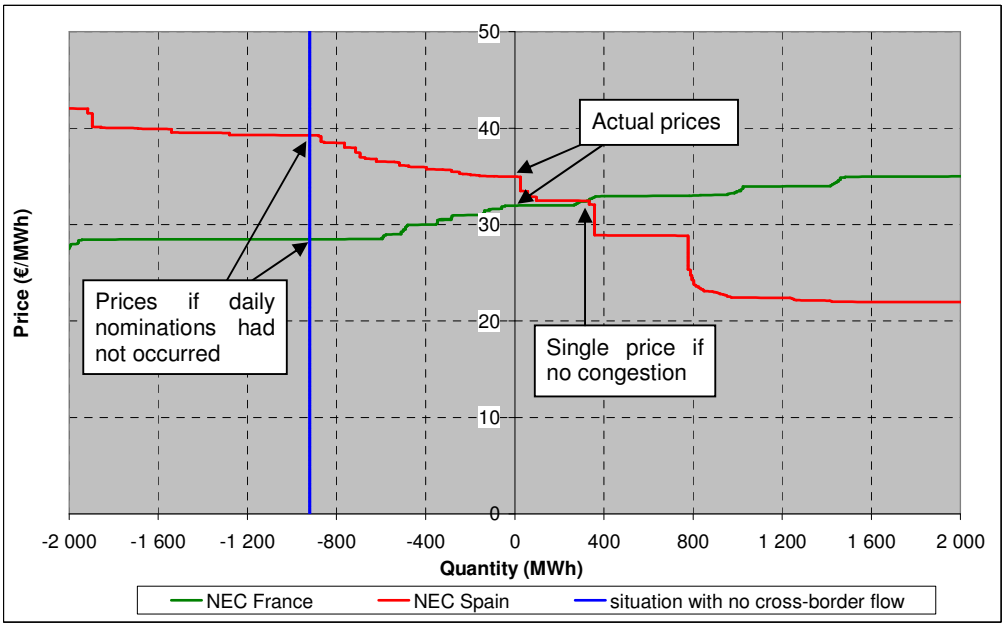


- NECs of both markets

The NECs deducted from demand and supply curves are the following:



The net daily nominations from France to Spain were 919 MW. Magnifiying the previous graph allows the prices of both of the markets to be observed if these nominations had not occurred. Moreover, one can also observe what would have been the single price of both markets if there was no congestion.

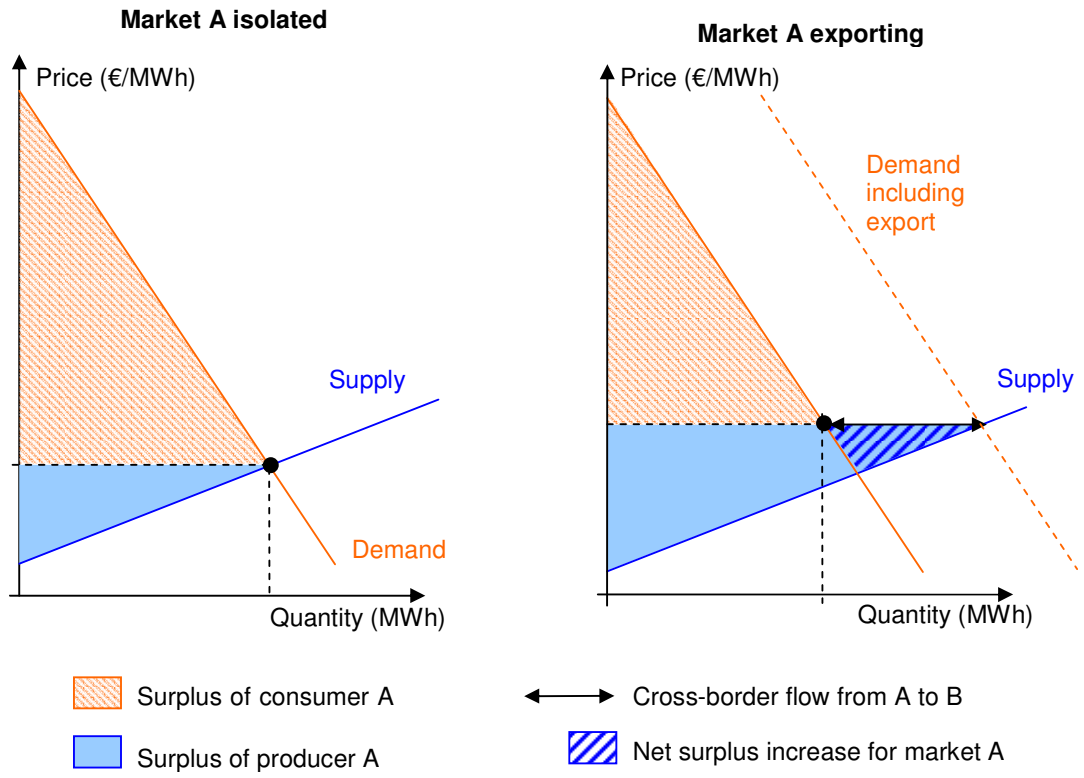


Annex 6 - Distribution of surplus generated by cross-border flows

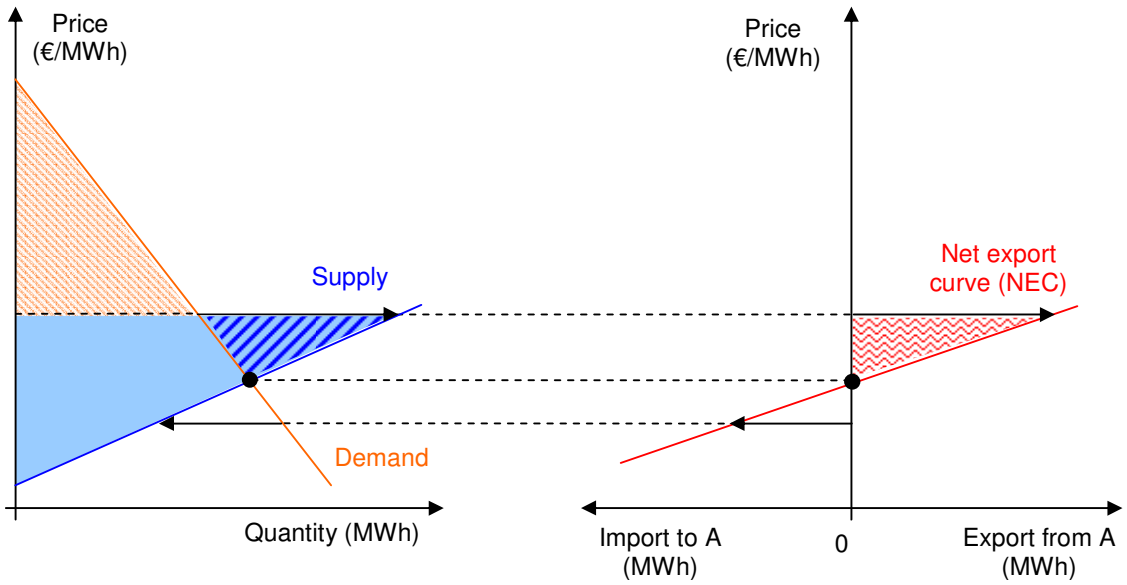
When a cross-border flow is operated from a low-price market to a high-price market, it generates an overall increase in social welfare (or total surplus), since a larger part of high-price demand is satisfied by a larger part of low-price supply, due to the cross-border flow.

For each market involved in the cross-border flow in the economic direction, the net surplus is positive, even if the surplus of some market participants is negative.

Indeed, if A is the exporting market, then an export from A is detrimental to consumers in market A, while it is beneficial to producers in market A. This can be considered as a transfer of surplus from consumers to producers of market A. However, the difference between the increase in surplus for producers in market A and the decrease in surplus for consumers in market A is always positive. Consequently, the net surplus for the market A as a whole is positive. This can be shown graphically:

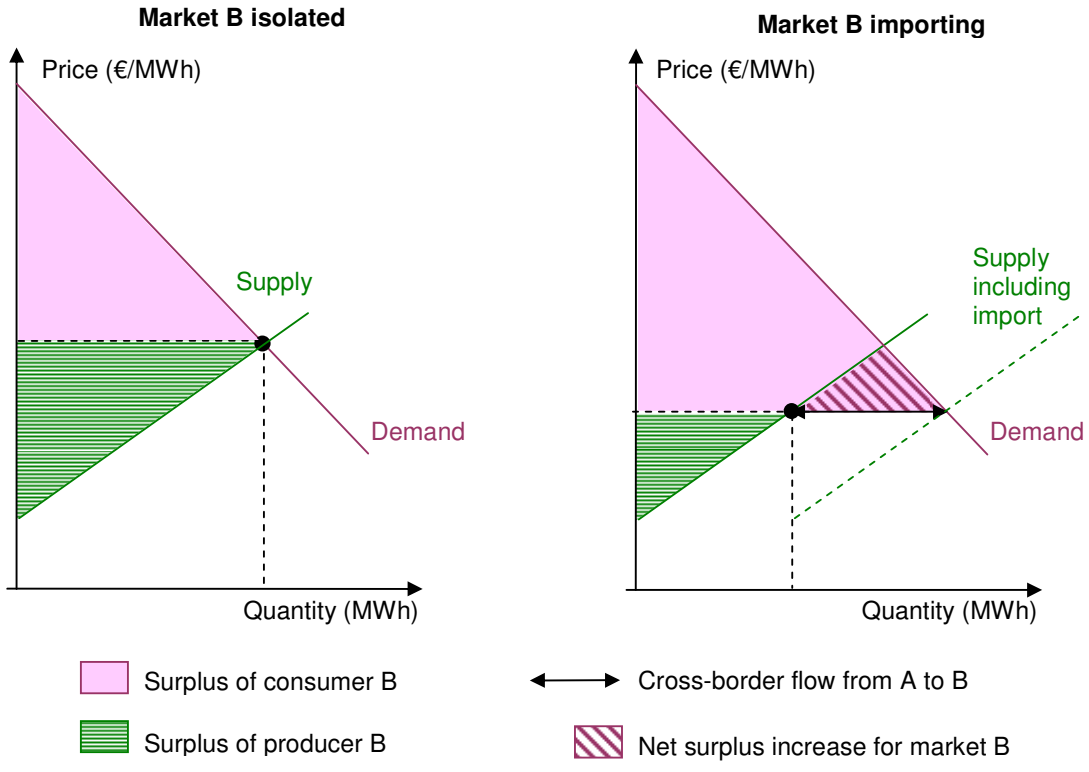


The net surplus increase for market A, generated by a cross-border flow from A to another market B, can also be schematised on the NEC of market A, as follows:

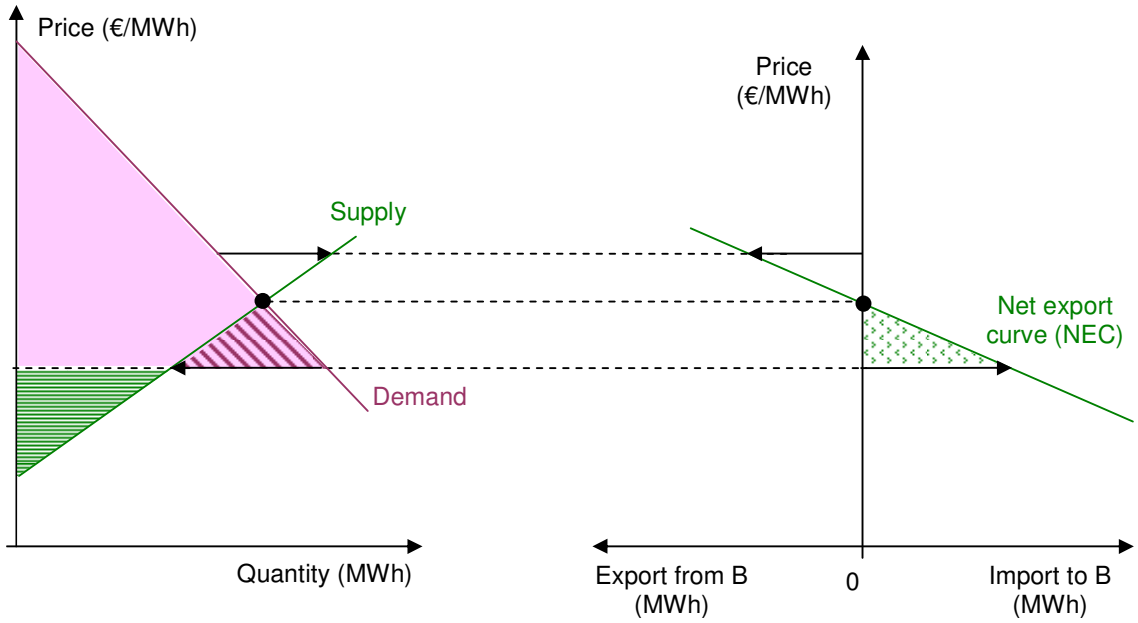


This shows how the net surplus of market A, as schematised in Figure 6, is constructed.

The symmetric situation occurs for the importing market B. Indeed, an import to B is detrimental to producers in market B, while it is beneficial to consumers in market B. This can be considered as a transfer of surplus from producers to consumers of market B. However, the difference between the increase in surplus for consumers in market B and the decrease in surplus for producers in market B is always positive. Consequently, the net surplus for the market B as a whole is positive. This can be shown graphically:



The net surplus increase for market B, generated by a cross-border flow from A to market B, can also be schematised on the NEC of market B, as follows:



This shows how the net surplus of market B, as schematised in Figure 6, is constructed.